SOIL HEALTH

THE FOUNDATION FOR
Regenerative Agriculture

REPORT

5th Annual Meeting

July 30-31, 2020

A Virtual Meeting

Celebrating 5 Years

SOIL HEALTH INSTITUTE

UNIFY ■ RESTORE ■ PROTECT

CONTENTS

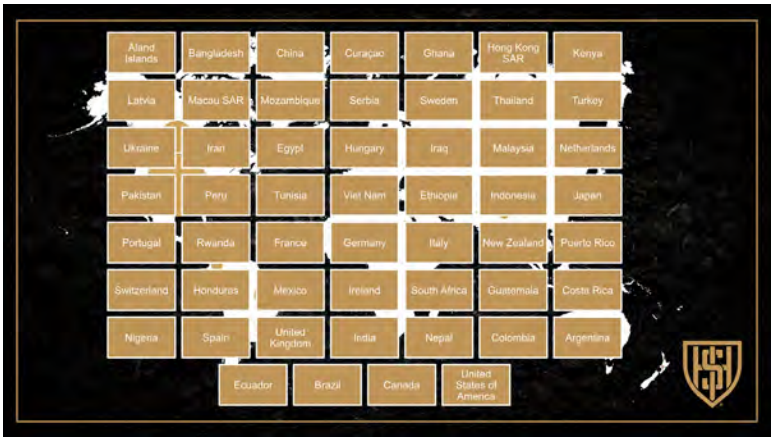
SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

EXECUTIVE SUMMARY

Soil Health: The Foundation for Regenerative Agriculture, the 5th Annual Meeting of the Soil Health Institute (SHI), was held July 30-31, 2020, as a virtual forum. The event advanced the opportunity we have to address climate change, water quality, food production, biodiversity, and many other pressing issues by improving soil health. Presentations addressed the actionable potential of soil health; including preliminary suggestions on how the agricultural industry can measure soil function in the future as well as the role of farmers and ranchers in combating global climate change and its impacts.

In addition to the Plenary Sessions, 26 researchers presented three-minute video summaries (video posters) of their current research. The Video Poster Sessions included the opportunity to visit with the presenters via Zoom live chat rooms.

SHI President and CEO Dr. Wayne Honeycutt and SHI Chairman of the Board Mr. Jason Weller welcomed participants from 63 countries. According to an in-meeting poll, half were scientists, other participants included field conservationists, consultants, farmers, agribusiness, government, and non-governmental organization professionals. Of those who don't farm full time, 27 percent indicated they farm part time.



Corporate sustainability leaders, including Mr. Jay Watson, Sourcing Engagement Manager, Global Sustainability, General Mills, and Mr. Ryan Sirolli, Global Row Crop Sustainability Director, Cargill, explained the relevance of soil health for regenerative agriculture and discussed 2020 research on how soil health reduces carbon emissions, builds drought resilience, and drives on-farm profitability and soil conservation.

Annual Meeting Highlights:

- Strategy to move the U.S. agricultural sector to net zero carbon emissions by 2040;
- Opportunities to accelerate regenerative agriculture implementation;
- Preliminary results of research that will lead to standardizing soil health measurements;
- A new online tool to help farmers build soil carbon and improve drought resilience.

EXECUTIVE SUMMARY

KEYNOTE: Mr. Jay Watson, General Mills

Mr. Jay Watson defined regenerative agriculture as a holistic, principles-based approach to farming and ranching that seeks to strengthen ecosystems and community resilience.

General Mills recognizes that companies are responsible for developing solutions to support sustainability, Mr. Watson explained, adding there are several opportunities based on early insights from regenerative agriculture implementation, such as:

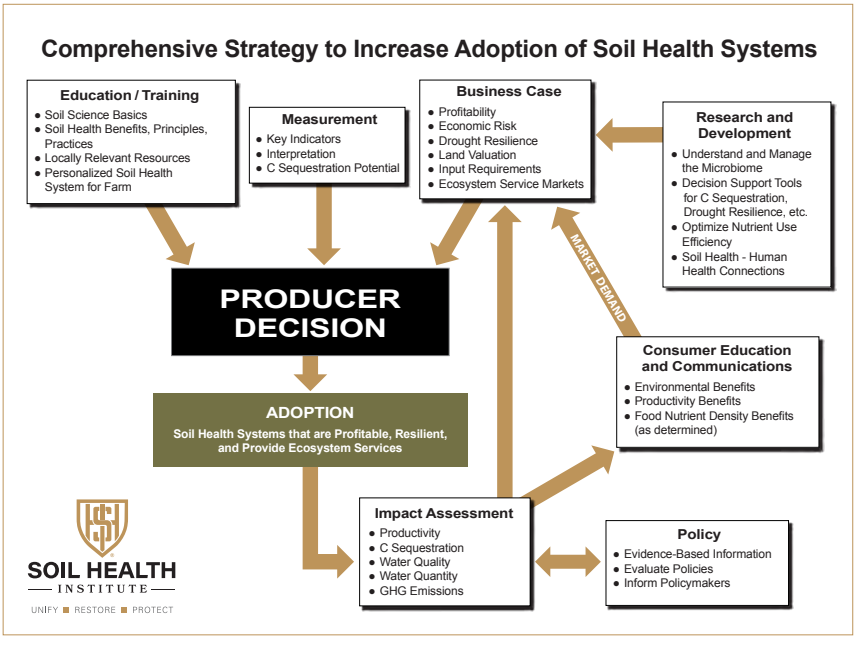
- How do we accelerate systems-level research vs. focusing on discrete parts?
- How do we more effectively team as an ecosystem of enablers to farmers and ranchers?
- How do we move from existence to potential?

Mr. Watson indicated agricultural sustainability is a critical mission for General Mills as it would address the looming challenges of topsoil loss, biodiversity loss, declining farm profitability, and it would decrease greenhouse gas emissions from agricultural practices.

KEYNOTE: Dr. Wayne Honeycutt, SHI

Dr. Wayne Honeycutt introduced a comprehensive strategy for advancing soil health, a strategy that SHI employs to increase adoption of soil health systems in order to achieve on-farm and environmental benefits at scale.

An abundance of research shows that practices designed to improve soil health also reduce nutrient loss to waterways, reduce greenhouse gas emissions, increase carbon sequestration, increase drought resilience, enhance yield stability, increase biodiversity, enhance pollinator/wildlife habitat, and provide many other benefits. In short, soil health is the foundation for regenerative and sustainable agriculture. Achieving these benefits at scale requires providing the information land managers need when deciding whether to adopt new management practices/systems.



SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

EXECUTIVE SUMMARY

MEASUREMENTS, STANDARDS, AND ASSESSMENT

Dr. LaKisha Odom, Scientific Program Director, Foundation for Food and Agriculture Research, explained that soil health leaders envision a world where every farmer and rancher deploys climate-smart solutions on every acre. Bridging the gap between scientific data and farmer adoption is needed to achieve sustainability and climate change mitigation goals, and only through broad cooperation can this bottleneck be addressed.

SHI is leading the North American Project to Evaluate Soil Health Measurements (NAPESHM) with the goal of identifying the most effective indicators of soil health by measuring more than 30 indicators across 124 long-term research sites in Mexico, the United States of America, and Canada. SHI coordinated a panel of scientists to help select appropriate measurement methods, and long-term research sites were selected from a list volunteered by scientists across North America. SHI scientists are working with research-site partners to create an information-rich database that can be used in future research efforts and outlining a flexible framework for quantifying soil function. Scientists also summarized initial data-driven observations, noting the impacts of specific soil health promoting practices over time.

More specific details regarding the indicators selected, the methods used, and the sites selected can be found on SHI's website and in a paper published in *Agronomy Journal*, Norris et al. (2020).

POLICY

Speakers summarized the economic incentives and environmental impact of almost 60 soil health provisions in the 2018 U.S. Farm Bill (Agriculture Improvement Act of 2018). They also highlighted innovative public and private programs, such as cost sharing and ecosystem services markets, that may shape, influence and drive soil health and protect ponds, lakes, rivers, and streams.

BUSINESS CASE

Speakers outlined multiple efforts to quantify the economic and environmental outcomes associated with successful soil health practices.

SHI has worked with the U.S. Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS), National Association of Conservation Districts, Cargill, and others to create partial budget methodology that quantifies changes in production costs associated with adoption of soil health management systems (SHMS). SHI has ongoing projects applying this partial budget analysis. Future reports will present comparative economic results with research plot trial data as well as case study farm data.

EXECUTIVE SUMMARY

American Farmland Trust and USDA-NRCS have created farm case studies that seek to establish the effects of soil health practices, specifically establishing the effect such practices have on the agricultural producer's bottom line.

The journey to adoption is personal and each farm field has its own story to tell. Three U.S. farmers, who have implemented soil health promoting practices in their farming operations, shared their observations during the annual meeting.

FARMER EDUCATION

During the Farmer Education Session, experts provided information resources and highlighted activities that currently promote soil health promoting practices.

Dr. Jerry Hatfield, former Laboratory Director and Supervisory Plant Physiologist of the U.S. Department of Agriculture, Agricultural Research Service's National Laboratory for Agriculture (retired), addressed producers' potential benefits in his presentation, "What Soil Health Means to a Producer and Why They Should Care." Dr. Hatfield explained that soil health is improved by reduced tillage, continuous cover with cover crops, crop diversity, livestock grazing, and bio-based fertilizers. These practices improve soil organic matter, water quality, water filtration, field access, and crop resiliency. He indicated continuous cover has been shown to increase water-use efficiency by as much as 49% in corn and 26% in soybean.

Dr. Dianna Bagnall, SHI Research Soil Scientist, announced a new decision support tool will be freely available soon as a part of the online CarbOn Management and Emissions Tool (COMET-Farm). The tool includes NAPESHM equations, and is being developed in partnership with Colorado State University, the USDA Natural Resources Conservation Service, and SHI. Currently in beta version, it will allow farmers and soil health advisers to explore how to build soil carbon and improve drought resilience.

Meanwhile, **Mr. John Mesko**, Senior Director of Soil Health Partnership, explained how the organization works with farmers to understand the benefits of cover crops, reduced tillage and other soil health promoting practices. This work, on 200 farms in 16 states, will contribute to a better understanding of soil health practices and their impacts across the Midwest.

Mr. David Lamm, SHI Project Manager of Healthy Soils for Sustainable Cotton, shared a snapshot of how Healthy Soils for Sustainable Cotton provides accessible farmer mentors, technical specialists, and advanced training for interested cotton growers. The program provides educational resources, such webinars, videos, virtual field days, and more.

EXECUTIVE SUMMARY

By close of the two-day annual meeting, participants had benefited from 10 hours of premier soil health research presentations and had the opportunity to visit 26 research projects during the Virtual Poster Session.

Continuing Education Units were available for qualifying attendees, including practicing soil and agronomy professionals. These CEUs were applicable to Certified Crop Adviser (CCA), Certified Professional Agronomist (CPAg), Certified Professional Soil Scientist (CPSS), as well as Certified Professional Soil Classifier (CPSC) certifications.

THANK YOU

SHI would like to thank everyone for participating in a successful annual meeting, the meeting sponsors for their generous support, and all those who contributed to the 2020 effort. What a great celebration of information and what a great way to enjoy the 5th anniversary of an organization so many created together.

SAVE THE DATE

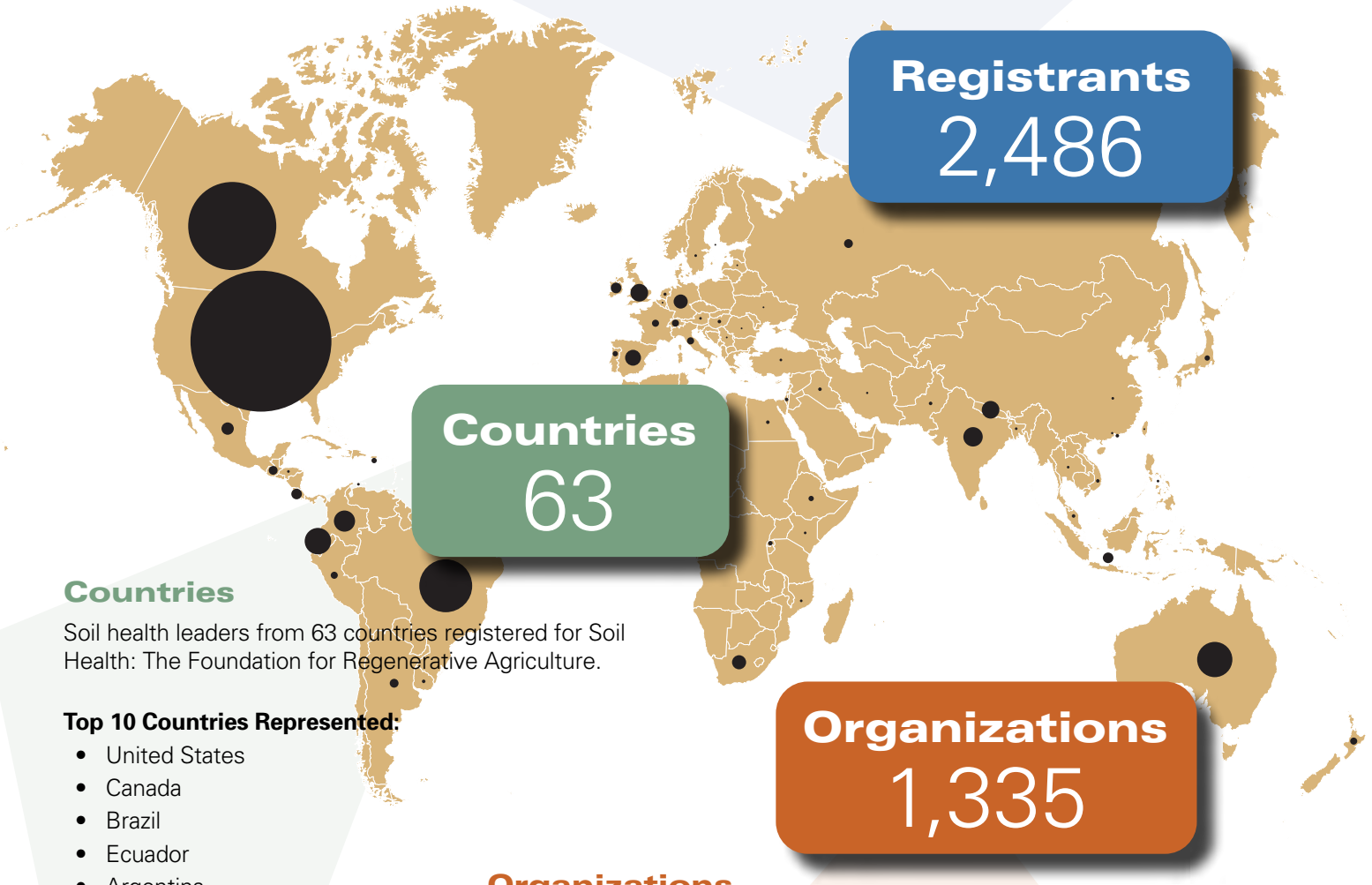
Please save the date for the 6th SHI annual meeting August 5-6, 2021, with an opening reception in the evening on August 4, at the Marriott Downtown, Des Moines, Iowa USA.

