



# Creating An Agricultural Technology Ecosystem

## OpenTEAM PROGRESS REPORT

2021



OpenTEAM  
is facilitated by  
**WOLFE'S NECK CENTER**  
FOR AGRICULTURE & THE ENVIRONMENT



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As a place-based institution situated on 626 acres of preserved coastal landscape in Freeport, Maine, [Wolfe's Neck Center](#) uses its diverse landscape of annual and perennial crop production, grazing, forest, fresh and saltwater, and rural-urban boundaries to connect people of all ages to the food they eat and where it comes from. Through regenerative farming, innovative soil health research, and visitor interactions, the land is used as an educational resource for the center's visitors and nearby farmers. WNC draws upon this rich history of innovation and experimentation to continue its legacy today through collaborative research initiatives like OpenTEAM and the Maine Soil Health Network, demonstrating how agriculture and the food system connect to global environmental systems. WNC leads our OpenTEAM hubs to bridge the knowledge and tools needed to improve soil health and mitigate climate change with farmers and ranchers around the world.



# Executive Summary

## THE CURRENT LANDSCAPE

*To sustainably serve the diverse environmental and humanitarian needs of the 21st century, the global agriculture ecosystem needs a collaborative open source digital transformation to support agriculture and climate solutions as a public science.*

As global leaders grapple with climate change and farmers on the ground seek ways to become more resilient to its effects, the opportunity is now to create an interoperable and open source technology ecosystem that supports farmers in their transition to regenerative agriculture systems. With global food demand driving nearly 20% of carbon emissions, a shared urgency exists to unite organizations and technologies with large-scale public and private resources to provide open access to global agricultural knowledge that will support adoption of regenerative farming practices and help producers sequester carbon in the soil. Through a shared digital toolkit that is equitable and accessible, this knowledge can be translated into site-specific decision support for farmers and, with protocols that protect farmers' control of their data, can maximize its value through supply chain, governmental, or climate smart incentives.

The Open Technology Ecosystem for Agricultural Management ([OpenTEAM](#)) is cultivating a community of diverse organizations and networks that are forging this interoperable and accessible technology system together, collaborating in ways that equip farmers and ranchers with mechanisms that protect and increase the value of their data, provide the best possible knowledge to improve soil health, and mitigate climate change.

### CREATING A SUSTAINABLE TECHNOLOGY ECOSYSTEM

In order to create a sustainable agricultural technology ecosystem, OpenTEAM is building trust with collaborators and technologies, improving the ability to work together, and adapting tools for better soil health management locally. Furthermore, we are incorporating an equity lens into the work

that we do so that we can design a technology ecosystem that is more accessible, equitable, and universal for the diverse group of land stewards (farms and ranchers) and food companies that are a part of it. By acting as a convener, technology steward and facilitator, OpenTEAM is increasing interoperability and knowledge shared across the agricultural technology landscape for a more sustainable technology ecosystem.

### OUR PROGRESS

Over the last 3 years of collaboration, OpenTEAM has collectively designed the functional core and framework for transparency in our agricultural system and laid the groundwork to accelerate future development of a technology ecosystem that is responsive to the needs of end users. This framework is not theoretical—it is built and actively used by a diverse global network of farms, ranches and other organizations.

This past year, we grew the OpenTEAM community—reaching 250 active skilled professionals in their field from over 45 organizations across the globe. We have expanded our capacity by developing new approaches to collaboration, integrated an equity lens into our work, advanced our internship program, and strengthened support for our Hub & Network farms and ranches. Our deeper co-working sessions have vitalized diverse communities of practice such as our Technology, Hub & Network, and Human Centered Design teams, leading to the development of the OpenTEAM Collabathon series. These series focus on particular workstreams with collaborative sprints toward long range shared goals and expand our community's capacity to dive deeper into building an open global technological

ecosystem for agriculture. Through this work, we are working to equip future food systems leaders to generate a new way of approaching agriculture and regenerative farming systems.

