Regenerating Soil Sequestering Carbon

Report on the Joint Meeting of the:

Carbon Farming Innovation Network & Regenerative Supply Working Group
Agriculture Innovation Networks
Green America
Center for Sustainability Solutions

November 11-13, 2019
Minneapolis, MN

Upcoming Meetings:

Spring:
June 23-25, 2020 in Little Rock, AR
Optional visit to Adam Chappell’s 8,000 acre regenerative farm!

Fall:
November 10-12, 2020;
Location TBD
Thank you!

To the 90+ network participants, guests, and special presenters: thank you for your sharing your wisdom, passion, and commitment to the shared networks’ goals of scaling soil health and soil-carbon sequestration.
Networks of Leaders

- Farmers
- Scientists
- Food Brand
- Seed Dealers
- Advocates
- Ingredient Suppliers
- Academics
Support a **robust and resilient** food system that **regenerates** soil health to **restore** the climate, water quality and biodiversity, while **creating** food security, farm economic sustainability and better nutrition for families.

90% of agricultural acreage in N. America meets robust soil-carbon outcomes by 2030.

**Soil Health to Scale**

**Policy Levers**

**Soil Super Heroes**

**Regional Implementation**

**Soil Carbon Index**

**Resourcing Farmers**

**Shared Initiatives**

**Carbon Farming Innovation Network Goal**

*Reverse* the climate crisis through *agricultural carbon sequestration* while *restoring* soil health, water quality and eco-system biodiversity, while *providing* global food security.

Reverse atmospheric CO2 from 410+ ppm to 280 ppm.
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- Affiliated with the Regenerative Supply Working Group
- Affiliated with the Carbon Farming Innovation Network
Meeting Learning Agenda: Speaker Highlights & Key Take-Aways

The learning agenda explored the economic, ecosystem, and human impact of soil health

What are the opportunities for soil health at scale?

What does soil health do for the planet and reversing the climate crisis?

How does soil health affect human health?

What ecosystem market developments are relevant to scaling soil health?
Speaker Highlight:
Nicole Masters/Integrity Soils

Background

- New Zealand, North America
- Agroecologist, systems thinker, author and educator
- Works with farmers, ranchers over 1.1 million acres

Lindsay Farm (Aukland, NZ) With a range of soil biology enhancements, topsoil increased from 10mm to 32mm in under 2 years; reduced pest pressure, improved soil function; increased nutrient availability and pasture density.

Case Example in Canada (35,000 acres in wheat, barley, canola & peas) Advanced soil health mgmt. reduced costs of: pesticide (95%), herbicides (40%), fuel (20%) & fertilizer ($100/acre) while maintaining yield

Haggerty Family’s Prospect Farms Queenstown: Advanced soil health systems have led to a 41.5% increase in carbon stocks; 2T/HA over 12,000 hectares

What is important to know?

- Transition is possible through cost/time saving benefits, even in degraded soils
- Soil health/regenerative agriculture improves nutritional density. It has the potential to reverse declines in nutrition in food and threats to human health that have been documented over the past 50 years.

Nicole Masters, Founder
Integrity Soils
www.integritysoils.co.nz
Speaker Highlight: Chappell Family Farms

Regenerative Practices → farm turnaround

Background
- 4th generation farmer, botany & entomology, Arkansas grad
- Farms with his brother, Seth Chappell

Highlights
- 8,000 Acres in Cotton Plant, Arkansas
- Crops in rotation: corn, soybeans, cotton, rice
- All no till, diverse cover crops, livestock integration
- 90% non-GMO
- Expanded into additional high-margin businesses, including cattle, cover crop seed sales, rice mill (gluten free premiums)

What’s important to know – Financial Results
- Weed management costs almost drove family out of business; shifted them to focus on soil health to save $
- Costs reduced from $4.5 million to $2.3 per year
- Time required for farming also reduced
- Cost and time savings allowed investment in other businesses with significant increase in revenues (see above)
Speaker Highlight: Kara Boyd/Boyd Family Farm

Regenerating soil by adding hemp rotation, pursuing farm resilience in the face of climate change

Background
- Association of American Indian Farmers
- Farms 1,300 acres with her husband, Dr John Boyd