MEETING METRICS

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

Registrants

SHI's first annual meeting was held in Louisville, Kentucky at the Galt House Hotel where 135 soil health leaders formed four working groups to establish paths forward for soil health research, measurements and standards, economics, and education, including an online library for soil health research. This year's annual meeting celebrated SHI's 5th Anniversary. The meeting also revealed preliminary insights from the largest collaborative North American soil sampling project in history. Due to COVID-19, a coronavirus pandemic that forced a worldwide meeting shutdown, Soil Health: The Foundation for Regenerative Agriculture was held virtually with 2,486 registrants.



Countries

Soil health leaders from 63 countries registered for Soil Health: The Foundation for Regenerative Agriculture.

Top 10 Countries Represented:

- United States
- Canada
- Brazil
- Ecuador
- Argentina
- Columbia
- Nepal
- India
- United Kingdom
- Spain

Continents Represented:

- Asia
- Australia/Oceania
- Europe
- North America
- South America

Organizations

Meanwhile, registrants represented 1,355 organizations. Registrants' affiliations included:

- Academia
- Agribusinesses
- Conservation Districts
- Crop Advisers
- Environmental Services Firms
- Farms
- Food and Clothing Retailers
- Government Agencies
- Land Management Firms
- Manufacturers
- Media
- Non-Governmental Organizations
- Ranches
- Research Institutes
- Rural Banks
- Scientific Laboratories
- Financial Consultancies

WELCOME

Dr. Wayne Honeycutt

Dr. Wayne Honeycutt, President and CEO of Soil Health Institute (SHI), opened the 5th annual meeting by thanking all sponsors, speakers, and attendees for helping to make Soil Health Institute's virtual annual meeting happen. This truly global conference was attended by participants in 63 countries. We are proud to advance the cause of global soil health.

Dr. Honeycutt explained that SHI is a non-profit whose mission is to safeguard and enhance the vitality and productivity of soil through scientific research and advancement. SHI works with its many stakeholders to identify gaps in research and adoption; develop strategies, networks and funding to address those gaps; and ensure beneficial impact of those investments to agriculture, the environment and society.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=iSN-5H5us00M&list=PLd-FVkeklZuqx-ZKtDFgRJMeI2oAvf-DjdF

FOR FURTHER RESEARCH:

For more information on the Soil Health Institute, visit: https://soilhealthinstitute.org/

To learn more about the soil health movement, watch Living Soil: https://vimeo.com/298616093

Mr. Jason Weller

Mr. Jason Weller, Chairman of the Board at the Soil Health Institute, welcomed participants to Soil Health: The Foundation for Regenerative Agriculture.

The Soil Health Institute's meeting marked a milestone in efforts to improve soil health on a global scale, Mr. Weller said. The Institute brought together the best minds in science, agriculture, and conservation in order to identify gaps in our understanding of soil health and offer practical solutions to resource management. This is the first time the Institute attempted a meeting of this scale entirely online.

Mr. Weller noted that recent challenges introduced by the most recent COVID-19 crisis highlight the need to understand unavoidable challenges and emphasizes the fact that we must do the research necessary to address the long-term needs of our planet, which include food security and protecting those around us.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=QPv8si0Z-qM&list=PLd-FVkeklZuqx-ZKtDFgRJMeI2oAvf-DjdF&index=2

KEYNOTE

Mr. Jay Watson

Advancing Regenerative Agriculture/Soil Health at General Mills

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=2tc0PU3IjDA&list=PLd-FVkeklZuqx-ZKtDFgRJMeI2oAvf-DjdF&index=3

FOR FURTHER RESEARCH

To learn more about Regenerative Agriculture at General Mills, visit: https://www.generalmills.com/en/Responsibility/Sustainability/Regenerative-agriculture

To learn more about the Soil Health Institute, visit: https://soilhealthinstitute.org/

Mr. Jay Watson, Sourcing Engagement Manager of Global Sustainability at General Mills, defined regenerative agriculture as a holistic, principles-based approach to farming and ranching that seeks to strengthen ecosystems and community resilience.

General Mills recognizes that companies are responsible for developing solutions to support sustainability, and it is committed to sustainably sourcing 100% of its 10 primary ingredients, Mr. Watson explained. They also were one of the first companies to set a science-based target for scope 3 emissions reductions and committed in 2019 to advancing regenerative agriculture on 1 million acres of farmland by 2030. This is a critical mission for General Mills as they work with partners to address challenges of topsoil loss, biodiversity loss, declining farm profitability, and increasing greenhouse gas emissions in agriculture.

Mr. Watson highlighted several opportunities based on early insights from regenerative agriculture implementation, such as:

- How do we accelerate systems-level research vs. focusing on discrete parts?
- How do we more effectively team as an ecosystem of enablers to farmers and ranchers?
- How do we move from existence to potential?

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

KEYNOTE

Dr. Wayne Honeycutt

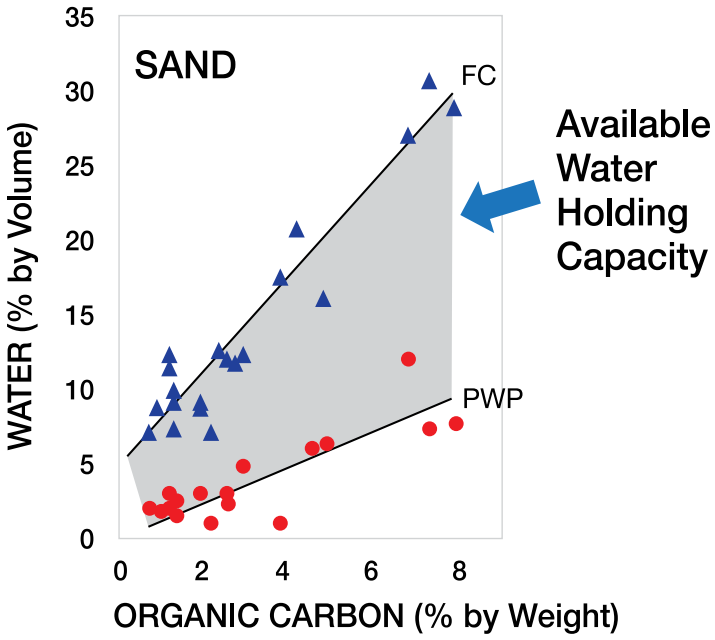
Comprehensive Strategy for Advancing Soil Health

Dr. Wayne Honeycutt, President and CEO of the Soil Health Institute, discussed a comprehensive strategy for advancing soil health, a strategy that the Soil Health Institute employs to increase adoption of soil health systems in order to achieve on-farm and environmental benefits at scale.

By 2050, our agricultural systems will need to support another 2 billion people. Yet, in the last century, many agricultural soils have lost 40%-60% of the basic building block that makes them productive (organic matter). The societal and environmental costs of soil loss and degradation in the United States alone are estimated to be as high as $85 billion every single year. Greenhouse gas emissions have reached the highest level ever recorded and are continuing to increase. Drought is expected to increase from impacting 1% of the world's arable land to over 30% by the end of the century due to climate change. Approximately 80% of our nation's rivers and streams are currently impaired due to nutrient runoff and other contaminants.

We are at a critical juncture in human history where we must address these challenges by transforming agriculture, and soil health is the framework to do just that, Dr. Honeycutt said.

An abundance of research shows that practices designed to improve soil health also reduce nutrient loss to waterways, reduce greenhouse gas emissions, increase carbon sequestration, increase drought resilience, enhance yield stability, increase biodiversity, enhance pollinator/wildlife habitat, and provide many other benefits. In short, soil health is the foundation for regenerative and sustainable agriculture. However, achieving these benefits at scale requires providing the information our land managers need when deciding whether to adopt new management practices/systems.



FC = Field Capacity
PWP = Permanent Wilting Point

Data adapted from Hudson, B.D. 1994. J. Soil Water Cons. 49:189-194.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=vYPcXT57a28&list=PLd-FVkeklZuqx-ZKtDFgRJMel2oAvf-DjdF&index=4

FOR FURTHER RESEARCH:

To learn more about the Soil Health Institute's comprehensive strategy for advancing soil health, visit: https://soilhealthinstitute.org/strategy/

To learn more about the Soil Health Institute's programs that advance soil health adoption, visit: https://soilhealthinstitute.org/programs/

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Dr. LaKisha Odom

Determining Effective Measurements of Soil Health

Dr. LaKisha Odom, Scientific Program Director at the Foundation for Food and Agriculture Research (FFAR), presented "Determining Effective Measurements of Soil Health" to introduce the Measurement, Standards, & Assessment session of Soil Health Institute's 2020 Annual Meeting.

In her presentation, Dr. Odom discussed how to use data to benefit the agricultural sector. Freeing up data, or alternatively, establishing data ownership, is a critical step to distributing data to farmers. A discussion is needed to determine how to overcome the challenges facing agricultural data management and usage to deliver the most value to farmers. FFAR, in partnership with several other organizations, has hosted webinars to move this discussion forward, including a virtual conference on September 24-25, 2020.

Soil health leaders envision a world where every farmer and rancher deploys climate-smart solutions on every acre. The Foundation for Food and Agriculture research, in partnership with the US Farmers and Ranchers Alliance and the World Farming Organization, has set a bold goal for U.S. agriculture: to achieve net negative greenhouse gas emissions through coordination and collaboration. Bridging the gap between scientific data and farmer adoption is needed to achieve current sustainability and climate change mitigation goals, and only through broad cooperation can this bottleneck be addressed, Dr. Odom said.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=pjXXF_6WG-So&list=PLdFVkeklZuqx-ZKtDFgR-JMeI2oAvfDjdF&index=5

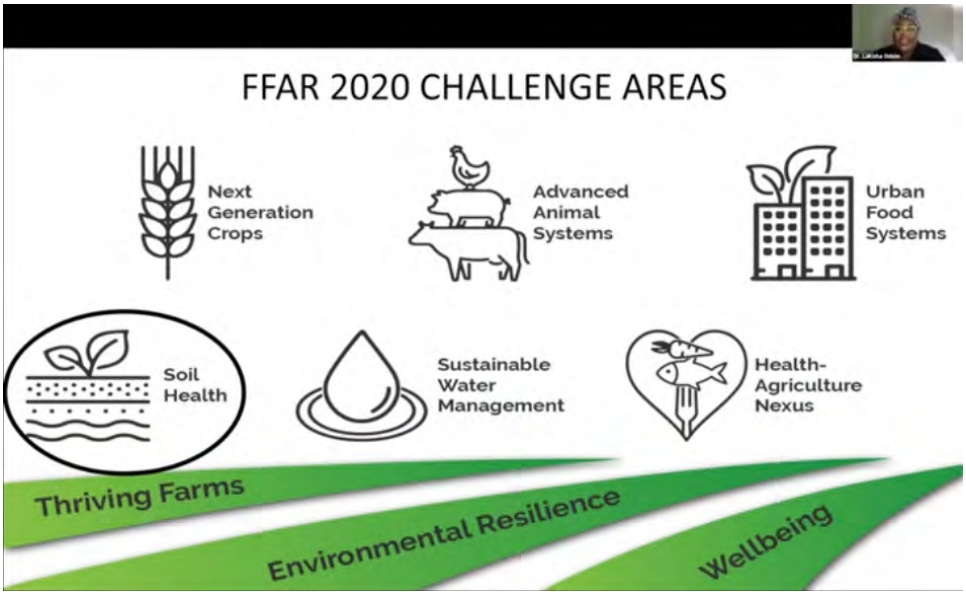
FOR FURTHER RESEARCH

For more information on Soil Health Institute measurement of 124 long-term research sites, visit: https://soilhealthinstitute.org/north-american-project-to-evaluate-soil-health-measurements/

For more information on how the Soil Health Institute will manage data, view: https://www.youtube.com/watch?v=VL7ZQUjM8Kg&list=PLdFVkeklZuqx-ZKtDFgRJMeI2oAvfDjdF&index=7

For more information on the Foundation for Food and Agriculture Research, visit: https://foundationfar.org/

For webinars hosted by Foundation for Food and Agriculture Research, visit: https://foundationfar.org/?event=unlocking-the-agricultural-data-revolution&event_date=2020-09-24



SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Dr. Cristine Morgan

North American Project to Evaluate Soil Health Measurements

The Soil Health Institute is leading the North American Project to Evaluate Soil Health Measurements (NAPESHM) with the goal of identifying the most effective indicators of soil health by measuring more than 30 indicators across 124 long-term research sites in Mexico, the United States of America and Canada. The Soil Health Institute coordinated a panel of scientists to help select appropriate measurement methods, and long-term research sites were selected from a list volunteered by scientists across North America. More specific details regarding the indicators selected, the methods used, and the sites selected can be found on the Soil Health Institute's website and in a paper published in *Agronomy Journal*, Norris et al. (2020).

All sites were successfully sampled in 2019, with more than 97% of sampling being completed in the spring before planting. Soil sample analyses and associated quality control checks of data were completed in spring 2020, except a few carbon samples that needed re-testing (delayed because of COVID-19 closures). All management data from the sites have been collected, catalogued and verified. The eight scientists working on the project are in the process of preparing peer-reviewed manuscripts and reports that analyze and synthesize results. Those manuscripts will be submitted for publication in fall of 2020, and the Soil Health Institute anticipates providing a recommendation of a soil health measurement framework in the fall of 2020.

