



Global Development and Environment Institute
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Farmers as Ecosystem Regenerators: Reimagining Agriculture with the Northeast Healthy Soil Network

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The climate crisis and agriculture

The August 2021 release of the Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC)¹ unequivocally predicted environmental crisis in the coming decades. Among the observed effects of a rapidly changing climate system are drought, heat waves, heavy precipitation and flooding, and more intense tropical cyclones, all of which are expected to disrupt modern agricultural production and further degrade the health of productive lands. Although farmers have always concerned themselves with maintaining the quality and longevity of their land and ecosystems, our entire agri-food system faces a calamitous future without immediate collective action. Small- and large-scale farms alike are reevaluating their current management practices as they seek to balance the economic viability of their livelihoods with the long-term ecological sustainability of these activities. There is a growing belief that farms and ranches can contribute significantly to climate change solutions.

In the last decades of the 20th century, a new agricultural paradigm emerged, involving research institutions, action agencies,

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and local communities, focusing on *soil health* as the key linkage between productivity, profitability, and sustainability. By isolating the dynamics of soil biology, this movement sought to enrich the ecological capacities of soil systems via practices known as *regenerative agriculture*.

The costs of intensive mechanization, such as soil erosion, biodiversity loss, water pollution, have stressed the limits of an agricultural system that depends on external inputs, leading many producers and consumers to move towards food production methods that build rather than degrade our ecosystems. Moreover, a regenerative approach could credibly store many metric tonnes of atmospheric carbon per hectare of cropland as soil organic carbon, which would otherwise be released by heavy tillage and the use of artificial inputs.² As soil science on the topic has evolved in the last decade, a strong link between healthy soils and climate resilience is now obvious.

Regenerative agriculture in practice

Importantly, the notion of regeneration, which seeks to correct some of the missteps that have led us to this point of environmental disaster, has long been important to indigenous and other pre-colonial traditional peoples. The practices and principles of regenerative agriculture in the United States and around the world—e.g. intercropping and agroforestry—should not be characterized as a novel science, but emerge from community-based approaches to land management that have survived despite the colonizing forces of European farmers.³

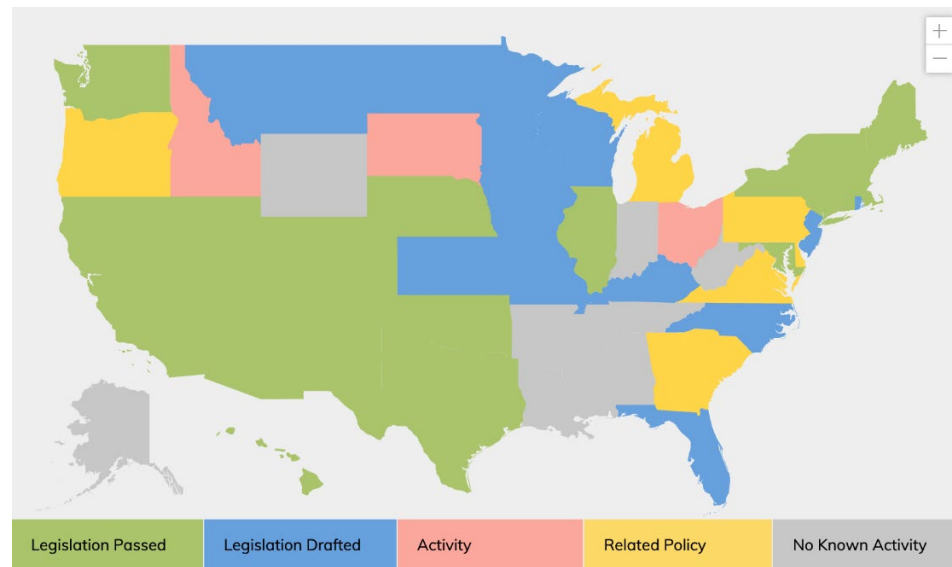
Regenerative agriculture explicitly describes a disruptive movement that challenges and seeks to redress the degenerative anthropogenic transformation of soils, as well as institutions of racial injustice, inequity, and exploitation, and undemocratic governance of land resources. In short, justice for the climate requires justice for the people. Reversing the global warming conditions explained by the IPCC must correlate with a simultaneous transformation of economic and political institutions.

