COLLABORATION PLATFORM
ON AGRICULTURE

Virtual CPA Workshop on "Transatlantic Perspectives on Soil Health"

On June 28, 2022, the European Union Delegation to the United States (US), in cooperation with the US Department of Agriculture (USDA), organized the half-day virtual workshop EU-US Collaboration Platform on Agriculture: Workshop on Soil Health with USDA and DG AGRI and External Experts. Featuring a range of soil experts from both sides of the Atlantic, this workshop aimed to transfer knowledge of maintaining soil health. Approximately 60 agricultural experts, farmers, and officials convened for the affair.

Participants discussed areas of collaboration, including sustainable management of soils to promote carbon sequestration and soil biodiversity. Topics focused on targeting research actions, fostering networks, identifying partnerships among users of soil data, and developing indicators designed to best inform policymakers.

Plenary session – The policy framework/initiatives in the EU & US

In a discussion moderated by Dr. Sarah Beebout of USDA's Agricultural Research Service (ARS) and Claudia Olazabal, Head of the Unit for Land Management at the EU Commission's Directorate-General for Environment opened the session with an introduction to the EU's new soil strategy for 2030. Ms. Olazabal spoke of soil sustainability as being a key component of the broader European Green Deal. She also addressed the rise in public awareness to meet the challenges we are facing: erosion, pollution, and desertification, which the Commission is responding to with initiatives such as the EU Soil Observatory. This initiative will allow access to data on an accessible, large-scale database of soil quality and the threats affecting it. Key actions areas include focus on achieving soil health to address climate change, biodiversity, and the circular economy, among others.

Kerstin Rosenow, Head of Agricultural Research and Innovation at the Commission, followed with a presentation on the Soil Deal for Europe. The objective is to establish 100 Living Labs (on the ground experiments) and Lighthouses (good-practice demonstration sites) across Europe. Together, these sites will comprise a comprehensive network of real-life sites for co-creating, testing, demonstrating, and upscaling solutions to improve and maintain health to achieve sustainable and healthy soils by 2030. The initiative recognizes that soil health is the basis for nutritious food, delivers vital interconnected ecosystem functions, and that 60-70% of soils in the EU are considered unhealthy. Soil health management is recognized in the new Common Agricultural Policy (CAP) as an important element to improve farm sustainability in economic and environmental terms.

Katina Hanson, Acting Senior Advisor at the USDA's Partnerships for Climate-Smart Commodities, then spoke on the public's growing interest in commodities produced in ways that overcome the threats of climate change. These partnerships seek to create new opportunities in agriculture and forestry which are farmer, rancher, and landowner led. They are voluntary and are incentive based. In support of these partnerships, $1 billion USD will be invested in projects supporting climate-smart agricultural opportunities. The fund will be matched with more than $8 billion in nonfederal money. Common commodities under partnership consideration are corn, soybean, timber, kelp, hemp, rice, beef, and dairy.

Joe Williams, Acting Director of the Soil Health Division at USDA's Natural Resources Conservation Service (NRCS) presented a summary on their soil health initiatives. The NRCS defines soil health as the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans. The Soil Health Division promotes biodiversity and living roots. NRCS promotes conservation practices that support soil production, as well as protecting soil aggregation and organic matter by minimizing soil disturbance and maximizing soil cover. The NRCS is uniquely positioned to assist producers in adopting better practices and has seen growing customer demand for engagement in recent years. The Soil Health Division was instituted to meet a focused national need for training, tech transfer, policy, and technical and strategic leadership.

Parallel Session 1: Science for soil carbon and diversity

This session focused on monitoring soil carbon and soil health. Best management practices and tools were presented for monitoring soil carbon and soil health throughout the EU and US.