Highlights
- Regenerating soil by adding an additional hemp rotation
- Re-connecting to tribal hemp and honoring its history
- Deeply committed to helping farmers transition by facilitating peer learning (Telephone, Tele-Kara)

What is important to know
- Adding a hemp rotation can be a pathway to economic and agricultural revitalization for farms – improved soil health and new market
- Hemp capture 4x more CO2 than a tree
- Cost of hemp seeds is threatening margins. Lowering the bar for farmers to enter this market on a time scale that matters for climate and soil erosion should be an industry priority
Building domestic supply of oats to support Oatly’s product and climate commitments

Highlights
- Building domestic supply of oats is important to the brand’s product and climate commitment.
- Oats in rotation are an important part of regenerating soils.
- Market trends and consumer interest are promising for regenerative oats.

What is important to know
- Greater farmer support and peer learning is needed about how to grow oats as part of a profitable rotation.
- Supply chain partners are key to grow supply and infrastructure together.

Sara Fletcher
Communications and Public Affairs Lead
Oatly US
Engaging supply chain in Regenerative Agriculture to help achieve company climate commitments

Highlights
- Cargill sees upside for regenerative agriculture for their farmers and as a way to achieve their company climate commitments
- Farmers view transition as risky
- Cargill is working to lower the risk through a range of interventions

What is important to know
- Cargill is investing in research to help farmers optimize soil health practices for their operations
- Helping finance and bank lending to align for the scale and potential of soil health and regenerative agriculture is a significant cross-system need.

Ryan Sirolli
Global Row Crop Sustainability Director
Cargill, USA
Cargill’s Supply Chain Climate Commitment

Cargill has committed to a 30% reduction in greenhouse gas emissions from our supply chain by 2030.*

**Soil Health**
Working with farmers to adopt resilient agriculture practices that increase the ability to store carbon in the soil and improve water quality and storage capacity.

**Farmer Prosperity**
Helping farmers realize shared economic and environmental benefits through innovative agricultural practices, inclusive market access and resilient agricultural communities.

**Beef**
Partnering across the supply chain to reduce emissions through grazing management, feed production, innovation and food waste reduction.

**Transportation**
Reducing our transportation emissions across all businesses and supply chains.

*Relative to a 2017 baseline.
Speaker Highlight: David Johnson/BEAM

BEAM, an open-source advanced soil management system drives soil to a healthy tipping point

Biologically Enhanced Agricultural Management is a advanced management system designed by Dr. David Johnson, New Mexico State University, currently at Chico State.

How does it work?
A complex, diverse, fungal-bacterial balanced microbial inoculum is used in combination with biologically supportive practices. The result: soil health rapidly improves to a healthy tipping point where yield substantially increases, nutrient run off is significantly reduced and carbon is sequestered in soil.

What is important to know?
BEAM is low cost. The inoculum is easy to use, easy to make, only needs 1lb per acre and is applied with equipment farmers already have. The biological practices include those that farmers already know – such as applying cover crops. BEAM accelerates soil to the soil health zone within 3 – 4 years with up to 10X carbon sequestration over the control.
BEAM Field Trial Ecological Results include:

- 10X carbon sequestration over control
- Microbial Biodiversity: Fungal-bacterial ratio improved to 50:50 in 1 – 2 years from bacterial dominant
- SOM increase from 0.5% to 3% in 3 years

Source: David Johnson
Ecosystem Markets and Impact Measures can Scale Soil Health

Highlights

- Rapidly growing field of ESM and Scope 3 measurement could help scale soil health
- Brands are being driven to align to outcomes/science-based targets and measurements as a way of tracking investment in soil carbon and impact
- New frameworks, including SCI, create opportunities for to work with farmers to for highest mutual benefit

What’s Important to know?

- Not all frameworks are using the most relevant science about the potential for carbon sequestration in soil (i.e. Science Based Targets).
- It’s important to engage to ensure draw down in soil is accurately credited in the climate accounting/target frameworks. This could be a key contribution of these networks and their members.
Soil Carbon Permanence is a human concept; natural systems measure in durability.

Field studies show soil carbon durability over hundreds and thousands of years at significant depths.

Durability gives us a way of understanding the potential for soils as part of the drawdown solution.

Sampled rigorously in field studies, these advanced soil management systems demonstrate significant potential for increases in additional carbon sequestration.

Why does durability matter?