In practice, a number of economic and financial constraints have prevented recent adopters of healthy soil practices from fully pursuing the regenerative capacities of their soils. For example, land ownership is out of reach for various farmers, which discourages them from taking on the added risk of changing their practices to improve land that they do not control.⁴ State and federal policies offering direct aid and business incentives are thus required to help farmers in this transition. Payments to producers and market transactions must reflect the real social and ecological value of their activities. Since all citizens are stakeholders in the agri-food system, not farmers alone, consumers must also take responsibility for the practical costs of healthy soils. Civil society organizations are increasingly bringing

these diverse stakeholders to the table to find the best strategies to reform agricultural production. Individuals, NGOs, and research institutions all have an important role to play in mediating healthy soils policies.

Notably, international, national, and local bodies have in recent years recognized farmers as key leaders on climate resilience. The “4 per 1000” initiative launched in 2015 at COP21—an annual United Nations summit addressing action on climate change—seeks to grow soil carbon stocks through on-farm activities.⁵ In the U.S., “National Healthy Soils Policy Network” formed in 2018 pushes to pass climate policy informed by farmers.⁶ Locally, the “Northeast Farms of Color Land Trust” has since 2019 connected with regenerative farmers via trainings, skill-shares, business development, and financial planning.⁷ As a result of this work, well over half of U.S. states have drafted or passed bills developing incentives for soil health improvements in the form of grants education, and technical assistance to farmers, ranchers, and landowners (see **Figure 1**).⁸ In the northeast, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and New York have all passed such legislation. Significant issues of implementation remain, however, and many financial and economic constraints on farmers still need to be overcome.

Figure 1. U.S. State Soil Health Policy Map⁹



What is the Northeast Healthy Soil Network?

The Northeast Healthy Soil Network (NEHSN) was created in 2019, to capitalize on this policy energy and to further inform a prompt transition toward financially viable regenerative farming at scale. Originally hosted by the Global Development and Environment Institute (GDAE) at Tufts University in the Boston, Massachusetts area, the NEHSN is an innovative initiative that attempts to bring

together a wide number of stakeholders from across the Northeastern U.S. under the mission of enhanced, science-backed regional soil management. Previously, few regional actors had been in conversation about the science and policy of regenerative agriculture. Subsequently, the network has grown to include partners from several universities, including Dartmouth, University of New Hampshire, and University of Vermont, NGOs, and farms, who engage in collaborative working groups that seek to catalyze agricultural reform at both the practice and policy levels. The NEHSN is now in the process of becoming a self-funded and self-governed advocacy and research entity.

Background for the NEHSN

In the fall of 2018, GDAE began investigating natural solutions to the climate crisis. This project focused on the roles of forests, wetlands, and agricultural lands (e.g., cropland and rangeland) in present and future climate change mitigation and adaptation.¹⁰ With the support of graduate students from both the Friedman School of Nutrition Science & Policy and the Fletcher School of Law & Diplomacy, this research team started asking what policies and practices would be required to transition regional agricultural production in the U.S. Northeast toward long-term ecological sustainability and net carbon sequestration.¹¹ We immediately learned that farmers and their knowledge and experiences would be central to any policy framework that sought to fundamentally shift the balance of power in the agri-food system. Principal to a comprehensive climate solution was the notion that healthy soils and regenerative agroecosystems represent processes that begin with farmers but flourish with broad institutional participation.

GDAE recognized a need to coalesce a network of stakeholders who are all pursuing forms of alternative, sustainable agricultural production systems in our geographic region but were not in conversation at that time. A panel discussion in April 2019 created a platform for about 40 participants from across the six New England states to discuss the main issues facing small-scale farmers and the obstacles to more sustainable practices. The success of this first gathering led to the expansion of our regional scope to include all Northeast states and ultimately the formation of the Northeast Healthy Soil Network.

Developing the NEHSN

The solidification of this network subsequently allowed for a [more ambitious symposium](#) in February 2020. Held at Tufts University's campus in Medford, MA and sponsored by GDAE and the Tufts Institute for the Environment (TIE), this [two-day conference](#) brought nearly 150 students, researchers, farmers, and activists under one roof to discuss the future of soil health.¹²

A diversity of groups with varying resources but strong regional connections participated in the 2020 symposium.¹³ Representatives came from state conservation districts, state departments of agriculture, USDA Natural Resource Conservation Service (NRCS) offices, Northeast Organic Farming Association (NOFA), American Farmland Trust, MIT, Harvard University, and nonprofit farm organizations like Stonewall Farm in New Hampshire and Wolfe’s Neck Center in Maine. Notably, participants from the 2019 event co-organized and co-led ongoing workshops. Working group meetings were held in the months leading up to these workshops to familiarize the members with each other, identify leading voices within each state, and focus the agenda on two core topics: soil measurement and farm financing. At its conclusion, the NEHSN broadly sought to realize regional goals for improving farmer livelihoods but more specifically had recognized a community that appreciated the science and dynamic potential of soils.