In 2022, we are further developing the community by strengthening our network and community and supporting the growing number of Hub & Network farms and ranches. We continue to invest in long-term projects like a digital coffeeshop by Our Sci, a social coordination platform for regenerative

agriculture communities with Hylo and Terran Collective, an ag data wallet concept for land stewards to manage, share and control their data, and an API switchboard to facilitate interoperability in the OpenTEAM ecosystem across diverse use cases. By creating feedback mechanisms, providing training on tools and adding additional capacity, we hope to create stronger systems of support and bridge the gaps farmers and ranchers currently face within the OpenTEAM technology ecosystem.

*Through this collaborative ecosystem of diverse communities and technologies, OpenTEAM is defining a new way to approach technology in agriculture.*

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## LETTER FROM DAVE HERRING

*EXECUTIVE DIRECTOR AT WOLFE'S NECK CENTER FOR AGRICULTURE & THE ENVIRONMENT*

Dear Readers,

I'm pleased to share this progress report of OpenTEAM with the larger agricultural community. Here at Wolfe's Neck Center for Agriculture and the Environment, we recognize the tremendous potential and need for creating accessible, equitable tools that empower land stewardship for every farmer and rancher. When we began this endeavor of OpenTEAM, we understood the challenges on the ground level and the need to bridge the knowledge and tools required to improve soil health and mitigate climate change with farmers and ranchers locally, regionally, and globally.

OpenTEAM now has more than 20 Hubs across the country and world, including Wolfe's Neck Center, connecting our work through their extensive local networks representing thousands of farms and millions of acres. These are Research & Development sites where farmers are co-creating emerging technologies and informing their development. In the coming years, OpenTEAM will be looking to test, iterate and scale our work across an increasingly diverse set of production systems, scales and bioregions. This powerful set of tools will increase equity in access to knowledge and markets and scale the technology and collaborative skills-building necessary to support the next generation of producers and technical assistance providers in unlocking access to new environmental value and meeting the needs of farmers. These networks also demand a better shared understanding for how they can support farmers as land stewards the way they deserve. Now is the time to go big in support of land stewards on the leading edge of climate smart agriculture, and the open technology ecosystem that OpenTEAM is building is what will enable that.

Wolfe's Neck Center is a place-based institution that is multiplying our impact globally through the community we are building through OpenTEAM. As we transform our relationship with farming and food for a healthier planet, we're excited to see this community continue to support locally-based knowledge and decision making for better land management through tech tools that can be globally applied.

Sincerely,



Dave Herring

Executive Director, Wolfe's Neck Center for Agriculture and the Environment



# The OpenTEAM Community

OpenTEAM is composed of a diverse community of skilled problem solvers. The farmers, ranchers, scientists, researchers, engineers, farm service providers, programmers and food companies that form this community contribute technical expertise, industry knowledge, and innovative ideas that make what OpenTEAM is accomplishing possible.

## OPENTTEAM COMMUNITY PARTICIPANTS:

COMET-Farm, Cool Farm Alliance, Digital Green, farmOS, FFAR, Field to Market Alliance, Foodshot Global, General Mills, Heartland Technology Group, LandPKS, LiteFarm, Mad Agriculture, Michigan State University, Purdue University (NECCC), NORI, OATS Center, Open Rivers, Organic Valley, Our Sci, Rhode Island School of Design, PastureMap, Quivira Coalition, Regen Network, Regen Foundation, Sustainability Innovation Lab at Colorado, Stonyfield Organic, Tech Matters, Terra Ethics, Terra Genesis International, UBC Farm, USDA ARS, Wolfe's Neck Center for Agriculture & the Environment, Zero Foodprint, Lexicon of Sustainability, White Buffalo Land Trust, Paicines Ranch, Caney Fork Farms, Propagate Ventures, Terran Collective, CIBO, INTO, We Are For The Land Foundation

## OPENTTEAM HUBS:

Caney Fork Farms, General Mills, Mad Agriculture, Michigan State University, Million Acre Challenge, Organic Valley, Paicines Ranch, Pasa, Quivira Coalition, Stonyfield, UBC Farm, Wolfe's Neck Center, White Buffalo Land Trust, We Are For The Land Foundation



# New Ways of Collaborating

## COLLABATHONS

This past year, we tried a new way of collaborating. We held a series of “[Collabathons](#)” where diverse groups of collaborators met to tackle a specific workstream within OpenTEAM. Each Collabathon had a defined goal, outcome, and proposed output shaped by a community of co-hosts. Series collaborators worked towards long range shared goals including building a conceptual framework and statement of need for an environmental claims clearinghouse, co-designing a community platform, and exploring equity in practice in regenerative agriculture and technology.