The Soil Health Institute acknowledges the many Partnering Scientists that have contributed their research sites, helped in sampling and offered data analysis ideas to the project. The project is funded by the Foundation for Food and Agriculture Research, General Mills and The Samuel Roberts Noble Foundation.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=y-30vt5goT4&list=PLd-FVkeklZuqx-ZKtDFgRJMeI2oAvf-DjdF&index=6

For further information on soil health indicators, visit: https://soilhealthinstitute.org/north-american-project-to-evaluate-soil-health-measurements/

Norris et al. (2020). Introducing the North American project to evaluate soil health measurements: https://acsess.onlinelibrary.wiley.com/doi/full/10.1002/agj2.20234

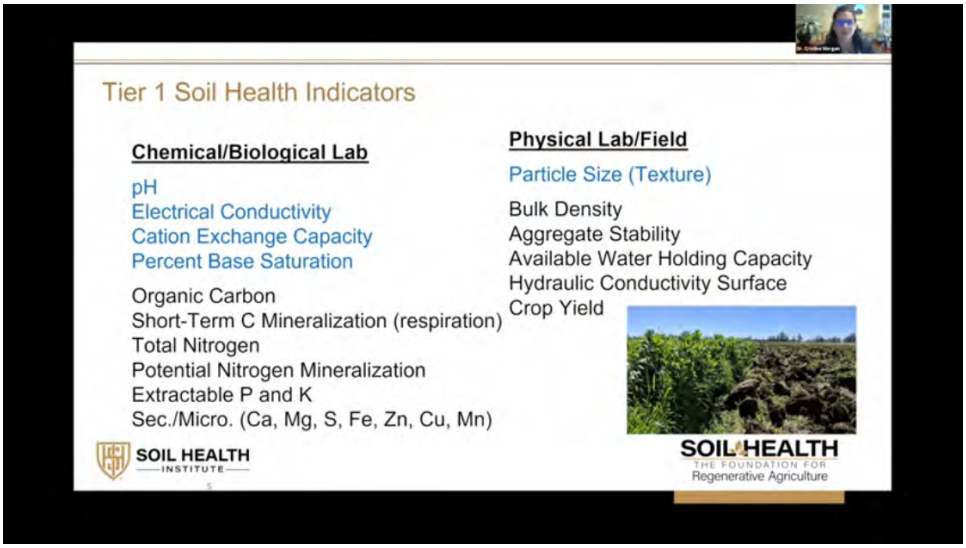
For more information on the Soil Health Institute, visit: https://soilhealthinstitute.org/

To learn more about the Agronomy Journal, visit: https://acsess.onlinelibrary.wiley.com/journal/14350645

For more information on the Foundation for Food and Agriculture Research, visit: https://foundationfar.org/

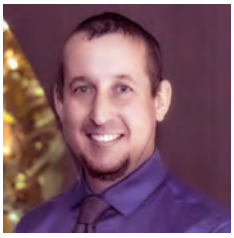
For more information on General Mills, visit: https://www.generalmills.com/

For more information on The Samuel Roberts Noble Foundation, visit: https://noblefoundation.org/



SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS



Dr. Michael Cope

Management Indices that Reflect Foundational Soil Health Practices

Soil health management systems are comprised of many specific management decisions such as crop rotation, tillage and cover cropping practices. Categorical (i.e. text- or label-based) characterizations of soil health management (e.g. "no-till" or "conservation till") overgeneralize important details about soil health management and can be regionally specific. As a result, the categorical descriptions limit our ability to synthesize soil health data across different sectors of agricultural production.

The Soil Health Institute, through the North American Project to Evaluate Soil Health Measurements (NAPESHM), is developing a numerical indexing system to represent core components of soil health management systems. The management indices, based on the principles of soil health, are being used to evaluate soil health measurements along continuous gradients of soil health management practices within and across different sectors of agricultural production.

PRESENTATION VIDEO:

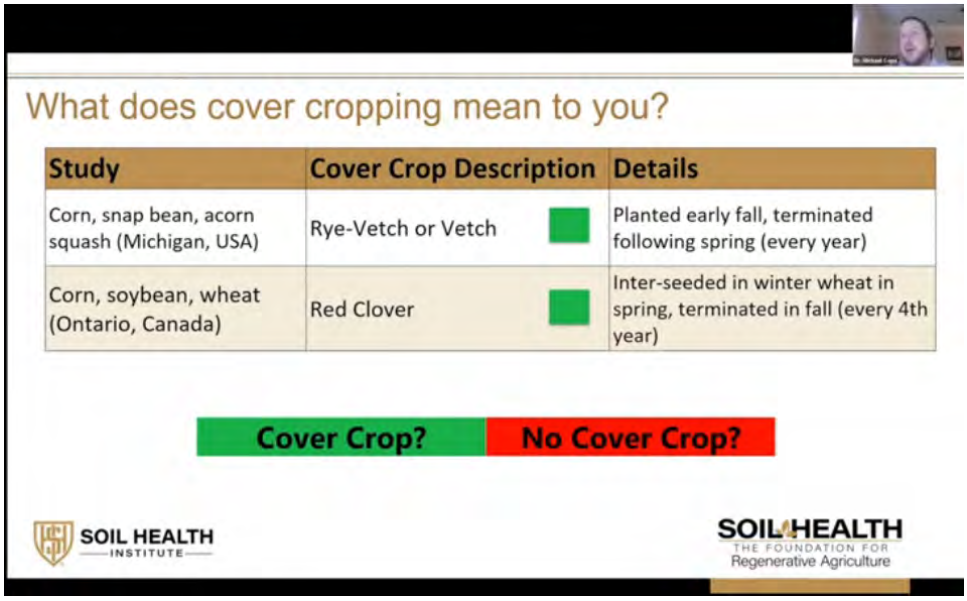
https://www.youtube.com/watch?v=VL7ZQUjM8K-g&list=PLdFVkeklZuqx-ZKtDFgR-JMeI2oAvfDjdF&index=7

FURTHER RESEARCH

For more information on the North American Project to Evaluate Soil Health Measurements (NAPESHM), visit: https://soilhealthinstitute.org/north-american-project-to-evaluate-soil-health-measurements/

To learn more about the principles of soil health, visit: https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/nd/soils/health/?cid=nrcseprd1300631#:~:text=The%20Soil%20Health%20foundation%20consists,%2Froot%2C%20and%20livestock%20integration.

To learn more about soil tillage intensity, visit: https://fargo.nserl.purdue.edu/RUSLE2_ftp/NRCS_Base_Database/Farm%20Equipment%20presentations/Farming%20Implements%20presentation%20slides.pdf



SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Dr. Shannon Cappellazzi

Flexible Framework to Quantify the Functions of Soil: Examples with Nitrogen Cycling

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=-U27bGcvKH-g&list=PLdFVkeklZuqx-ZKtDFgR-JMeI2oAvfDjdF&index=8

FURTHER RESEARCH

Soil Health Indicators:

https://soilhealthinstitute.org/north-american-project-to-evaluate-soil-health-measurements/

North American Project to Evaluate Soil Health Measurements:

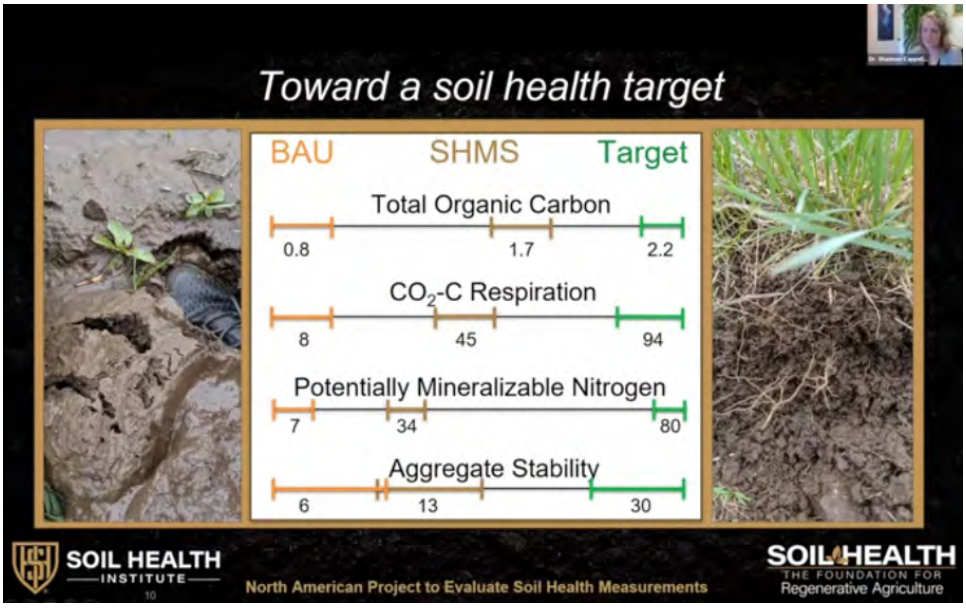
https://acsess.onlinelibrary.wiley.com/doi/full/10.1002/agj2.20234

The Soil Health Institute is working on building a flexible framework to quantify the functions of soil as a means of interpreting soil health measurements. This framework will be meaningful for farmers and ranchers, those interested in ecosystem services provided by soils, and a host of other stakeholders, according to Dr. Shannon Cappellazzi, Lead Scientist at SHI.

A healthy soil is a vital living ecosystem that functions to its capacity. Soil Health Institute soil scientists are using a suite of tests to develop formulas that assess how well a particular soil is storing carbon, cycling nitrogen and other nutrients, storing water, infiltrating water, purifying water, providing habitat, being a source of biological diversity, suppressing pests and disease, and regulating atmospheric gases such as carbon dioxide (CO_2) and nitrous oxide (N_2O).

Rather than expensive testing that measures each of these outcomes specifically, we are evaluating more than 31 soil health indicators to draw relationships between simple measurements and these functions. In doing so, we will determine a minimum suite of measurements that provide scientifically rigorous data while maintaining economic feasibility for a wide variety of potential stakeholders, Dr. Cappellazzi said.

Preliminary results show that grouping soils for inherent climate and soil features and then measuring soil organic carbon, microbial respiration through a 24 hour CO_2 test, and testing aggregate stability using a smart phone application called SLAKES, can tell us nearly as much about the soil's ability to function to its potential as a more extensive suite of tests. Additional tests will be analyzed and potentially added to this base suite for quantification of each specific function.



SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Dr. Daniel Liptzin

Effects of Soil Health Management Practices on Soil Carbon Dynamics

Carbon has long been considered central to soil health because it plays many roles in soil function. Measuring total soil carbon has been possible for decades, but many other soil carbon measurements have been proposed recently to quantify soil health. These alternative indicators measure some type of biological activity or chemical fraction of carbon and are thought to be more sensitive to management decisions. The Soil Health Institute, through the North American Project to Evaluate Soil Health Measurements (NAPESHM), compared soil organic carbon (SOC) measurements with permanganate oxidizable carbon (POx-C), respiration, microbial biomass, water extractable organic carbon, and beta glucosidase enzyme activity.

Preliminary results show that correlations of indicators with climate and soil texture were weak. The correlations among the indicators were moderate, except for microbial biomass which was weak. All of the indicators (except microbial biomass) had a similar capability to detect changes in management. While the cost of most of these tests is similar, the POx-C and 24 hour respiration assays have advantages of being widely available at commercial labs and offer the option of a "field" test. These tests are suggested to respond quickly to changes in management.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=82YC4gZ-VQPQ&list=PLdFVkekIZuqx-ZKtD-FgRJMeI2oAvfDjdF&index=9

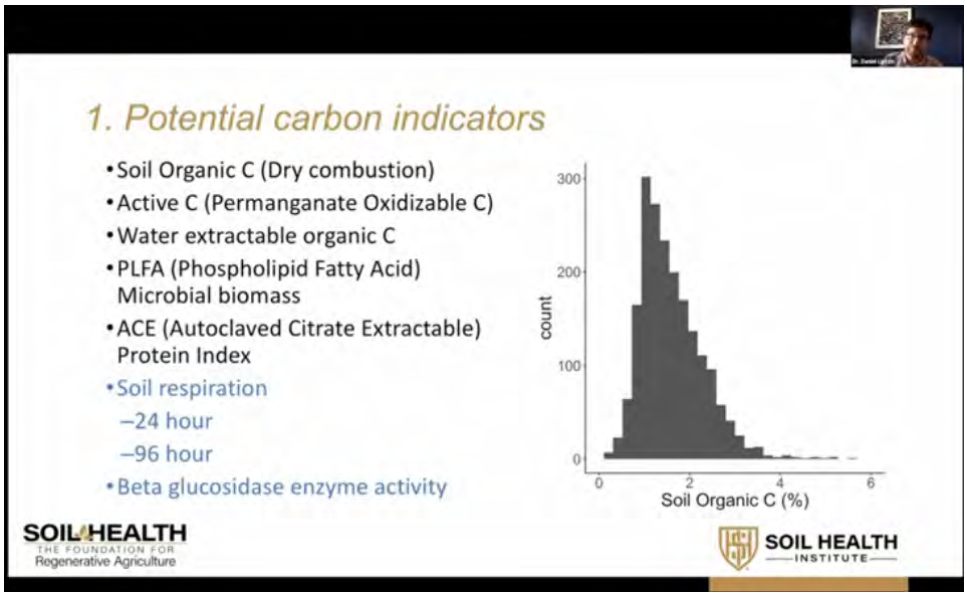
FURTHER RESEARCH

For more information on soil health indicators, visit:

https://soilhealthinstitute.org/north-american-project-to-evaluate-soil-health-measurements/

For more information on the North American Project to Evaluate Soil Health Measurements, visit:

https://acsess.onlinelibrary.wiley.com/doi/full/10.1002/agj2.20234



PLENARY SESSIONS

Dr. Elizabeth Rieke

Selecting for Microbial Life Strategies in Agricultural Soils Under Soil Health Promoting Practices

Soil microbes are largely responsible for degrading organic materials and cycling nutrients in soil, and are highly sensitive to physical and chemical changes in soil. Biological measurements currently used to assess soil health provide an understanding of available resource pools, metabolic byproducts, and overall community sizes of these microbes. While these measurements are sensitive to changes in agricultural management practices, less is known regarding which microbes are responsible for driving the changes due to management. Incorporating 16S rRNA amplicon sequencing in soil health studies allows for examination of bacterial and archaeal taxa at finer resolutions.