Skye Wills is the National Leader for Soil Science Research at the USDA National Soil Survey Center. Dr. Wills discussed new ideas and methods to protect soil health. Through the Dynamic Soil Properties (DSPs) program, soils can be measured over a human lifetime and can be used to monitor and predict how soil changes with land use, management, and disturbance. These properties can be used within the concept of ecological sites, to allow scientists to stratify the landscape into meaningful units based on distinct kinds of soil which support typical kinds and amounts of vegetation, and response to varying with characteristic responses to different disturbances. Tying these together is a new project called the Science of Soil Health Initiative. It ties these two strategies together to metrics and identify dynamic soil properties that can be captured in soil survey databases and products. This project will build a reference for assessing soil health across multiple locations using methods and procedures from the Soil Health Laboratory Indicators Tech Note and the Soil and Plant Science Division Dynamic Soil Property (DSP) National Instruction. This framework uses ecological sites to develop reference values for soil health indicators across a diverse variance in locations. By using samples from different locations and soil management systems, the Science of Soil Health Initiative can determine the expected range of environments. Probability density functions can then be used to determine and identify if properties for a site and show if an individual measurement at a particular site is under or over performing against a standard database.

Emanuele Lugato is a soil scientist working for the EU Joint Research Center (JRC). He presented JRC work in monitoring soil organic carbon. The EU has a goal of carbon neutrality by 2050. Soil organic carbon accumulation will play an important
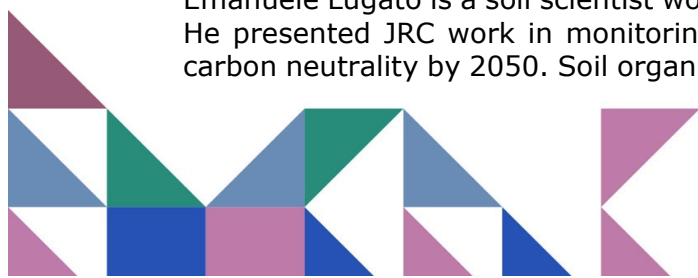
role in achieving this goal. To monitor this at the European continent scale, the Land Use and Coverage Area Survey (LUCAS) is used. The survey is taken every several years to determine the trends of European soil health across the continent. Updating LUCAS ensures that models are working with current data. It also allows for comparison of model predictions with real-world data. Along with new technologies like satellite imagery, LUCAS data can also be used to help ensure compliance from farmers and land managers using surveillance.

Jennifer Moore is a Research Soil Scientist with USDA- Agricultural Research Service (ARS) at the Forage Seed and Cereal Research Unit. She gave a -high-level overview of research, describing evaluating management impacts on soil health and carbon sequestration. USDA-ARS is divided into five geographical regions employing over 2000 scientists and post-docs. Agriculture in the US is responsible for ~10% of carbon emissions and the plan for achieving carbon neutrality in this sector is to cut emissions in half while increasing carbon storage by a factor of 10. In order to achieve this goal, soil will have to act more as a "carbon bank" than it has in recent history. Over the past 200 years, soil carbon levels have dropped 20-75% depending on the region. Using better management practices to help put carbon in the soil (i.e., cover cropping, conservation tillage, and improved crop rotations) will help reverse this trend. Dr. Moore also warns that, although different practices may be helpful in alleviating the carbon problem, unintended consequences such as lower yields or application of more herbicides can occur.

Jean Francois Soussana is a researcher with the National Institute of Agricultural Research in France (INRAE). He spoke about the future of carbon farming and sustainable carbon cycles and highlighted the many benefits of low-carbon farming for adaptation, food security, the environment, and biodiversity. In order to effectively study soil carbon change, a large framework for soil monitoring is necessary. This includes short and long term experiments, remote sensing with satellites, and a number of computer models to determine change over time. Such a framework is already in place in the Netherlands in the "NIVA" project which uses a mixture of data approaches to model net carbon fluxes in croplands. Models used on a European scale could facilitate the creation of voluntary carbon markets for agriculture either as taxes for carbon production or grants for carbon mitigation. Although there are potential benefits for farmers adopting conservation approaches, there are also risks with adopting newer practices. Therefore, farmers may need to be compensated for that risk.