Given how vulnerable our ecosystems have become to extreme weather events, building carbon in soil is worth greater efforts to scale.

Soil carbon durability is the most appropriate frame for understanding investment and policy support for building soil health.
Ecosystem Soil Carbon Durability (Years)

Semi-arid: Palouse

Arid West, New Mexico

Wisconsin glacial till plain

Unglaciated

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Monger, C. NMSU

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<tr>
<td>0.1</td>
<td>100-300</td>
</tr>
<tr>
<td>0.1 to 1</td>
<td>500-2k</td>
</tr>
</tbody>
</table>

1-2            | >30k                     |
>2             | >200k                    |
Published & Reconnaissance Sampling

Food Security and Climate Goal
0.4% C gain/year

Gain of 1.1% C/year over 10 years with AMP (2-3TC/ac-yr)
Apfelbaum et al. 2016

Gain of 1.7% C/year over 15 years with AMP
Teague et al. 2011

Gain of 2.1% C/year over 6 years with AMP (5-7 TC/ac-yr)
Apfelbaum et al. 2015
Early Results of Rodale’s Vegetable and Grain Trials
testing nutritional impact of cropping systems

Highlights
- Nutritional value of foods has been declining for decades; Rodale’s fruit and veg trial look at relationship between soil quality and vegetable quality and nutrition
- Research has historically looked at impact of no or reduced tillage systems, systems with reduced chemical inputs and their potential for creating foods with improved nutrient content.
- Seems to be a connection between microbial diversity, and fungi role, in soil and nutrient values

What’s important to know?
- Promising current studies are focusing on ergothionine which is synthesized by fungi that may make the role of fungi and fungi-like bacteria clearer.
Ergothioneine (ERGO):

- Naturally occurring antioxidant
  - Anti-inflammatory,
  - Accumulates in cells and tissues,
  - Potential to mitigate neurodegenerative diseases such as Alzheimers
- Only synthesized by fungi and fungi-like bacteria in soil
- Unknown how enters and moves within plants.

Highest levels occur in mushrooms
Bob Beelman, Michael Kalaras, John Richie, 2018

The graph shows a scatter plot with the x-axis representing ergothioneine consumption (mg/day) and the y-axis representing Alzheimer's/dementia death rate per 100,000. Points are marked for Finland, U.S., France, Ireland, and Italy.
Ergothioneine is associated with reduced mortality and decreased risk of cardiovascular disease

Einar Smith, Filip Ottosson, Sophie Hellstrand, Ulrika Ericson, Marju Orho-Melander, Céline Fernandez, Olle Melander

British Medical Journal. 2019
Key Take-Aways

The Networks’ growing body of soil health and carbon sequestration knowledge
Soil Health Benefits
Emerging as Industry Focus

Regenerating soil health is emerging as a key focus in many food & ag companies, as soil health benefits address key company sustainability drivers, including:

• Carbon sequestration, including permanence
• Nutrient management
• Water quality & conservation
• Increased biodiversity (above & below ground)
• Reduced inputs, including pesticides, fertilizers
• Accelerated transition to organic
• Pollinator protection
• Supply chain security
• Improved nutrient density
• Increased yields
• Improved farm, farmworker & rural community economic sustainability
On the soil health spectrum, there is a ‘zone’ where soil becomes sufficiently healthy and, once reached, benefits of soil health rapidly accelerate.
There are advanced soil health management systems that accelerate degraded soil into the soil health zone and increase the eco-system and economic benefits of soil health – literally shifting the curve on soil health.
Science & Practice: Soil Health Spectrum & Advanced Management Systems

- Regenerative farmers & innovators including:
  - Will Harris, White Oak Pastures
  - Gabe Brown, Brown’s Ranch
  - Rick Clark, Clark Land & Cattle
  - Steve Tucker, Tucker Farms
  - Adam Chappell, Chappell Family Farms
  - Nichole Masters, Integrity Soils
  - Dr. Elaine Ingham, ECI
  - Dr. David Johnson, Chico State University

- Soil Scientists, peer-reviewed publications including:
  - Dr. Stuart Grandy, University of New Hampshire
  - Dr. Jerry Hatfield, USDA, Iowa State University
  - Dr. Jonathan Lundgren, USDA (former), Ecdysis Foundation
  - Jason Rowntree, Michigan State University
**Key Takeaways**

**Transition to Organic**

“Having already improved my soil health and learned weed control through no till, my transition to organic was a breeze -- and I maintained yields from Day 1.”