Both the 2019 panel discussion and 2020 symposium workshops further underscored an array of acute and chronic challenges that farmers who engage in the transition toward regenerative agriculture face under current conditions:

- 1) costly watershed management;
- 2) vulnerability from agrichemical use;
- 3) uneven access to land first generation farmers;
- 4) unreliable farm incomes and high debt ratios;
- 5) disconnect between rural, urban, and suburban environments; and
- 6) lack of fair pay for the positive social and environmental impacts of healthy soils.

Inspiration for the NEHSN came from the recognition of these issues and the accomplishments of other regional initiatives. The consortium behind the Marin Carbon Project (MCP), including researchers, county and federal agencies, and ranchers, and the ability of farm-centered groups to forge networks around regenerative land management in a large state like California showed the distinct potential for coordination and change at a regional scale.¹⁴

In crafting our mission, NEHSN members articulated this need for transformative processes that would connect a great number of communities. “We want a new regional food system, one that pays our farmers to build soil, not for crops. Reward our farmers for stewarding ecosystems, taking care of soils, watersheds, landscapes, and providing nutritious food in the process,” stated the action plan created by symposium participants.¹⁵ The transition toward healthy soils is an all-inclusive transformation of the way society conceives of agriculture driven by the

same producers and consumers who are most affected by the current crisis. It is nothing short of a revolution in agricultural production.

The COVID-19 pandemic hit the U.S. only days after the 2020 symposium and immediately froze all in-person networking activities. In response, NEHSN members began meeting online and sought to maintain momentum through a series of three panels via Zoom.¹⁶ Beginning in the spring of 2021, these virtual events brought Stonewall Farm, Tufts University, Dartmouth University, and the University of Vermont in closer collaboration around topics of strengthening agricultural resilience during COVID-19, designing payment for ecosystem services, and measuring healthy soil outcomes.

These online discussions exemplified the regional nature of the network—connecting Massachusetts, New Hampshire, and Vermont—while also expanding the audience to several hundred participants. 2021 has thus brought a lot of questions regarding the shape, form, and purpose of the NEHSN as a large diverse, decentralized, and democratic body. A July 2021 presentation to the International Society for Ecological Economics on [“Farmers as Ecosystem Regenerators”](#) summarizes some of these issues.¹⁷

What is the future of regenerative agriculture?

On the path towards regenerative agriculture, the NEHSN employs a two-pronged method for translating soil health goals into actionable policy: *research* and *advocacy*. Given this current context in which a farmer-led movement has identified regenerative soil properties as critically important to the future of a changing climate, we acknowledge that both the science and the activism need to be able to keep pace with each other. The capabilities to monitor biological, chemical, and ecological processes of the soil system are only as valuable as the current public support and policies for these outcomes, and vice versa. Therefore, there are a few questions to which we continue to return as the diverse perspectives from the academic, advocacy, and agricultural institutions within our network undergo debate:

- How do we practically translate our soil health measurement tools into collaborative outcome-based marketplace for regenerative products?
- Are payment for ecosystem services arrangements the most appropriate set of policies for valuing healthy soils in current market transactions?
- What are the responsibilities of the regenerative agriculture movement to the needs of under-resourced and historically excluded producers in the region?

Measurement and data harmonization are critical to ongoing research efforts to observe and verify existing inferences about ecologically-based practices and translate these activities into environmental outcomes. Not only will accurate, reliable indicators of soil health validate farmers' efforts at revitalizing a range of traditional ecosystem knowledge, but they will also inform and shape policymaking processes that rely on measurable results to satisfy constituents. Agricultural research groups have only recently merged the needed observation tools, remote sensing data, and agroecosystem models to monitor, evaluate, and communicate soil-based outcomes on farms. Factors like habitat quality and biodiversity, water quality and quantity, and carbon sequestration are important dimensions of soil health. Due to the evolving nature of this research, we have a unique chance to build a collective science with the help of both producers and consumers, which should be based on coherence and accessibility across geographies.