Alan Franzluebbers is an ecologist with USDA-ARS. He addressed soil functions as they are indicated by soil-test biological activity. There are multiple methods for testing determination, but simple indicators can be most useful, particularly for indicators related to soil-tests. For example, respiration is a simple measure of organic resources in soils that are readily digestible by the community of soil microorganisms at the time of sampling. Collaborations were discussed. Dr. Franzluebbers collaborated on a project where 196 on-farm trials across Virginia, North Carolina, and South Carolina were surveyed. Management history was documented and soil sampling was deployed. These trials determined how different methods of farming, soil types, and climates interacted to impact soil-test biological activity. On-farm trials showed how farmers could become more efficient with nitrogen cycling from enhanced surface soil organic matter. Dr. Franzluebbers concluded by highlighting further research opportunities with on-farm trials and a focus on other nutrients.

Wim van der Putten is a researcher at the Netherlands Institute of Ecology at Wageningen University. He outlined the main challenges for science on soil carbon and biodiversity. In particular he focused on the need for an integrated multi-disciplinary approach for soils, noting that soils and soil health are connected globally. Stakeholders in business, politics, and the general public are in favor of change, but the question is how to achieve that change. In the past, soil science was primarily a physics and chemistry domain. Today, soil science has added biology as a partner. It is an unequal partner when considering declining soil health and biodiversity. In the future, all relevant sciences for soil health need to be treated equally to prevent soil degradation.

Parallel Session 2: Knowledge transfer of soil carbon and biodiversity

The second session dealt with challenges and opportunities for knowledge transfer in the measurement and definitions surrounding soil health and biodiversity. Speakers talked about different models, land use policies, and other programs to help develop new programs in both the US and EU.

Dr. Arwyn Jones, researcher at the EU Soil Observatory, shared with the panel her description of the soil biodiversity monitoring mechanism, LUCAS. Soil samples have been taken throughout the EU since 2009, in roughly three-year intervals. This is the only harmonized soil data collection program for the EU. The program has grown extensively, now comprising of samples collected from 41,000 locations, many of which are fixed for soil organic carbon prediction. Dr. Jones further presented some of the biodiversity outcomes of the LUCAS 2018 module. There are large scale drivers of relationships between soil microbial properties and organic carbon across Europe. Land-use intensification has affected bacterial and fungal community composition. As to the question of whether there were correlations between soil microbiomes and plant protection products, Dr. Jones noted that the metabolite aminomethylphosphonic acid (AMPA) was found in most sites and in various types of vegetation cover.

Ms. Francine Lheritier, a Soil Scientist with the USDA-NRCS joined from Colorado to speak about dynamic soil properties (DSP). These are properties that change within a human lifetime and whose assessment helps measure and predict soil change with land use and management. While inherent soil properties (ISP) remain over millennia, DSP examines soil physical structure, organic matter concentration, and microbial diversity and abundance. Combining ISP and DSP observations into field surveys represents a shift towards incorporating ecosystem complexity and a better understanding of soil health. The goals of the DSP program are met through local partners who identify conservation questions that are relevant to specific regions and cropping systems currently across the US. There are 250 DSP projects distributed across 92 offices and 17 universities. Research is primarily focused on "benchmark" or "extensive soil series" amounting to anything over 81,000 hectares. These data can help identify maximum expected crop yield from a particular soil under different management systems. Ecological sites and state and transition models show promise for grouping soils and organic information.

Brandon Smith, National Program Coordinator of USDA-NRCS Soil Health Division provided his insights on how technology is transferred to landowners and other stakeholders. He emphasized the NRCS is a voluntary – not regulatory – body that works with land managers to develop conservation plans and implement

conservation practices. Conservation planning includes technical assistance to farmers (one-to-one). The Environmental Quality Incentive Program and Conservation Stewardship Program are key in supporting farmers to make practice changes to support improved soil health. Top resource concerns for soil health are organic matter depletion, compaction, aggregate instability, and soil organism habitat loss. Raising awareness of best management practices to sustain soil health is achieved with soil health testing, source testing for nutrient management, and organic carbon stock monitoring. Mr. Smith advocated for the need of both state and national soil health strategies and enhanced technical expertise. He concluded noting that one-half of US states have passed soil health laws with the remainder looking to do the same.