The Soil Health Institute, using data from the North American Project to Evaluate Soil Health Measurements, identified inherent soil properties and management practices which significantly affect bacterial and archaeal communities in soil using 16S rRNA amplicon sequencing. Preliminary results show *between* site variation in bacterial and archaeal community structures is highly dependent on soil pH and climate moisture regimes, while *within* site variation is dependent on management practices. Reducing tillage intensity from intense management to minimal disruption resulted on average in a 13% shift in bacterial and archaeal community structures. Additionally, relative abundances of three bacterial and archaeal orders directly related to nitrogen cycling were significantly greater in minimum tillage systems.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=ScLI6mNj7Vs&list=PLd-FVkeklZuqx-ZKtDFgRJMeI2oAvf-DjdF&index=10

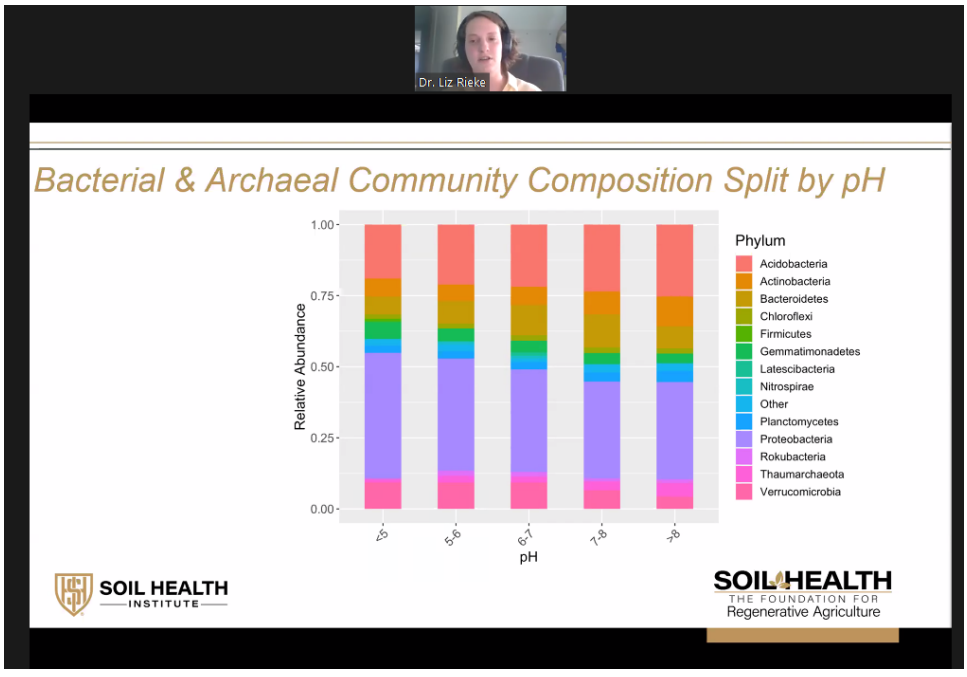
FURTHER RESEARCH

To learn more about soil health indicators, visit:

https://soilhealthinstitute.org/north-american-project-to-evaluate-soil-health-measurements/

For more information on the North American Project to Evaluate Soil Health Measurements, visit:

https://acsess.onlinelibrary.wiley.com/doi/full/10.1002/agj2.20234



SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Dr. Charlotte Norris

Evaluating a Biological Measurement of Soil Health in Agricultural Ecosystems Across North America

What is the phospholipid fatty acid (PLFA) procedure for soils? What do you want to think about when comparing PLFA lab reports? Dr. Charlotte Norris addressed these questions within an agricultural context.

Dr. Norris, Forest Soils Research Scientist with Natural Resources Canada, presented on "Evaluation a Biological Measurement of Soil Health in Agricultural Ecosystems." In her presentation, Dr. Norris introduced the phospholipid fatty acid (PLFA) procedure and how soil scientists use it to identify the soil microbial community.

Dr. Norris suggested the measure needs some further work to be a universal tool in reporting microbial diversity, and she mentioned other things to consider when comparing across lab reports. She concluded with initial results showing how the tool could be used to assess local environmental conditions for soil microbial health.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=iQ76A9hVc-5Q&list=PLdFVkeklZuqx-ZKtDF-gRJMeI2oAvfDjdF&index=11

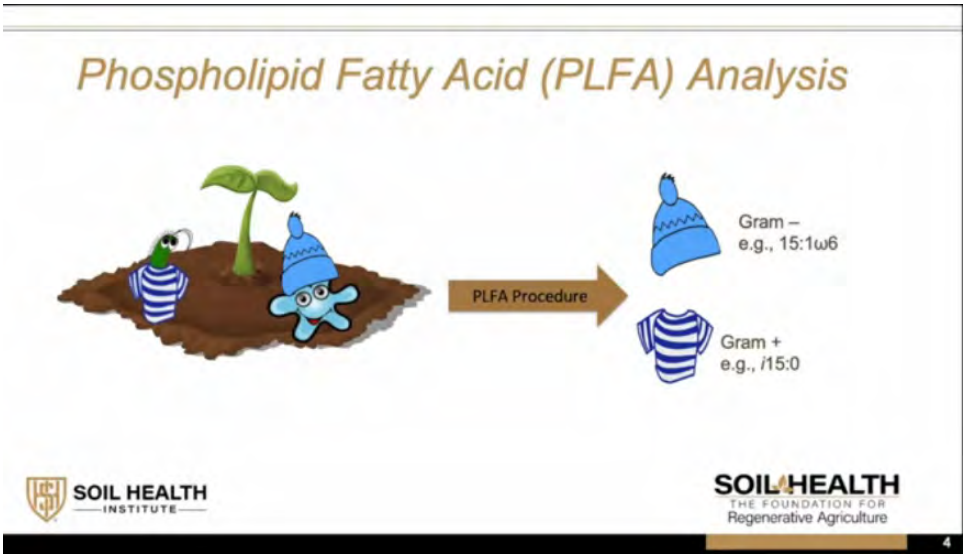
FURTHER RESEARCH

Phospholipid Fatty Acid (PLFA) Extraction and Analysis:

https://www.jove.com/t/54360/extraction-and-analysis-of-microbial-phospholipid-fatty-acids-in-soils

Phospholipid Fatty Acid (PLFA) Use and Misuse:

https://www.sciencedirect.com/science/article/abs/pii/S0038071710004426



PLENARY SESSIONS

Dr. Kelsey L. H. Greub

Aggregate Stability as an Indicator of Soil Health for North American Soils

Aggregate stability is defined as the ability of a soil to maintain its physical structure and withstand external forces. Aggregate stability is related to physical, chemical, and biological soil properties, and is sensitive to changes in soil management, which makes it a useful indicator of soil health.

Several methods for quantifying aggregate stability exist; however, the methods differ greatly in the amount and type of external force applied, size and weight of aggregates used, output unit and scale used to quantify aggregate stability, and cost of each analysis. These differences make comparing aggregate stability values for soil health management difficult and raise the need for a universal method for quantifying aggregate stability.

For the North American Project to Evaluate Soil Health Measurements (NAPESHM), scientists at the Soil Health Institute compared four aggregate stability methods, including the Cornell Rainfall Simulator, Wet Sieve Procedure, SLAKES smartphone application, and Soil Stability Index. Each method was evaluated for sensitivity to inherent soil properties, sensitivity to management, and overall utility for stakeholders.

Overall, the methods showed minimal sensitivity to soil organic carbon, as soil organic carbon was poorly correlated with aggregate stability. All methods were sensitive to changes in tillage, with significant increases in aggregate stability when tillage intensity decreased. The Cornell Rainfall Simulator and SLAKES methods also responded significantly to the implementation of cover crops, as well as the removal of crop residue. Based on the results from this study, the SLAKES method is recommended for evaluating aggregate stability due to its high sensitivity to changes in management, low cost, and fast turnaround time for results.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=RKT1r-1mUinU&list=PLdFVkeklZuqx-ZK-tDFgRJMeI2oAvfDjdF&index=12

FURTHER RESEARCH

To learn more about the SLAKES method, visit:

https://acsess.onlinelibrary.wiley.com/doi/epdf/10.1002/saj2.20012

To learn more about the principles of soil health, visit:

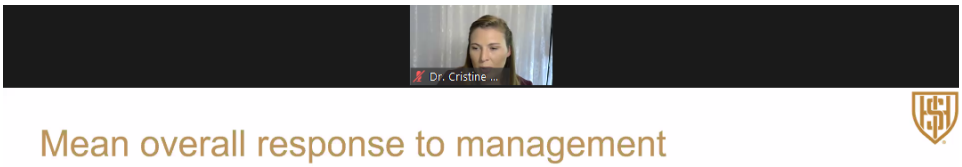
https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/nd/soils/health/?cid=nrcseprd1300631#:~:text=The%20Soil%20Health%20foundation%20consists,the%20first%20principle%3B%20soil%20armor.

To learn more about soil health indicators, visit:

https://soilhealthinstitute.org/north-american-project-to-evaluate-soil-health-measurements/

To learn more about the North American Project to Evaluate Soil Health Measurements, visit:

https://acsess.onlinelibrary.wiley.com/doi/full/10.1002/agj2.20234



Mean overall response to management

Management Action	Cornell Rainfall Simulator	Wet Sieve Procedure	SLAKES	Wet Soil Stability Index
Reduce Tillage Intensity	+14%	+9%	+12%	+17%
Implement Cover Crops	+19%	ns	+15%	ns
Remove Crop Residue	-21%	ns	-11%	ns
Apply Organic Amendment	ns	+6%	ns	+8%

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Dr. G. Mac Bean

Effects of Soil Health Practices on Soil Water Characteristics

Soil structure and aggregate stability regulate the capacity of the soil to capture, transmit, store and release water. Damaging these soil properties can result in greater soil water runoff and erosion. Therefore, determining how agricultural management practices such as tillage, cover crops, and organic amendments affect soil water cycling is important for regenerative agriculture.

There are several soil measurements related to soil water cycling, including bulk density, saturated hydraulic conductivity and available water holding capacity (AWHC). These measurements were included as part of the Soil Health Institute's North American Project to Evaluate Soil Health Measurements and were collected at more than 120 long-term agricultural research sites. The measurements at each site represented a business-as-usual practice as well as comparison treatment with soil health management practices. The measurement differences between the treatments were compared to evaluate the sensitivity of each measurement to soil health practices such as reduced tillage, cover cropping, crop rotation, and organic amendments.

Preliminary results show that bulk density and saturated hydraulic conductivity were both responsive to changes in tillage intensity. However, AWHC, measured using intact soil cores, was responsive to changes in both tillage intensity and cover crops with increases in AWHC by 7% and 6%, respectively. No measurement was sensitive to the addition of organic amendments. Overall, AWHC was the most sensitive measurement for determining the effects of management on soil water cycling.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=UAbm1YNSS-r0&list=PLdFVkeklZuqx-ZKtDFgR-JMeI2oAvfDjdF&index=13

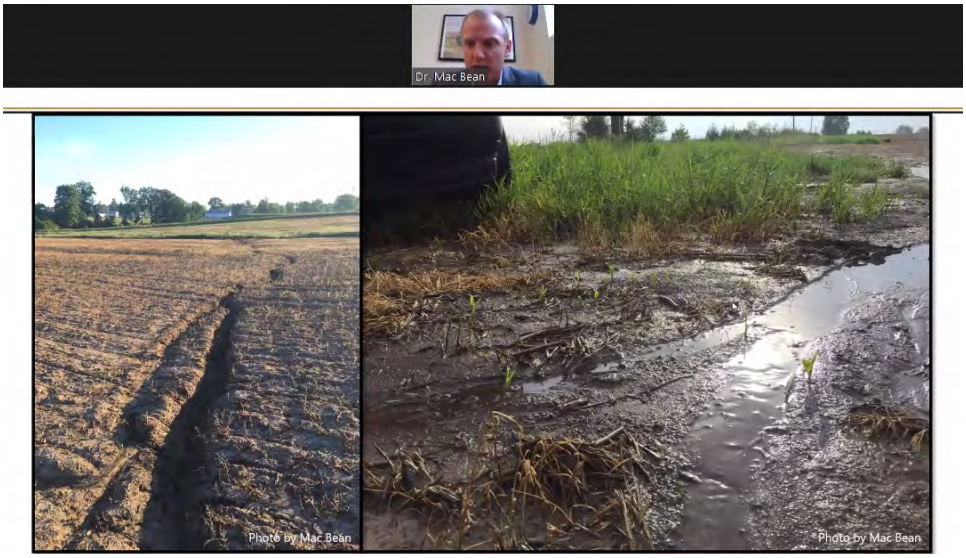
FURTHER RESEARCH

For more information on soil health indicators, visit:

https://soilhealthinstitute.org/north-american-project-to-evaluate-soil-health-measurements/

For more information on the North American Project to Evaluate Soil Health Measurements, visit:

https://acsess.onlinelibrary.wiley.com/doi/full/10.1002/agj2.20234



SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Dr. Paul Tracy

Soil Health Impacts on GHG Emissions

Soils function as both a source of and sink for greenhouse gases (GHG's), including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The soil's capacity to store carbon and nitrogen as organic compounds improves its functionality while reducing atmospheric GHG concentrations, a win-win situation.

Tracking soil-GHG dynamics is time consuming, costly and spatially challenging. The Soil Health Institute, through the North American Project to Evaluate Soil Health Measurements (NAPESHM), compared soil organic carbon (SOC) measurements with simulated SOC/CO_2 emission values at several long-term agricultural research sites using the CarbOn Management and Emissions Tool (COMET-Farm) model. Our goal is to improve GHG estimation strategies to meet a wide range of societal needs.