-- Rick Clark, farmer
Clark Land & Cattle

“When the 30 Iowa farms in our study hit the soil health zone with advanced soil health practices, moving from 2% to 4% SOM, they improved net profitability by $120 - $150/acre -- & they did it in 3 years.”

-- Dr. Jerry Hatfield
USDA, Ames IA

“Go all in on soil health – take care of your microbial livestock underground – and your operations will turn around”

-- Dr. David Johnson

“Farming this way brings us profitability and resilience.”

-- Adam Chappell
Chappell Family Farm

“Farming this way brings us profitability and resilience.”

-- Adam Chappell
Chappell Family Farm
Meeting Action Agenda

Updates on:
- MidWest Regional Regen
- Policy Levers to Scale Soil Health
- Soil Carbon Initiative
- Resourcing Farmers
- Soil Health to Scale/ Innovator Research
Action Agenda: Out-takes & Next Steps

• **Soil Carbon Initiative**
  • Secured commitments for next $150,000 of 2020 funding. Moving into Pilot Phase; Pilot enrollment open from Q2 2020. Continuing to look for launching funding

• **Midwest Regional Regen**
  • Convening a community of practice for soil health in the Upper Midwest with support from McKnight Foundation

• **Resourcing Farmers**
  • Participating in Vermont CIG grant to pilot stacked finance model of public/private funding for farm transitions
  • Developing ideas for scaling farmer resources for peer-to-peer and other learning on “all in” soil health

• **Soil Health to Scale**
  • Documenting case studies of regenerative farmer; exploring peer-to-peer farmer learning models

• **Policy Levers**
  • Leveraging our network of influencers to ensure that state and federal policy on soil health is sufficiently robust and encourages an ‘all-in’ approach to scale regenerative agriculture outcomes
Much soil health research fails to capture the potential of regenerative agriculture for carbon sequestration, broad eco-system benefits and farm-rural community economic benefits. Through the network learning agenda, we’ve identified farmers going all-in for soil health and innovative researchers and scientists documenting what’s possible. Our discovery is that farmers and research on advanced soil health systems achieve soil health outcomes that far surpass what earlier research says is possible. Our action agenda focus: Scale the reach, visibility and influence of the farmers and scientists innovating advanced soil health systems.

We already have good data and know-how for soil health and carbon sequestration. We need more but we can’t wait for more research to scale. So, based on what we know now, our action agenda includes how to influence farmers, food companies, policy makers, and funders to scale the adoption and measurement of soil health practices – and prepare for continued improvements as more data become available. The Soil Carbon Initiative is a breakthrough acceleration tool.
Addressing the barriers to scaling soil health for farm and climate resiliency means getting the right data to the right in field and in supply chain decisions makers. So our action agenda includes developing models of peer-to-peer learning as well as novel data aggregation and distribution tools to help scale transition to advanced soil health systems.

Agriculture and farm finance is based on data and practices from the conventional agriculture system. It fails to see the potential for more resilient, less risky, and more profitable farms managed under advanced soil health systems. So our action agenda includes identifying ways to align resources to help farmers transition, along with aggregating more data on transition costs and the financial benefits of optimizing soil health, and by educating financial institutions and improving data on the financial benefits of optimizing soil health.
Next Meeting: June 23-25, 2020
Little Rock, Arkansas

Agenda highlights:

• Regenerative farmers achieving agronomic and financial results at scale
• Brands leading the transformation of the industry to regenerative agriculture and leading on soil as a climate solution
• Key Innovators from other industries who have designed rapidly-scalable training and technical support
• Researchers connecting soil health/human health/nutrition
• Updates on state and national policy opportunities for soil health and carbon sequestration in soil
• Roundtable on finance/soil health/climate solutions.
• Option to visit Adam Chappell’s 8,000-acre regenerative farm prior to the program kick-off on Tuesday afternoon.
Join Us

To explore membership in the Green America Innovation Networks, or to discuss attending an upcoming meeting, please contact:

• Mary Johnson, Carbon Farming Innovation Network: mjohnson@greenamerica.org
• Jessica Hulse Dillon, Regenerative Supply Working Group: jhdillon@greenamerica.org