## ENVIRONMENTAL CLAIMS CLEARINGHOUSE COLLABATHON

More than thirteen organizations in OpenTEAM, representing diverse market perspectives, came together to address the global urgency of creating credible environmental service marketplaces that support paying those working most closely with the land for actions which produce specific environmental benefits. These “Environmental Claims,” whether the sequestration of carbon, increases in biodiversity, improvement in water quality, reduction in flooding risk, or other science-based claims, will require a functioning multi-faceted system that will enable stacking of benefits without double counting. This will benefit land stewards, purchasers, project developers and markets. In 2022, OpenTEAM members will build out a model for the claims clearinghouse to demonstrate to stakeholders. ([Read](#))

## COMMUNITY PLATFORM COLLABATHON

OpenTEAM is partnering with Terran Collective to create a free and open source digital community platform for land stewards and the regenerative agriculture movement based on [Hylo](#), a social coordination platform. Through the Collabathon, the OpenTEAM community and Regen Foundation identified what tools are needed most. The work focused on facilitating pathways to connect farmers, ranchers and land stewards with similar growing operations for mentorship, collaboration, and market opportunities in the transition to regenerative practices. Through the design of new features and implementation of community governance principles on Hylo, the infrastructure will build

upon existing relationships of mutual support among land stewards and conservation groups, create new community connections between farmers, ranchers and the public, connect individuals across bioregions, and enable a greater flow of resources, ideas, information and inspiration to fuel the next phase of regeneration in agriculture. Collaborators will continue to give feedback as the development of the community platform continues into 2022.

## EQUITY IN PRACTICE IN REGENERATIVE AGRICULTURE

Co-led by Terra Ethics Consulting and Open Rivers Associates, this Collabathon guided participants in building new skills and creating the outline of a toolkit for viewing their work through an equity lens. Much of the discussion focused on how a better understanding of ourselves and others can help bring equity into our daily work, projects, and organizations. The sessions covered the core topics needed to guide this work across agricultural communities. This included discussing concepts of value gauging and positionality, understanding principles of equity, sharing historical context, learning leadership tools, and developing ways to drive effective change across the OpenTEAM community. As a synthesis, the Collabathon leadership created a resource guide for implementing equity in practice. ([Read](#))



# New Ways of Collaborating (cont.)

## CARBON SERIES

The Carbon Series is focused on defining and communicating key considerations for carbon quantification methodologies across diverse goals, scales, and management practices. The group is using a Point Blue project use case for creating standardized, efficient, and robust carbon monitoring protocols for focusing initially on rangeland management practices. The two main objectives of the project are to 1) Provide blueprints for ranchers and technical service providers to track changes in carbon and 2) Help build a large scale verifiable dataset that documents changes in carbon. Point blue will expand their current handbook to support producers and technical service providers more broadly. As the Carbon Series wraps up and participants work to refine protocols, they will share the protocols and process which will serve as the basis for a Collabathon series in 2022 that will expand to incorporate cropland methodologies.

## WORKING GROUPS

The OpenTEAM community participates in [working groups](#) that target specific work streams including creation, interoperability, accessibility, implementation, iteration, and maintenance of the technology ecosystem that we are building.

### Technology Working Group

*Technology Review & Development*

Identifying opportunities for co-development, prioritizing work packages, and supporting interoperability of technologies.



### Field Methods Working Group

*Bridging science with the tech tools*

Bridging science with the available tools to create a versioned and tiered approach that will support needs of farmers, ranchers, researchers, and markets.