Preliminary results show the model closely estimated the effect soil health enhancing management practices like reduced tillage, cover crops, nutrient management and crop diversity had on soil organic carbon gains/losses.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=28S6xHrNG-bU&list=PLdFVkeklZuqx-ZKtDF-gRJMeI2oAvfDjdF&index=14

FURTHER RESEARCH

For more information on greenhouse gases, visit:

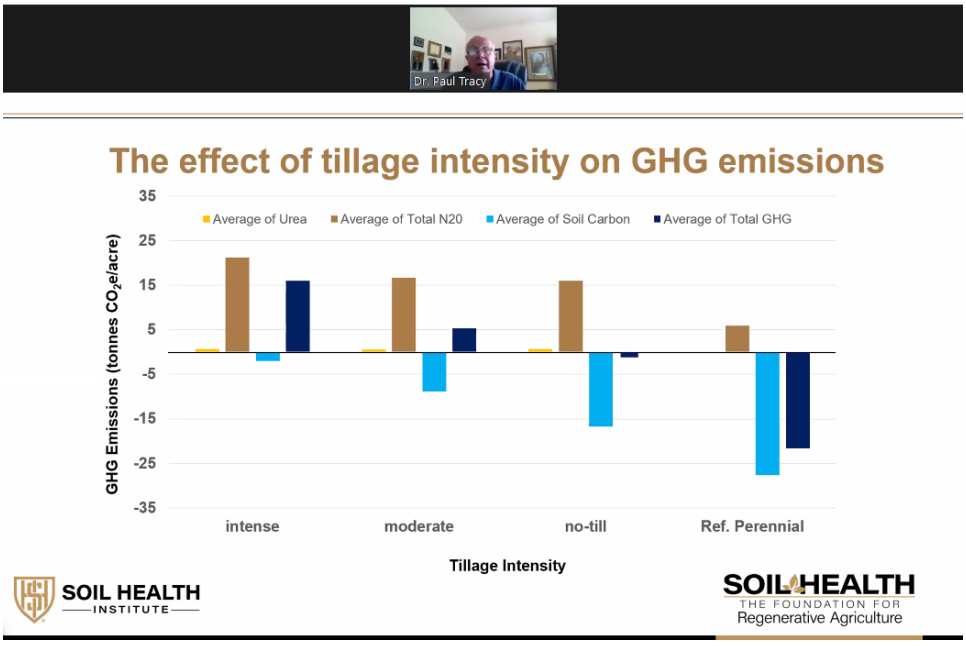
https://www.ncdc.noaa.gov/monitoring-references/faq/greenhouse-gases.php

For more information on the North American Project to Evaluate Soil Health Measurements, visit:

https://soilhealthinstitute.org/north-american-project-to-evaluate-soil-health-measurements/

To learn more about COMET-Farm, visit:

http://www.comet-farm.com/



PLENARY SESSIONS

Ms. Pippa Elias

Soil Health Policies and Programs in Action

Ms. Pipa Elias, Director of Agriculture in North America for The Nature Conservancy, introduces the Policy Session during Soil Health: The Foundation for Regenerative Agriculture, July 31, 2020. Policy decisions have broad impact, ranging from the largest public expenditures on private land (U.S. Farm Bill provisions) to policies that affect landowner decisions – even food labeling. When done right, policy provides incentives to drive soil health promoting practices.

The Policy Session (see Pages 23 and 24) included:

- Federal and State Level Soil Health Legislation;
- Improving Soil Health and Water Quality through the Conservation Infrastructure Initiative.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=kbPvUxMe5d-Q&list=PLdFVkeklZuqx-ZKtDFgR-JMeI2oAvfDjdF&index=15

FURTHER RESEARCH

To learn more about soil health policies, visit:

https://soilhealthinstitute.org/resources/catalog/

To learn more about the impact of 2018 Farm Bill provisions on soil health, visit:

https://soilhealthinstitute.org/wp-content/uploads/2019/09/Table.pdf

To review a summary table of 2018 Farm Bill provisions that impact soil health, visit:

https://soilhealthinstitute.org/wp-content/uploads/2019/09/Table.pdf

To learn more about The Nature Conservancy's sustainability programs in agriculture, visit:

https://www.nature.org/en-us/what-we-do/our-priorities/provide-food-and-water-sustainably/food-and-water-stories/north-america-agriculture/

Table 2. Funding Comparison of 2014 and 2018 Farm Bill Programs Relating to Soil Health

Farm Bill Title and Program	2018 Farm Bill	2014 Farm Bill
Conservation Title		
Conservation Reserve Program (CRP)	Annual acreage cap increasing from 24,000,000 acres in fiscal year 2019 to 27,000,000 acres in fiscal year 2023; projected obligations of $9,767,000,000 or an average of $1,953,400 per year	Annual acreage cap declining from 27,500,000 in fiscal year 2014 to 24,000,000 in fiscal year 2018; Total FY 2014-18 obligations of $9,075,000,000 or an average of $1,815,000,000 per year
CRP Transition Incentives Program (TIP)	$50,000,000 for the period of fiscal years 2019 through 2023, including not more than $5,000,000 to provide outreach and technical assistance	$33,000,000 for the period of fiscal years 2014 through 2018
Environmental Quality Incentives Program (EQIP)	$1,750,000,000 for fiscal year 2019 $1,750,000,000 for fiscal year 2020 $1,800,000,000 for fiscal year 2021 $1,850,000,000 for fiscal year 2022 $2,025,000,000 for fiscal year 2023 5% to be allocated to beginning farmers/ranchers and 5% to socially disadvantaged farmers and ranchers	$1,350,000,000 for fiscal year 2014 $1,600,000,000 for fiscal year 2015 $1,650,000,000 for fiscal year 2016 $1,650,000,000 for fiscal year 2017 $1,750,000,000 for fiscal year 2018 5% to be allocated to beginning farmers/ranchers and 5% to socially disadvantaged farmers and ranchers
EQIP Conservation Innovation Grant (CIG) for On-Farm Conservation Innovation Trials	$25,000,000 annually from the amounts for EQIP above	n/a
EQIP Conservation Innovation Grant (CIG) for Air Quality Concerns from Agricultural Operations	$37,000,000 annually from within the annual amounts for EQIP above	$25,000,000 annually from the annual amounts for EQIP above
EQIP Conservation Innovation Grant (CIG) - Other	Determined annually by USDA from within amounts provided annually to EQIP	Determined annually by USDA from within amounts provided annually to EQIP

Table 2. Funding Comparison of 2014 and 2018 Farm Bill Programs Relating to Soil Health 25

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Ms. Katie Harrigan

Federal and State Level Soil Health Legislation

Ms. Katie Harrigan of Tufts University provided an update on both U.S. federal and state soil health legislation during the Policy session of the Soil Health Institute's 2020 Annual Meeting in her talk "Federal and State Level Soil Health Legislation."

The 2018 Farm Bill (Agriculture Improvement Act of 2018) includes approximately 60 federal-level provisions that include soil health. Almost every provision is active by 2020. Provisions to land stewardship programs such as the Environmental Quality Incentives Program (EQIP) and Conservation Stewardship Program (CSP) encourage soil health planning, resource-conserving crop rotation planning, soil tests and soil remediation through increased incentive payments. Other provisions for land retirement programs, like the Conservation Reserve Program (CRP), enhance end of contract considerations in favor of conservation efforts and form a new Soil Health and Income Protection Program (SHIPP). These and other policy and program provisions will help buffer some of the investment costs as farmers and ranchers change the landscape of soil health.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=hIlWOKY0vA-Q&list=PLdFVkeklZuqx-ZKtDFgR-JMeI2oAvfDjdF&index=16

FOR FURTHER RESEARCH:

To access the "Impact of 2018 Farm Bill Provisions on Soil Health" report, visit: https://soilhealthinstitute.org/wp-content/uploads/2019/09/Impact-of-2018-Farm-Bill-Provisions-on-Soil-Health.pdf

To learn more about the Agriculture Improvement Act of 2018, visit: https://www.agriculture.senate.gov/imo/media/doc/Agriculture%20Improvement%20Act%20of%202018.pdf

To learn more about federal and state soil health policies and programs, visit: https://soilhealthinstitute.org/resources/catalog/

To learn more about the Environmental Quality Incentives Program, visit: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/

PLENARY SESSIONS

Mr. Sean McMahon

Improving Soil Health and Water Quality through the Conservation Infrastructure Initiative

Mr. Sean McMahon, Executive Director of the Iowa Agriculture Water Alliance, highlighted innovative public and private partnerships that improve soil health and water quality.

While existing public sector programs have driven soil health adoption and improved water quality for a small minority of farmers who are innovators and early adopters of conservation practices, new opportunities exist to reach the even greater number of farmers that constitute middle and late adopters of conservation practices. Harnessing economic drivers and market-based solutions to improving soil health and water quality, and more robust engagement of the private sector, are essential to reach more farmers. New strategies and opportunities, such as ecosystem services markets, linking soil health to land valuation and public-private partnerships are elements of the 'Conservation Infrastructure Initiative,' which will create additional rural jobs and economic development opportunities by expanding conservation practices such as cover crops while improving environmental outcomes. Sustainability efforts, Mr. McMahon said, should focus on placing farmers' returns on investment front and center, including rewarding farmers for implementing soil health-promoting practices.

PRESENTATION VIDEO:

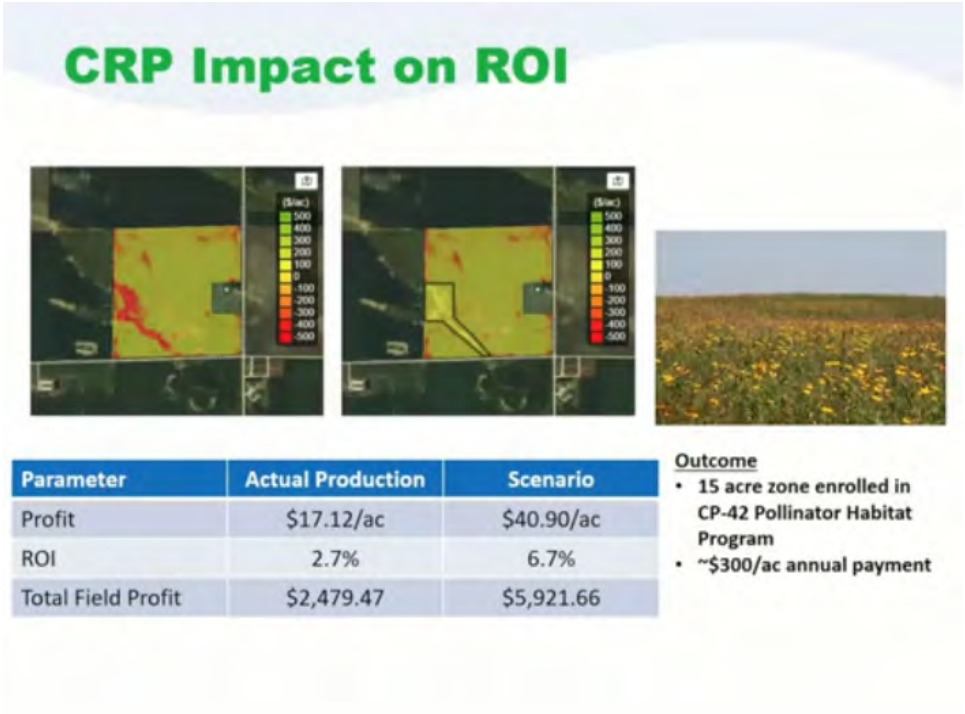
https://www.youtube.com/watch?v=LFUJc8jpeVQ&list=PLd-FVkeklZuqx-ZKtDFgRJMeI2oAvf-DjdF&index=17

FURTHER RESEARCH

To learn more about soil health policies, visit: https://soilhealthinstitute.org/resources/catalog/

To learn more about the Iowa Water Alliance, visit: https://www.iowaagwateralliance.com/

To learn more about the Soil Health Institute, visit: https://soilhealthinstitute.org/



SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Mr. Ryan Sirolli

Filling the Economics Gap for Farmers

Mr. Ryan Sirolli, Global Row Crop Sustainability Director for Cargill, introduced the Business Case session at the Soil Health Institute's 2020 Annual Meeting. His presentation, "Filling the Economics Gap for Farmers," highlighted the importance of economics in soil health.

Mr. Sirolli highlighted collaborations such as those between the Soil Health Institute, American Farmland Trust, U.S. Department of Agriculture Natural Resources Conservation Service, National Association of Conservation Districts and Cargill. These partners work to understand the costs and returns on investment of soil health practices, recognizing that the business case is critical to soil health adoption at scale.

The Business Case Session (see Pages 26 through 28) included:

- Identifying Costs and Benefits of Soil Health Management Systems;
- Quantifying Economic Outcomes through Case Studies of Eight "Soil Health Successful Farmers;"
- Panel: Farmers' Experience.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=KIkA45s8YiM&list=PLd-FVkeklZuqx-ZKtDFgRJMeI2oAvf-DjdF&index=18

FURTHER RESEARCH

To learn more about Cargill's supply chain climate commitment, visit: https://www.cargill.com/sustainability/priorities/climate-change

To learn more about upcoming information that will begin to address the single most influential factor affecting adoption of soil health systems – the economic impact on farmers, visit: https://www.prnewswire.com/news-releases/economics-of-soil-health-to-be-assessed-across-north-america-300857845.html

To learn more about the Soil Health Institute, visit: https://soilhealthinstitute.org/

To learn more about American Farmland Trust, visit: https://farmland.org/

To learn more about U.S. Department of Agriculture, Natural Resources Conservation Service, visit: https://www.nrcs.usda.gov/wps/portal/nrcs/site/soils/home/

To learn more about National Association of Conservation Districts, visit: https://www.nacdnet.org/about-nacd/what-we-do/soil/

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Dr. Archie Flanders

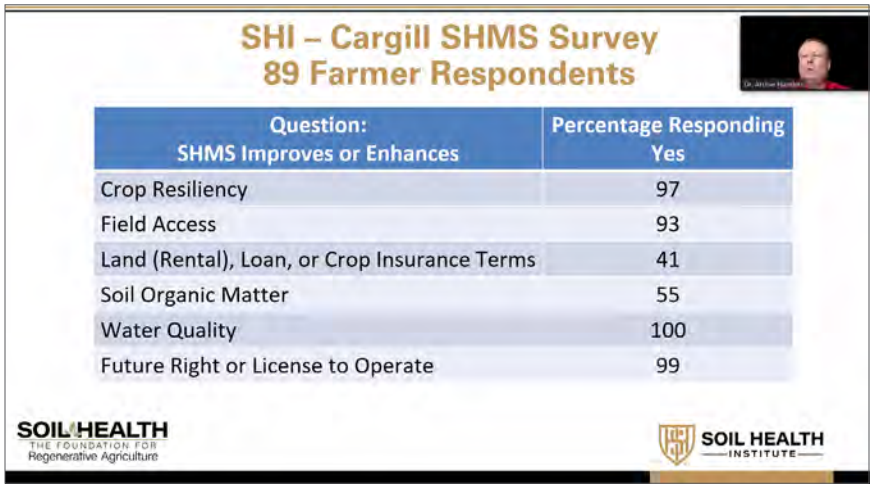
Identifying Costs and Benefits of Soil Health Management Systems