Professor Gabriele Broll, a soil scientist from the University of Osnabrück, Germany, talked about how communication on soil-related issues can be improved. She discussed the relevant topics that should be included in communication efforts on soil health: 1) the connections among food, agriculture, and soil health, 2) soil organic carbon, carbon sequestration, and climate change, 3) soil biodiversity, general biodiversity, ecosystems and nature conservation, 4) land-take and soil governance, and 5) general awareness on soil health.

Kristen Veum with the USDA-ARS presented the soil health interpretation tool, Soil Health Assessment Protocol and Evaluation (SHAPE). The SHAPE tool provides a low cost, timely, and accurate way for landowners to interpret soil health measurements on their property. SHAPE currently interprets five soil health indicators to represent ecosystem services of the soil. Inherent climate and soil conditions define the soil health potential at any one site. SHAPE version 1.0 practices to interpret soil health in a robust way between different regions by accounting for the inherent climate and soil conditions across the US continent. After accounting for inherent conditions, uninformative SHAPE assigns a score for each of the five indicators, including soil organic carbon, soil respiration, active carbon, total protein, and aggregate stability. Scores fall between 0–100 percent and are assigned a measure of uncertainty that is simple and easy for landowners to understand. Spatially-explicit SHAPE v2.0 will be released soon with more accurate measures and improved user friendliness.

Christian Steiner is a landscape planner and head of the Department of Rural Development in Austria. He talked about the role of windbreaks and hedges as instruments for soil protection in Lower Austria. Soil protection is very important for Austria due to the role that the agricultural sector plays in sustaining Austria's food supply and economy. During recent decades, agricultural intensification led to serious problems with soil degradation and wind erosion. As a response, Austria initiated a hedge and tree planting campaign throughout the country. Hedges planted in between fields of crops have numerous advantages that make them extremely useful. By providing shade, limiting evaporation, and accessing deeper soil water, hedges preserve soil moisture levels for the entire field. They also prevent soil and nutrients from wind erosion by physically stopping soil movement and creating barriers to limit wind speed across crop fields. Hedges also provide other benefits such as carbon storage, providing a habitat for local animals and insects, increasing biodiversity, and increasing yields from 9–25% compared to unprotected fields.

Final Wrap Up Session

Renee Leech, a USDA-NRCS Animal Husbandry Specialist, summarized her takeaways from Parallel Session #1. She noticed a common thread between speakers was the need for a standardized protocol for monitoring soil carbon and soil health. The discussions on the history of soil science and recent addition of biodiversity of soil health were important. She was especially interested in several speakers talking about a consortium on soil carbon changes and voluntary carbon markets for agriculture.

Anne Marechal, a Science Officer at EU Science Hub, summarized Parallel Session #2. She found the common talking points on the difficulties of communicating and transferring knowledge on soils particularly interesting. For example, 1) guidance to farmers and land managers in the US providing technical ways to increase yield, 2) the challenges of talking about soil to the general public, and 3) practical examples of improving soil health. They all provided opportunities and challenges in knowledge transfer and raising awareness about soil functions.

Claudia Olazabal spoke on the diversity of land use, climates, and soil types in the US and EU. How these issues are defined and communicated to the public was a common theme among speakers. She was glad to see that biology and carbon farming were getting the recognition they deserve in the soil health debate.

Joe Williams found the commonality of how the US and EU face similar soil issues to be reassuring. Both sides are working in the same realms and in the same directions such as focusing on other biomes besides just croplands. He agrees that it is an important goal to further educate the public on the importance of soil health to get the necessary scientific, financial, and political support for protecting soil.