### Hub & Network Working Group

*Grounding theory in practice with land stewards*

Grounding and coordinating the other working groups across, scales, geographies, production systems through farmers, rancher, research and market networks.



### Human Centered Design Working Group

*Social Review & Development*

Creating internal and external social feedback and design processes for the OpenTEAM community to ensure the ecosystem is usable and useful for the user.



### Equity in Practice & Technology Working Group

*Implementing Equity Principles*

Amplifying the work of our members and supporting collaborative efforts toward racial equity and inclusion throughout the OpenTEAM ecosystem.



# New Ways of Collaborating (cont.)

This year, the Technology Working Group began co-creating a digital coffeeshop for farmers to connect, compare methods, and engage in data driven story sharing around soil health practices. They also developed an Ag Data Wallet concept to facilitate interoperability and data sovereignty within the OpenTEAM ecosystem and an environmental claims clearinghouse concept with the goal of creating improved efficiency that benefits land stewards.

The Equity in Practice & Technology Working Group introduced an equity lens throughout the OpenTEAM ecosystem, held panels on equity in agriculture and technology, shared strategies through a Collabathon series, and developed an equity in practice toolkit for the OpenTEAM community to use within their own organizations.

The Field Methods Working Group developed a beta set of field methods cards that was distributed across the OpenTEAM network to support Hub & Network farms and ranches with their soil health measurements and also held the Carbon Series.

The Hub & Network Working Group used the last growing season to test the suite of tools within OpenTEAM. The tech liaisons from the Hubs tested a variety of tech tools to collect data in the field, keep track of management and provide feedback to tech ecosystem developers. Through a virtual gathering in November of our Hubs, technology members, and our Collabathon leaders each of our Hubs shared their research and monitoring projects from the year, their tech tool use, and their plans and goals for next year.

The Human Centered Design (HCD) Working Group has centered its activities around exploring how, where, and why soil health data is collected and stored within Hubs. Additionally this fall kicked off an HCD in-depth study led by Dr. Ankita Raturi at the Agroinformatics Lab at Purdue University, investigating information challenges faced

by US-based farmers as they practice regenerative agriculture and seek to improve soil health quality on the land they steward.





# Building a Technology Ecosystem *(cont.)*

The work that the OpenTEAM community is putting in today will go towards the creation and facilitation of shared software services to accelerate the rate of soil health discoveries and impact on the ground.

*By developing trust and creating interoperability, OpenTEAM fosters collaborative use of this data in research and markets while enabling data sovereignty, security, and protection for farmers and ranchers.*

## **CREATING INTEROPERABILITY WITHIN THE ECOSYSTEM**

Interoperability denotes the ability for two technologies to connect and exchange information with each other. When creating a technology ecosystem, this is foundational to creating a system where different tools work together to collaborate and exchange data.

OpenTEAM's tech community has co-developed data structures and schemas, as well as the community process to maintain them, that form the basis of an open source approach to interoperability. This fundamental approach to shared, sustainable software services is essential for sharing agricultural knowledge locally and globally in an accessible and portable format.

This year, the OpenTEAM community has led several initiatives to implement this interoperability and structure across the ecosystem.

### **AG DATA WALLET**

OpenTEAM is developing an ag data wallet that would provide secure storage and transactions of important data under the control of farmers, ranchers, and other land stewards. While the word "wallet" evokes both a place where important documents are kept, and something that is under an individual's control, an ag data wallet can go beyond that by providing mechanisms for individuals to safely exchange data and giving opportunities for financial compensation for ecosystem services.

### **QUESTION SET LIBRARY**

Transparent data collection methodologies are crucial to sharing data and building aggregated datasets. This past year, community participant Our Sci developed a Question Set feature in the SurveyStack software to help users who have similar research or monitoring goals to ask the same questions in the same way. This allows for them to collect data in the same format, leading to better data comparability. OpenTEAM Hubs will be working to add their research and monitoring protocols

to the question set library this season to start building the library.