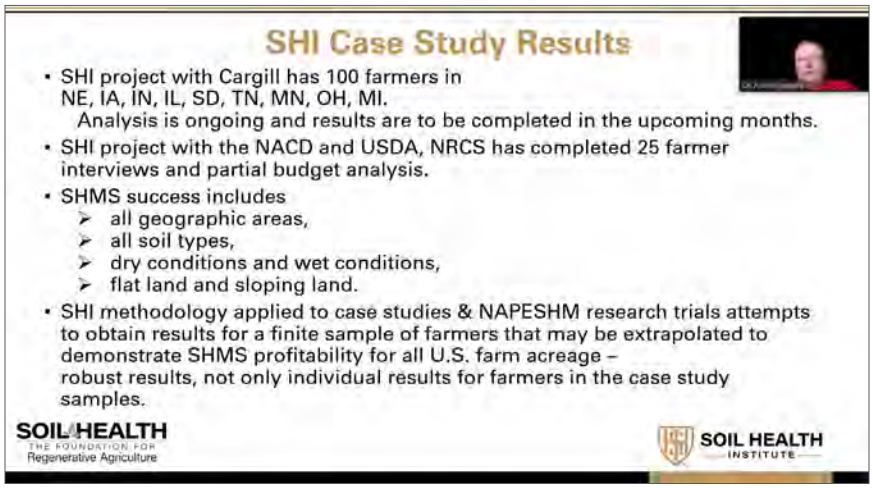
Research indicates that soil health management systems (SHMS), which include reduced tillage and incorporating cover crops with production of cash crops, decreases soil erosion, improves water infiltration, increases soil carbon, and reduces inputs that can have potentially adverse environmental impact. Encouraging production practices that improve soil health includes demonstrating that individual farm profitability is increased by adoption of SHMS.

Partial budget analysis is a farm management analytical method in which comparative financial returns are determined by quantifying the net effect of only specific proposed changes in production.

For example, converting from conventional tillage without cover crops to no-till production with cover crops will eliminate field activities that impact associated costs. A partial budget analysis will account for the cost of cover crop seeds and costs associated with planting and terminating the cover crop, all of which are specific to the change of adding cover crops to the management system.

The partial budget methodology presented demonstrates procedures for quantifying changes in production costs associated with adoption of SHMS. The Soil Health Institute has ongoing projects applying partial budget analysis to research plot trial data as well as case study farm data, Dr. Flanders said.





PRESENTATION VIDEO:

https://www.youtube.com/watch?v=7t81dVpRTIQ&list=PLd-FVkeklZuqx-ZKtDFgRJMeI2oAvf-DjdF&index=19

FURTHER RESEARCH

Economics of Soil Health to be Assessed across North America:

https://www.prnewswire.com/news-releases/economics-of-soil-health-to-be-assessed-across-north-america-300857845.html

Principles of Soil Health

https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/nd/soils/health/?cid=nrcse-prd1300631#:~:text=The%20Soil%20Health%20foundation%20consists,%-2Froot%2C%20and%20live-stock%20integration

Soil Health Indicators

https://soilhealthinstitute.org/north-american-project-to-evaluate-soil-health-measurements/

North American Project to Evaluate Soil Health Measurements

https://acsess.onlinelibrary.wiley.com/doi/full/10.1002/agj2.20234

For more information on soil health economics, please visit:

https://soilhealthinstitute.org/economics/

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Dr. Michelle Perez

Quantifying Economic Outcomes through Case Studies of Eight "Soil Health Successful Farmers"

Dr. Michelle Perez, Project Leader & Water Director with American Farmland Trust (AFT), presented "Quantifying Economic Outcomes through Case Studies of Eight 'Soil Health Successful Farmers.'" During the presentation, Dr. Perez shared soil health economic, water quality, & climate case studies from a collaborative effort between AFT and the U.S. Department of Agriculture, Natural Resources Conservation Service.

The eight 2-page case studies feature estimates of the economic, water quality, and climate outcomes associated with soil health practices adopted by farmers in California, Illinois, Ohio, and New York. The studies contribute to efforts that quantify the economic and environmental outcomes associated with successful use of soil health practices and increase awareness of those effects. Additionally, these case studies develop persuasive education tools to convince producers to adopt similar practices, and improve landowner and operator communication and interactions.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=7-LzHjvRAto&list=PLd-FVkeklZuqx-ZKtDFgRJMeI2oAvf-DjdF&index=20

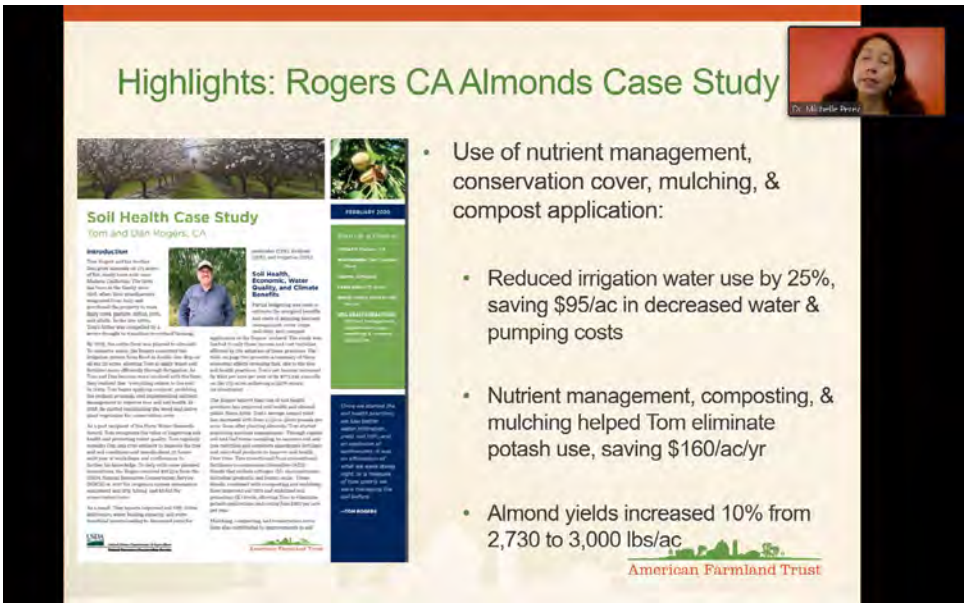
FOR FURTHER RESEARCH:

In order to view these soil health case studies, please visit:

https://farmlandinfo.org/publications/soil-health-case-studies/

https://farmland.org/project/quantifying-economic-and-environmental-benefits-of-soil-health/

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/health/?cid=nrcseprd1470394



SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Dr. John Shanahan

Lisa Lunz

Matt Griggs

Mark Jackson

Panel: Farmers' Experience

Dr. John Shanahan, SHI's Project Manager – Agronomy, moderated a three-farmer panel, which shared their individual soil health adoption journeys.

Each grower shared details about their operations, including how long they've been farming, how many acres they farm, and what crops are grown. They also highlighted what soil health practices they have adopted, such as reduced tillage and cover cropping, and how long they've been using them. The farmers outlined the agronomic and economic benefits they have observed from using these practices. The farmers shared challenges they have faced in implementing these practices and offered advice for growers who want to start the soil health journey.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=M-AJL3Hi9sc&list=PLdFVkeklZuqx-ZKtDFgRJMeI2oAvfDjdF&index=21

FURTHER RESEARCH

Economics of Soil Health to be Assessed across North America:
https://www.prnewswire.com/news-releases/economics-of-soil-health-to-be-assessed-across-north-america-300857845.html

Principles of Soil Health:
https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/nd/soils/health/?cid=nrcseprd1300631#:~:text=The%20Soil%20Health%20foundation%20consists,%2Froot%2C%20and%20livestock%20integration.

Soil Health Indicators:
https://soilhealthinstitute.org/north-american-project-to-evaluate-soil-health-measurements/

North American Project to Evaluate Soil Health Measurements:
https://acsess.onlinelibrary.wiley.com/doi/full/10.1002/agj2.20234

PLENARY SESSIONS

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=ZWt_WLcpp-pA&list=PLdFVkeklZuqx-ZKtDF-gRJMeI2oAvfDjdF&index=22

Dr. Cristine Morgan

Dimensions of Adoption

Dr. Cristine Morgan, Chief Scientific Officer of the Soil Health Institute, introduced Dimensions of Adoption, a series of virtual presentations by U.S. soil health research leaders who discussed translating soil health research, moving soil health knowledge from research sites to farms, and helping farmers and consultants implement soil health management practices.

The Farmer Education Session (see Pages 31 through 33) included:

- What Soil Health Means to a Producer and Why They Should Care;
- A New Tool for Farmers to Build Drought Resilience through Soil Health;
- Soil Health Education Programs of the USDA-NRCS;*
- The Soil Health Partnership: Partnering for Soil Health; and
- Healthy Soils for Sustainable Cotton Program.

**This 5th Annual Meeting report uses copyright protection that requests any reproduction of included content provide attribution/recognition to SHI. The summary of the USDA-NRCS presentation, "Soil Health Education Programs of the USDA-NRCS," is not included in this report in order to avoid possible content stewardship conflicts.*

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Dr. Jerry Hatfield

What Soil Health Means to a Producer and Why They Should Care

What is the value of soil health? How will it affect my management? Will it increase profit? Yield? These are essential questions any farmer should ask before adopting a soil health management system.

During the Farmer Education session of the Soil Health Institute's 2020 Annual Meeting, Dr. Jerry Hatfield, former Laboratory Director and Supervisory Plant Physiologist of the U.S. Department of Agriculture, Agricultural Research Service's National Laboratory for Agriculture (retired), addresses these questions in his presentation "What Soil Health Means to a Producer and Why They Should Care." Dr. Hatfield explained that soil health is improved by reduced tillage, continuous cover with cover crops, crop diversity, livestock grazing, and bio-based fertilizers. These practices improve soil organic matter, water quality, water filtration, field access, and crop resiliency.

Continual cover on soil provides protection against the impact of rain, soil water evaporation and, since some plant roots can be nearer the surface, protected roots can take advantage of small rainfall events. Continuous cover has been shown to increase water-use efficiency by as much as 49% in corn and 26% in soybean, Dr. Hatfield said.

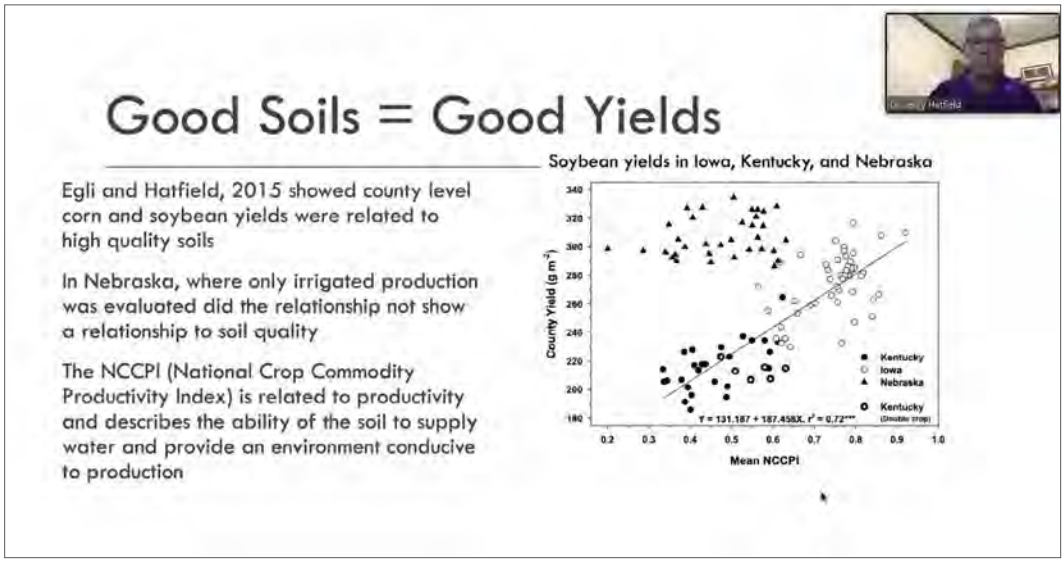
PRESENTATION VIDEO:

https://www.youtube.com/watch?v=uWaSkVfZ-tOA&list=PLdFVkeklZuqx-ZKtDF-gRJMeI2oAvfDjdF&index=23

FURTHER RESEARCH

To learn more about the principles of soil health, visit: https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/nd/soils/health/?cid=nrcseprd1300631#:~:text=The%20Soil%20Health%20foundation%20consists,%2Froot%2C%20and%20livestock%20integration.

For more information on the Soil Health Institute, visit: https://soilhealthinstitute.org/



SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Dr. Dianna Bagnall

A New Tool for Farmers to Build Drought Resilience through Soil Health

Farmers know that soil health-promoting practices increase soil organic carbon, drought resilience, and farm profitability. Despite this, equations provided in soil science literature have not shown this relationship. As a result, farmers have not had a tool that estimates how a management practice will change their farm's drought resilience.

New data from the North American Project to Evaluate Soil Health has allowed scientists at the Soil Health Institute to create new equations. These equations capture the link between soil organic carbon and plant-available water. The newly collected data include the effects of soil health-promoting practices and soil structure.

Using the new equations, Colorado State University, the U.S. Department of Agriculture, Natural Resources Conservation Service, and the Soil Health Institute have developed a decision support tool that will be freely available as a part of the online CarbOn Management and Emissions Tool (COMET-Farm). The decision support tool, currently in beta version, will allow farmers to explore how to build soil carbon and improve drought resilience. Farmers and their advisers can calculate changes in plant-available water that are driven by soil health management practices, such as no-till or cover crops. This significant advancement provides a powerful incentive to drive the adoption of soil health management practices and enhance on-farm profitability.