Dorn Cox, who holds many titles as farmer, researcher, and leader of the OpenTEAM platform, speaks of agriculture as a public science.¹⁸ In his work, he asks, what does shared and applied inquiry look like when bringing together a diverse community of stakeholders with sometimes conflicting concerns?¹⁹ Stakeholders are not just asking for food, fiber, and energy from farmers but also need agriculture that supports human health, economic development, climate resilience, safe habitat, and clean water. Since current market transactions do not capture most of these outcomes in the valuation of products or services, Cox and other members of the NESHN are working to translate their measurement tools into collaborative outcome-based marketplaces. By relying on systems-level thinking, we can begin to understand production and consumption as part of the ecosystem. Our questions about climate, agriculture, and soil therefore cannot be answered with regards to a single scale or measurement.

Farm viability is essential to ensure that regenerative agriculture is socially, politically, and economically sustainable. How do farmers cover the costs of the transition to regenerative practices? In addition to existing issues of land tenure, outstanding debt, and labor costs, transition costs can include new machinery, inputs, and training. The goal of farm viability thus includes finding funders, securing long-term investors, and setting up diversified revenue streams. Without comprehensive and equitable financing for the transition to regenerative management, these issues will become prohibitively costly and exclude newly interested producers. Advocacy and collective action are also key mechanisms for transforming the long-term structural viability of healthy soil practices. One-time on-farm cash infusions will not counterbalance years of farm consolidation and anti-environmental policies. Rather, the advocacy and support for healthy soils must be sustained and unyielding.

Creating a political consciousness and engaging farmers in the policymaking processes builds group identity and facilitates enduring communication that can

cultivate leaders as well as soils. Reforming the social, political, and economic features of the agri-food system requires building farmer confidence in their capacity to create institutional change.

Vermont-based educator and community organizer Cat Buxton speaks of strengthening a social mycelium that gives structure to ecosystems of change, similar to the function of the soil mycelium.²⁰ In other words, cultural and biological health cannot be separated. The social networks created among peers, especially among children and young adults, hold much of our knowledge about food, agriculture, and ecosystems, and we must feed these networks with lessons of climate change, regenerative farming, and food justice. Dynamic problems ultimately require dynamic solutions, and public policies investing in soil health must be rooted in similarly effective behavior.

Both producers and consumers around the world are joining in a revolutionary movement to reorganize the agri-food system. Conversations are increasingly shifting to identify farmers not only as cultivators of our food but as stewards of the ecosystem and regulators of the climate. Policies at all levels have been slow to acknowledge and properly compensate these contributions. In response, domestic and global networks of farmers, scientists, activists, and concerned citizens have united to enable a transition toward regenerative agriculture by transferring knowledge, sharing the latest scientific findings, and co-developing best practices for healthy soils. The lessons of the Northeast Healthy Soil Network reveal the social utility of these communities and their latent power to mobilize for political and economic change.

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⁹ Policy advocate Steven Keleti, who is also a partner on this project, has drafted multiple pieces of soil health legislation across the country and helps maintain a crowd-sourced policy tracker (nerdsforearth.com/state-healthy-soils-policy/) for publicly sharing legislative data, policy guidance, and lessons learned across states.

¹⁰ Professor William Moomaw, co-director of GDAE, Professor Emeritus at the Fletcher School, Tufts University, a world-renowned scientist and climate policy expert, and a key drafter of previous IPCC reports led this effort. His recent research focuses on the role of trees and forests in the U.S. as key to fighting climate change.

¹¹ This team included researcher Dr. Anne-Marie Codur and research assistants Josephine Watson, Kayleigh Fey, Bethany Tietjen, Benjamin Johnson and Sam Polzin, under the direct leadership of Dr. Jonathan Harris and the supervisor of GDAE co-directors Dr. Neva Goodwin and Dr. William Moomaw.

¹² Visit sites.tufts.edu/gdae/conferences-panels-and-events/ for more details on the GDAE soil health events.

¹³ The 2020 symposium also enjoyed international support from the 4 per 1000 Initiative. Executive Secretary Paul Luu, as well as two scientists from the French National Institute of Agronomy and the Environment (INRAE), Laure Bamiere and Abad Chabbi, presented their research and led working group discussions. The Consulate General of France in Boston partially funded and sponsored the proceedings.

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¹⁶ The current 2020-2021 NEHSN planning and coordinating team includes Dr. Julie Snorek, Dr. Alissa White, Julie Davenson, Steven Keleti, Dr. Anne-Marie Codur, Sam Polzin, and Josephine Watson.

¹⁷ Anne-Marie Codur and Sam Polzin, “[Farmers as Ecosystem Regenerators: A Case Study of the Northeast Healthy Soil Network.](#)” **Presentation to the International Society for Ecological Economics Conference**, July 2021.

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²⁰ Ibid.

Access additional publications on climate change at:

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