### **DIGITAL COFFEESHOP**

OpenTEAM community participants are developing a benchmarking tool for better strategic decision making for farmers. This "digital coffeeshop," modeled after the daily conversations of understanding between two neighbors, is where farmers will be able to meet online and compare their farm's soil health measurements and farming practices with others of similar characteristics.

### **A COMMUNITY PLATFORM FOR COLLABORATION IN AGRICULTURE**

Terran Collective is developing a social coordination platform called Hylo that supports community building, collective sensemaking, collaborative decision making, and group coordination. This platform will serve OpenTEAM members and Hub farms & ranches to easily connect with similar growing operations for mentorship, collaboration, and market opportunities in the transition to regenerative

# Building a Technology Ecosystem *(cont.)*

practices. This upcoming year, OpenTEAM Hubs will be testing out the community platform on Hylo by generating profiles through a SurveyStack onboarding survey. This community platform will be used to share management practices, research projects and goals, and a place to exchange updates and ideas.

## API SWITCHBOARD

An API switchboard is a connecting and translating mechanism designed to support interoperability across existing systems and data standards. Data translated through the API switchboard and connected to the Ag Data Wallet will enable data to be entered once and used many times across the ecosystem. This will directly benefit farmers, ranchers and land stewards by facilitating access to multiple

## FUNCTIONALITIES OF THE ECOSYSTEM

Within the OpenTEAM ecosystem, there are a wide range of tools that enable land stewards to conduct field-level carbon measurement, digital management records, remote sensing, predictive analytics, and input and economic management decision support. These are being connected in a technology toolkit that reduces the need for farmer data entry and supports adaptive soil health management for farms of all scales, geographies, and production systems. ***This ecosystem supports:***

- Greenhouse gas, water quality, biodiversity, and other environmental impact modeling, quantification and accounting.
- Farm and/or grazing data collection, record management, planning, and record-keeping. Data collected can be leveraged for certifications, ecosystem services markets, storytelling, environmental impact quantification and accounting, etc...
- Data sharing and sovereignty.
- Soil health measurement, monitoring, identification, and support.
- Buy and sell ecosystem services credits and make environmental claims.
- Supports collaboration and social coordination among land stewards.
- Economic analytics and insights for farmers, ranchers, and food producers.
- Storytelling and story-sharing to connect land stewards with their customers.

tools without additional data entry and assist researchers and analysts who can use the API switchboard to ease the creation of larger distributed and trusted data sets from multiple sources.

## IN-DEPTH LEARNING SERIES

OpenTEAM serves as a platform for dialogue. Through the [In-Depth Learning Series](#), we are building the knowledge base of the OpenTEAM community in a way that fosters coherence and collaboration. Each In-Depth helps us to collaboratively evaluate new concepts and technologies in an effort to ask better questions and to build better tools through sharing our work. Through these series, we have documented the dynamic nature of our community in a pre-competitive space that enables the emergence of new collaborations and technology approaches through community-strengthening.

# Adapting Locally to Hub & Network Farms and Ranches

OpenTEAM Hub & Network farms and ranches serve as a primary testing ground for the OpenTEAM platform, and their experience and feedback inform OpenTEAM's user interface design and calibration of the tools that are part of the OpenTEAM platform. Farmers and ranchers using the OpenTEAM technology toolkit come from diverse regions, countries, and climates. As each farm is unique in their size, production type, and research goals, their feedback is integral to the improvement and local adaptability of the tech tools in the OpenTEAM technology ecosystem.