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=O_HjvBfhsrU&list=PLd-FVkeklZuqx-ZKtDFgRJMeI2oAvf-DjdF&index=24

FURTHER RESEARCH

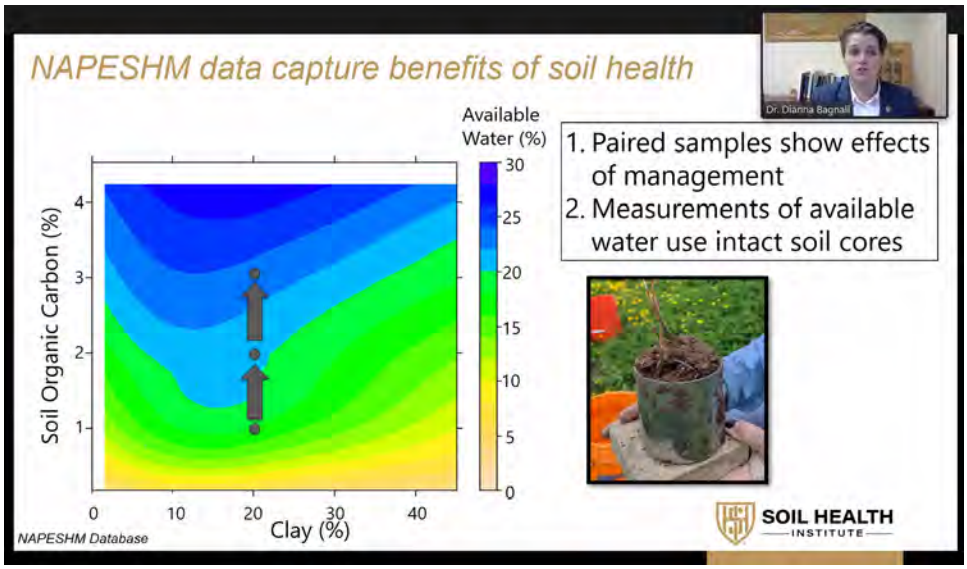
To learn more about the Soil Health Institute, visit: https://soilhealthinstitute.org/

To learn more about the North American Project to Evaluate Soil Health Measurements, visit: https://soilhealthinstitute.org/north-american-project-to-evaluate-soil-health-measurements/

To learn more about COMET-Farm, visit: http://comet-farm.com/

To learn more about Colorado State University, visit: https://soilcrop.agsci.colostate.edu/

To learn more about the United States Department of Agriculture Natural Resources Conservation Service, visit: https://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/



SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Mr. John Mesko

The Soil Health Partnership: Partnering for Soil Health

During the Farmer Education session of the Soil Health Institute's 2020 Annual Meeting, Mr. John Mesko, Senior Director of the Soil Health Partnership, presented "The Soil Health Partnership: Partnering for Soil Health." Mr. Mesko highlighted the Soil Health Partnership's role in working with farmers to understand the benefits of cover crops, reduced tillage and other soil health promoting practices on 200 farms in 16 states, primarily in the Midwest.

According to Mr. Mesko, the Soil Health Partnership works with farmers for three to five years to identify resource concerns, design a research protocol for the farmer, and understand and begin to resolve the concern. Data obtained from farms is aggregated to better understand soil health practices and their impacts across the Midwest.

The Soil Health Partnership also offers podcasts and webinars to individuals interested in learning more about soil health.

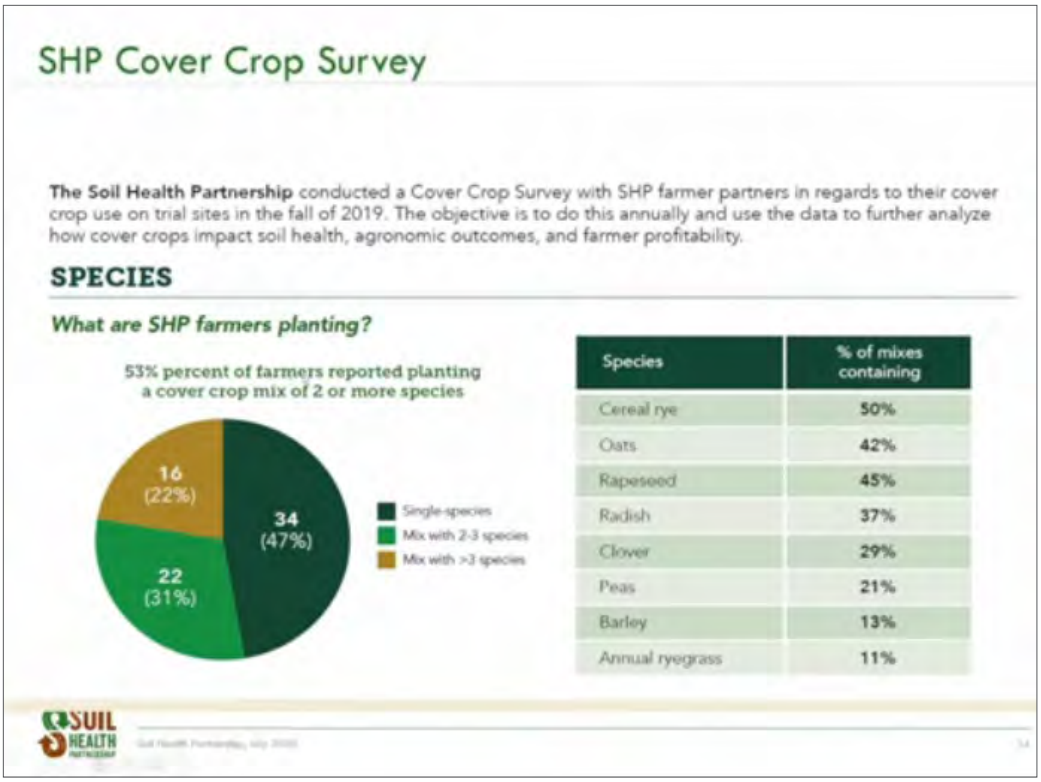
PRESENTATION VIDEO:

https://www.youtube.com/watch?v=VA2EUXn-7H7I&list=PLdFVkeklZuqx-ZKtDF-gRJMeI2oAvfDjdF&index=25

FURTHER RESEARCH

For a podcast about best soil health practices, visit: https://www.soilhealthpartnership.org/podcast/10-wayne-honeycutt-farmer-adoption-of-best-soil-health-practices-is-key/

To learn more about the Soil Health Partnership and review its informational resources, visit: https://www.soilhealthpartnership.org/



SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Mr. David Lamm

Healthy Soils for Sustainable Cotton Program

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=GdFfSMptn-qE&list=PLdFVkeklZuqx-ZKtDFgR-JMeI2oAvfDjdF&index=26

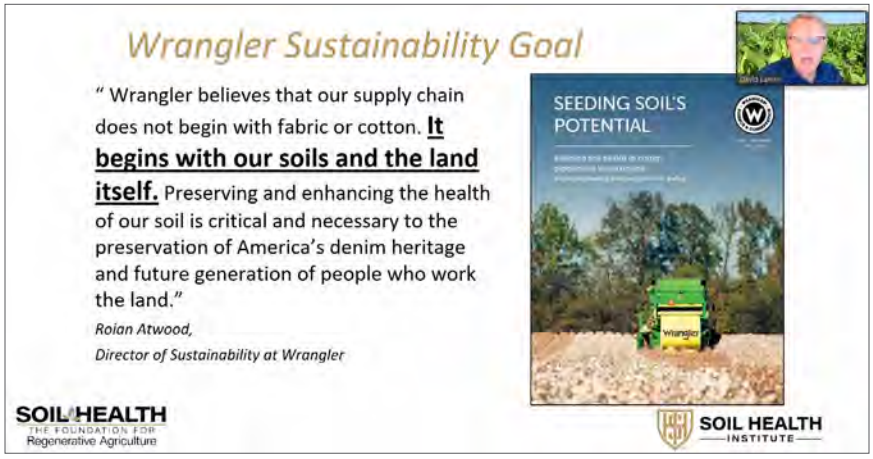
FURTHER RESEARCH

To learn more about *Healthy Soils for Sustainable Cotton,* visit: https://soilhealthinstitute.org/soil-health-training/

To learn more about soil health indicators, visit: https://soilhealthinstitute.org/north-american-project-to-evaluate-soil-health-measurements/

Today's consumers want to know their food and fiber products are sustainably grown and the cotton industry is listening. Cotton farmers, manufacturers and retailers are collaborating to deliver cotton in a way that increases soil organic carbon as well as reduces greenhouse gas emissions, soil loss, and water use.

In partnership with the Walmart Foundation, Wrangler® Jeans and the VF Foundation, the Soil Health Institute is working with cotton producers to increase soil health management system adoption. The *Healthy Soils for Sustainable Cotton* project offers farmer-focused education and training events delivered by Soil Health Institute scientists, partnering soil health technical specialists and farmer mentors who produce cotton using soil health promoting practices. *Healthy Soils for Sustainable Cotton* farmer mentors and soil health technical specialists provide producer guidance and technical assistance throughout the term of the project as part of a farmer-to-farmer network.



SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLENARY SESSIONS

Dr. Wayne Honeycutt

Closing Comments

PRESENTATION VIDEO:

https://www.youtube.com/watch?v=bWJZm2Mrf-hY&list=PLdFVkeklZuqx-ZKtDFgR-JMeI2oAvfDjdF&index=27

FOR FURTHER RESEARCH:

To learn more about the Soil Health Institute and its programs, visit: https://soilhealthinstitute.org/

Dr. Wayne Honeycutt, President and CEO of Soil Health Institute (SHI), closed the 5th annual meeting by thanking all sponsors, speakers, and attendees for helping to make Soil Health Institute's virtual annual meeting a success.

SHI is a non-profit whose mission is to safeguard and enhance the vitality and productivity of soil through scientific research and advancement. SHI works with its many stakeholders to identify gaps in research and adoption; develop strategies, networks and funding to address those gaps; and ensure beneficial impact of those investments to agriculture, the environment and society.

Soil Health: The Foundation for Regenerative Agriculture, the 5th Annual Meeting of the Soil Health Institute, was held July 30-31, 2020, as a virtual forum. Soil Health: The Foundation for Regenerative Agriculture advanced the opportunity to address climate change, water quality, food production, biodiversity, and many other pressing issues by improving soil health. Presentations addressed the actionable potential of soil health, including preliminary suggestions on how the agricultural industry can measure soil function in the future and the role of farmers and ranchers in combating global climate change and its impacts.

VIDEO POSTERS

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

The 5th Annual Meeting Video Poster Session included entries in eight subject categories:

- Capability & Soil Survey
- Connectivity and Economics
- Cover Cropping
- Cropping Systems
- Macro and Microbiology
- Nitrogen Cycling
- Novel Measurement
- Organic Amendments

Each presenter provided a three-minute research summary of a current research project and participated in a virtual conversation with annual meeting participants. Many presentations will be available via links from soilhealthinstitute.org.

CAPABILITY & SOIL SURVEY

Poster Title	Presenter & Affiliation	Other Authors	Description of Research
Soil Health Gap	Bijesh Maharjan, Ph.D. Assistant Professor and Extension Specialist, University of Nebraska-Lincoln	Saurav Das (University of Nebraska-Lincoln); Bharat S Acharya (Oklahoma Department of Mines)	A benchmark for soil health management
Soil Health Baseline Sampling on 100 Crop Fields in Central Kansas	Patrick Daniels, B.S. Field Technology Specialist, Applied Ecological Services	Ry Thompson, Ecologist (AES); Eoghan O'Neill, Ecologist (AES)	This presentation describes the General Mills and Applied Ecological Services effort to do baseline soil health sampling on 100 fields in central Kansas in the Cheney Reservoir Watershed.
Increasing Carbon Sequestration in the Eight-County Gulf-Houston Region	Karla Gorostieta Coordinator of HW Programing, Houston Wilderness		This research is working to understand a potential 0.4% annual increase in nature-based carbon sequestration on regional lands through large-scale native tree plantings, grasses, and enhanced soils in the region. Research on the ecosystem services of specific regional native tree species and creation/implementation of a regional large-scale targeted tree planting initiative.

VIDEO POSTERS

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

CONNECTIVITY & ECONOMICS

Poster Title	Presenter & Affiliation	Other Authors	Description of Research
Activating Financial Markets to Reward Soil Stewardship: a Systemic Co-inquiry	Nicholas Pawsey, Ph.D. Charles Sturt University	Catherine Allan, Associate Professor (Charles Sturt University); Benjamin Wills (Federation University); Francisco Ascui (University of Tasmania); Geoff Cockfield, Professor (University of Southern Queensland); Simon Cook, Professor (Murdoch University); Mark Frost (Charles Sturt University); Alfred Wong (Charles Sturt University); Julia Lynch (Charles Sturt University); Ross Colliver (The Training and Development Group)	This video provides an overview of the results of a systemic co-inquiry focused on the identification of opportunities to activate financial markets to reward soil stewardship. A series of three co-inquiry workshops across Australia brought together more than 50 soil researchers, farming, financial market, government, and conservation stakeholders to: 1. Establish a shared understanding of the soil-farmer finance system, 2. Investigate and reach agreement on opportunities for activating financial markets to reward soil stewardship, and develop a shared research agenda to facilitate the process.
Social Networks for Healthy Soils	Erin Nelson, Ph.D.	University of Guelph	The Social Networks for Healthy Soils project aims to increase understanding of the role that peer learning programs play in soil health BMP (Best Management Practices) adoption. The project is conducted in close collaboration with three Ontario-based farm organizations that each run peer learning programs aimed at increasing farmer adoption of soil health BMPs.
Working Together For Soil Health	Carol McFarland, M.Sc. Washington State University	Washington State University and University of Idaho	A Novel Participatory Outreach Model is used to identify key issues in soil health.
Establishing a Soil Health Baseline & Testing Guide for Institutional Landowners	Olga Lyandres, Ph.D.	Senior Specialist, Delta Institute	This presentation highlights how Delta Institute, in partnership with McHenry County Conservation District, developed a practical guide to testing soil health and informing land management. The goal of this research is to help institutional landowners navigate the complexities of soil health testing and provide considerations for how to incorporate these practices in decision-making processes.