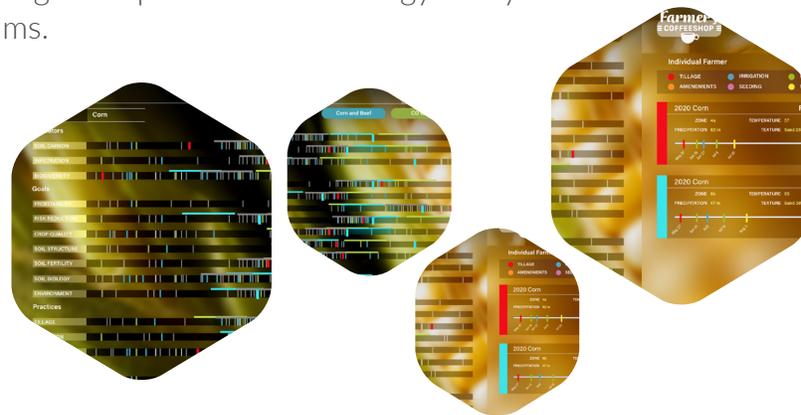
This past field season, Hub & Network farms and ranches developed different methods to collaborate and approach soil health measurements while integrating the OpenTEAM technology ecosystem into their record keeping and ecological monitoring programs.

## NORTHEAST GRAZING NETWORK CALIBRATES EMERGING SOIL HEALTH TOOLS

Spearheaded by the Stonyfield Hub, the Northeast Dairy Grazing Network tracked daily cow movement and pasture forage using PastureMap. A subset of these producers also participated in a pilot program to test Our Sci's SoilStack software and handheld spectrometer to determine soil sampling locations and measure carbon levels in the soil. The Stonyfield team collected all the samples from the designated spots, sent a portion of the sample to the lab and the rest of each sample was used for calibration of the handheld spectrometer. This year, the team at Our Sci will work to match the spectrometer data with the lab data to create more accurate carbon estimation models so that researchers and farmers can eventually get soil carbon data right in the field. The data collected on the farms and user experiences shared by farmers will help the development of SoilStack by Our Sci in the upcoming months. ([Read](#))

## USING TOOLS FOR SOIL HEALTH BENCHMARKING STUDY

PASA, Pennsylvania based sustainable agriculture association, started the Soil Health Benchmarking Study in 2016 to provide Pennsylvania farmers with soil health data to assist with management decisions. Since then, the Million Acre Challenge and the Maine Soil Health Network joined the study with their own regional cohorts. More than 100 farms in Pennsylvania, Maryland and Maine are contributing soil health and management data



to the study. Each of these cohorts use the same survey created in SurveyStack to collect, store and compare data from all the farms in the network. This ensures that all data is entered in the same format for sharing and analysis.

## EQUIPPING FOOD SYSTEMS LEADERS

Through OpenTEAM, we are working to equip future food systems leaders to generate a new way of approaching agriculture and regenerative farming systems. In the coming year, we are paying particular attention to supporting farmers and ranchers throughout our Hub & Network farms and ranches through a fellowship program. Through this program, fellows will learn how to provide technical and community support to OpenTEAM Hubs, develop leadership skills with an equity lens and advance land stewards' digital literacy. By creating feedback mechanisms, providing training on tools and adding additional capacity, we hope to create stronger systems of support and bridge the gaps farmers and ranchers currently face within the OpenTEAM technology ecosystem.

# Future of OpenTEAM

In 2022, our goal is to take the collaborative framework we have built and unite the strengths of the technology ecosystem we have built and the community practices that have formed around it. By developing a mechanism that marries these strengths, we can enable the acceleration and transfer of knowledge to a skilled ground-level community.

*This transformational work will further implement a lens of equity and diversity through human centered design processes that ensures our work best serves not just the traditional farmer, but the dynamic agricultural communities across the globe through a connected, open source and accessible toolkit.*

## GET CONNECTED

- Visit our [website](#)
- Quick Links: [Blog](#), [Get Involved](#), [In-Depth Learning Series](#)
- [Sign up](#) for the OpenTEAM monthly newsletter
- [Register](#) for the 2022 OpenTEAM webinar series: Creating the Ag Tech Ecosystem
- [Sign up](#) for an OpenTEAM orientation
- Email: [info@openteam.community](mailto:info@openteam.community)

Special thanks to *Caney Fork Farms, General Mills, Michigan State University's Malawi Hub, Organic Valley, UBC Farm, White Buffalo Land Trust, and Wolfe's Neck Center* for allowing us to use their photos.