VIDEO POSTERS

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

COVER CROPPING

Poster Title	Presenter & Affiliation	Other Authors	Description of Research
Cover Crops: Soil Health and Profitability	Laura Van Eerd, Ph.D. Professor, University of Guelph, Ridgetown Campus	Inderjot Chahal (University of Guelph, Ridgetown Campus, Ridgetown, Ontario, Canada); Richard J. Vyn (University of Guelph, Ridgetown Campus, Ridgetown, Ontario, Canada); Danielle Mayers (University of Guelph, Ridgetown Campus, Ridgetown, Ontario, Canada)	Research from a long-term cover crop experiment in a temperate, humid climate.
Challenges of Cover Cropping in the Semi-arid Subtropics	Pushpa Soti, Ph.D. Assistant Professor, University of Texas Rio Grande Valley	Alexis Racelis (University of Texas, Rio Grande Valley)	Here scientists present some of the challenges faced when implementing cover crops in the semi-arid region of south Texas.
Impact of Wheat on SCN (Heterodera glycine) in DC Soybeans	Leonardo Rocha, B.S. Southern Illinois University Carbondale	Jason Bond (SIU Carbondale); Ahmad Fakhoury (SIU Carbondale)	Double cropping (DC) is defined as producing more than one crop on the same parcel of land in a single growing season, and it is reported to have many benefits when incorporated in cropping systems, including improved soil health. In some DC systems, soybeans are planted following winter wheat. The soybean cyst nematode (SCN) (Heterodera glycines I.) is a major soybean pathogen, and several reports suggests suppressive effects of wheat on SCN populations. A field trial was conducted from 2017 to 2018 to investigate the effect of wheat on SCN populations in DC soybeans. Nine fields with 3 levels of initial SCN populations (low, moderate, and high) were selected in Illinois. In each location, wheat (WT) was planted in strips alternating with strips maintained in fallow (FL) over winter. Soybeans were planted in all strips after wheat harvest. SCN counts were assessed at four timepoints: pre-wheat planting, post-wheat/pre-soybeans, mid-soybeans (R1) and after soybean harvest.
Impact of Long-term Cover Crops on Soil Health Enhanced Tomato Productivity, Plant Health and Fruit	Jessica Awrey University of Guelph, Ridgetown Campus		To evaluate the long-term benefits of cover cropping (CC) in a grain and vegetable production system, a CC experiment was initiated in 2007 and repeated at an adjacent site in 2008, at Ridgetown, Ontario. Previous research on this experiment demonstrated greater concentrations of surface soil health indicators, such as organic carbon, with CCs than no-CC, which led researchers to hypothesize whether these CC-induced improvements in soil health would positively influence tomato plant health and fruit quality. This research project focuses on the tomatoes that were grown in 2019 and that are now being grown in 2020.

VIDEO POSTERS

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

CROPPING SYSTEMS

Poster Title	Presenter & Affiliation	Other Authors	Description of Research
Long-term Effects of Crop Diversification on Soil Fungal Communities	Kari Dunfield, Ph.D. Professor, Canada Research Chair, University of Guelph		This video poster will summarize data from two research studies conducted at the University of Guelph. Two long-term field experiments in Ontario Canada were sampled in order to assess the impacts of crop rotation, tillage and cover crops on soil fungi. Using a high-throughput sequencing approach, we observe changes in the biodiversity of the fungal communities in diversified cropping systems.
Use of Cover Crop Forage Mixes to Enhance: Forage, Soil and Water Quality	Ann-Marie Fortuna, Ph.D. Research Soil Scientist (Soil Biology), USDA-ARS, Grazinglands Research Laboratory, El Reno, OK, USA	Patrick Starks, Research Soil Scientist (Grazinglands Research Laboratory, USDA-ARS, El Reno, OK, 73306, USA); Brian Northup, Research Ecologist (Grazinglands Research Laboratory, USDA-ARS, El Reno, OK, 73306, USA); Jean L. Steiner, Adjunct Professor, Agronomy Dep., (Kansas State Univ., Manhattan, KS, 66506, USA); Daniel Moriasi, Research Hydrologist, (Grazinglands Research Laboratory, USDA-ARS, El Reno, OK, 73306, USA.)	Novel adaptive management practices need to be integrated into wheat, livestock systems to mitigate adverse impacts of variable weather and climate in the Southern Great Plains (SGP). Cattle production in the SGP experiences "forage gaps" during which high quality forage for animal weight gain is limited. Incorporation of fertilized, rain-fed, mixed forage cover crops can fill forage gaps, increase cover, enhance soil health and water holding capacity.
Evaluating Soil Health Indicators in Residential Lawns	Iin Handayani, Ph.D. Professor, Murray State University	Nathan Folz (Murray State University, Kentucky Hutson School of Agriculture)	Sprawling urban areas often result in the conversion of woodlands, grasslands, and agricultural fields into residential areas. This conversion leads to notable changes in the area's soils which exhibit significantly different properties than those of the pre-residential soil. After the initial disturbance, many factors influence the formation of the soil in these residential areas, especially time since the property's development. The objective of this research was to determine differences in soil health indicators due to the age of the residential lawns. The study was conducted in silt loam soils in Vanderburgh and Warrick Counties in southwest Indiana. The results showed that soil compaction at depths of 25 cm was 77% higher at the residential lawns than either the grassland or the forest sites. Soil organic matter content decreased in the residential lawns with a 35% decline between the 65-year site and the 6-year site.
Determining Soil Aggregation Following Long-term No Till and Conventional Tillage Systems	Iin Handayani, Ph.D. Professor, Murray State University	E.Cook (Southern Illinois University); S. Still (Southern Illinois University); M. Coyne (University of Kentucky); J. Grove (University of Kentucky); and A. Freytag (University of Kentucky)	Soil management practices such as no tillage and conventional tillage can alter soil quality. In this research, the effects of long-term conventional and no-tillage systems on soil aggregation and organic matter content were determined in continuous corn production on a farm with Maury silt loam soil.
Soil Health - Agroforestry	Pinakesh Das, M.Sc. Bidhan Chandra Krishi Viswavidyalaya	Subhabrata Panda (Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia -741 252, West Bengal,India) www.bckv.edu.in	Cultivation of alley crops under such Agro-forestry Systems (AFS) of mango and sweet orange with gamhar could improve soil fertility and soil organic carbon (SOC) status.

VIDEO POSTERS

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

■ MACRO & MICROBIOLOGY

Poster Title	Presenter & Affiliation	Other Authors	Description of Research
Native Biocontrol Agents Reduce Pythium Damping-off in Soybean	Mirian Filgueira Pimentel, Ph.D. Southern Illinois University Carbondale		High populations of aggressive pathogenic species in the soil show an imbalance of the soil microbiome and can lead to plant disease. This project focused on the evaluation of potential native biological control agents (BCAs) against Pythium damping off in soybean under field conditions. The BCAs, used alone or in different combinations, protected soybean seedlings from Pythium damage as BCA-treated plots had higher stand counts and vigor compared with control plants. These results can lead future efforts to focus on management practices that can benefit native BCA populations already present in the soil.
Can Exotic Earthworms be an Integral Part of Healthy Soils?	Kyungsoo Yoo, Ph.D. Professor, University of Minnesota	Adrian Wackett (University of Minnesota); Tyler Baumann (University of Minnesota); Lee Frelich (University of Minnesota); Derek Sikes (University of Alaska, Fairbanks); Matt Bowser (Kenai National Wildlife Refuge); Stephen Brown (University of Alaska, Fairbanks); Claudia Ihl (University of Alaska, Fairbanks); Mingchu Zhang (University of Alaska, Fairbanks); Julie Riley (University of Alaska, Fairbanks); Jonatan Klaminder (UmeÃ¥ University)	Exotic earthworm survey data from Alaska: Vegetable gardens are an important mechanism of introducing exotic European earthworms that threaten the sustainability of the boreal forests. This raises a question to our common perception and management of earthworms as an indicator of healthy soils.
Soil Aggregate Formation by Earthworms in an Oxisol Soil	Mauricio Morejón, M.Sc. University of Puerto Rico at Mayaguez	Yaniria Sánchez de León	This work reports on the influence of earthworms in soil aggregation and the relationship between earthworm abundance with soil aggregate proportion of large and small macroaggregates.

VIDEO POSTERS

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

NITROGEN CYCLING

Poster Title	Presenter & Affiliation	Other Authors	Description of Research
Biological Nitrification Inhibition in Sorghum: A Forgotten Trait with Potential for Greenhouse Gas	Nithya Rajan, Ph.D. Associate Professor, Texas A&M University	Sakiko Okumoto, Bal Maharjan, Dinesh Phuyal, William L Rooney, and Guntur V Subbarao (Soil and Crop Sciences, Texas A&M University, College Station, TX, USA and the Japan International Research Center for Agricultural Sciences, Tsukuba, Japan)	1. Investigating low-nitrifying sustainable farming systems is essential as current agriculture accounts for approximately 80% of total anthropogenic emissions of nitrous oxide, a highly potent greenhouse gas (GHG) that has also become the largest ozone depleting substance in the atmosphere. 2. Some plants can suppress nitrification by releasing specific root exudates that inhibit soil nitrifier activity and production of nitrates in soils (a property called biological nitrification inhibition, (BNI). 3. Exploiting the BNI activity of crops could be an effective and innovative strategy for developing long-term solutions for improving environmental sustainability of agricultural practices.
Resource Additions Increase Dryland Plant Biomass and Change Belowground Allocation Patterns	Eva Stricker, Ph.D. Director of Carbon Ranch Initiative, Quivira Coalition	Jenn Rudgers (University of New Mexico); Scott Collins (University of New Mexico)	Given that significant biomass in drylands is belowground, researchers investigated how total and belowground plant productivity responded to manipulations of the summer rainfall regime and additions of nitrogen. Additionally, they compared the magnitude of response to resource treatment across ambient environmental conditions. Water additions marginally increased total biomass in dry but not wet years. The influence of N addition did not vary with ambient climate conditions, and thus did not support the hierarchical resource limitation hypothesis.

NOVEL MEASUREMENT

Routine Soil Micrbial Biomass Carbon Analysis	Yuch-Ping Hsieh, Ph.D. Professor, Florida A&M University		Soil microbial property has not been included in most soil testing protocols. This study was initiated to identify a convenient real-time soil microbial biomass C (SMBC) procedure for routine soil testing purpose. Researchers identified a convenient real-time SMBC procedure suitable for routine soil analysis.

VIDEO POSTERS

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

■ ORGANIC AMENDMENTS

Poster Title	Presenter & Affiliation	Other Authors	Description of Research
Soil Amendments to Close the Nutrient Cycle in Organic Systems	Jessica Nicksy University of Manitoba	Dr. Martin Entz, Professor of Plant Science (University of Manitoba); Dr. Brian Amiro, Professor of Soil Science (University of Manitoba)	This research evaluates amendments that cycle nutrients from cities back onto farms for their capacity to supply phosphorus, improve yields, and maintain soil health on P-deficient organic farms.
Wood Chip Incorporation Increases Soil CO_2 Efflux and has Transient Effects on Tree Growth	Hana You, M.S. University of California, Davis	Mae Culumber (University of California Cooperative Extension-Fresno County, CA, USA); Astrid Volder, Department of Plant Sciences (University of California Davis, CA, USA)	Recycling the old orchard by chipping the remaining trees and incorporating the wood chips into the soil can be one option for agricultural burning process. Wood chip incorporation into the soil can increase soil carbon availability, which could have a positive effect on microbial activity. Increased microbial activity may initially immobilize nitrogen; however, it might have long-term benefits in terms of recycling nitrogen and soil water holding capacity.
Short Term Effect of Organic Amendments in Microbial Biomass on an Oxisol	Paola Rodriguez, B.S. Graduate student, University of Puerto Rico-Mayaguez		Researchers incorporated organic amendments (compost, compost tea and active biochar) on an Oxisol soil from the Daguey series in Puerto Rico to evaluate the microbial biomass, using phospholipid fatty acid analysis (PFLA), of white bean crops. The results indicate a reduction in microbial biomass 90 days after the white beans were sowed in all treatments with the exception of compost tea.
The Influence of Poultry Manure and its Biochar on Soil Chemical Properties and Growth of Amaranth	Amarachukwu Agbim, M.Sc. Federal Polytechnic Ede	Thomas, Eunice Y, Agronomy Department, Faculty of Agriculture (University of Ibadan); Olotu, Blessing, Agronomy Department, Faculty of Agriculture (University of Ibadan)	This research was conducted to evaluate the combined treatment effects of poultry manure and its biochar on the chemical and productive characteristics of a low nutrient tropical soil. The result revealed that application of combined treatment of poultry and its biochar can improve the chemical and productive capacity of poor soils better compared to single application of either poultry manure or biochar.

THANK YOU

SOIL HEALTH
THE FOUNDATION FOR
Regenerative Agriculture

PLATINUM SPONSORS

VALENT BIOSCIENCES®

THE SAMUEL ROBERTS NOBLE FOUNDATION

USDA ARS
United States Department of Agriculture
Agricultural Research Service

METER

USDA United States Department of Agriculture
Natural Resources Conservation Service

GOLD SPONSORS

WARD Laboratories, Inc.

National Association of Conservation Districts

American Society of Agronomy

Crop Science SOCIETY OF AMERICA

Soil Science Society of America

SILVER SPONSORS

TRUTERRA™

Farm Foundation®

THE FERTILIZER INSTITUTE

IAWA
IOWA AGRICULTURE WATER ALLIANCE

AGRICULTURE COUNTS

syngenta®

BASF
We create chemistry

SARE
Sustainable Agriculture Research & Education

SOIL HEALTH PARTNERSHIP

RALPH K. MORRIS FOUNDATION

ABOUT THE SOIL HEALTH INSTITUTE

The Soil Health Institute works with its many stakeholders to identify gaps in research and adoption; develop strategies, networks and funding to address those gaps; and ensure beneficial impact of those investments to agriculture, the environment and society.

OUR MISSION: SAFEGUARD AND ENHANCE THE VITALITY AND PRODUCTIVITY OF SOIL THROUGH SCIENTIFIC RESEARCH AND ADVANCEMENT

To become even more involved in SHI activities,
please contact us at soilhealthinstitute.org.

Celebrating 5 Years

SOIL HEALTH INSTITUTE

UNIFY ■ RESTORE ■ PROTECT

2803 Slater Road | Suite 115 | Morrisville, NC 27560 | 919-230-0303 | soilhealthinstitute.org