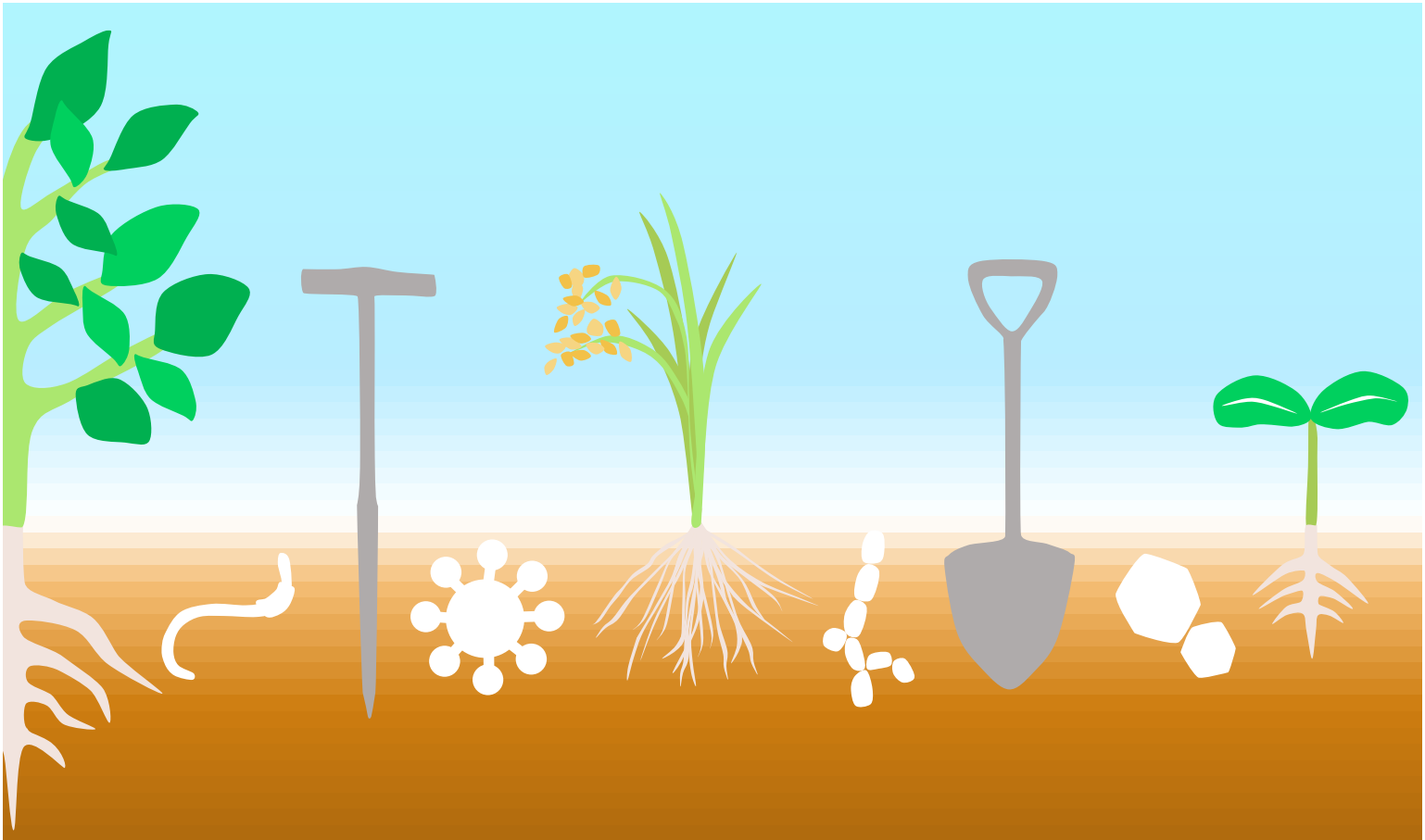

Soil Health 2024 Japan Workshop

January 30-31, 2024
Online

Program & Abstracts

NIAES International Workshop

Soil Health 2024 Japan Workshop

「土壌の健康」についての国際ワークショップ

Date: January 30–31, 2024

Venue: Online (Zoom Webinar)

Organized by: Institute for Agro-Environmental Sciences, NARO (NIAES)
(https://www.naro.go.jp/english/laboratory/niaes/index.html)
Kannondai 3-1-3, Tsukuba, Ibaraki 305-8604, Japan

Supported by: Japanese Society of Soil Science and Plant Nutrition (JSSSPN)
(https://www.jssspn.jp/Eng/index_eng.html)
(tentative) International Union of Soil Science (IUSS) (https://iuss.org/)

Funded by: Ministry of Agriculture, Forestry and Fishery, Japan (MAFF)
(https://www.maff.go.jp/e/index.html)

Rationale: Soil health may be defined as the continued capacity of soil to function as a vital living ecosystem that sustains biological productivity, promotes air and water quality, and maintains plant, animal, and human health. This term may also be regarded as a tool to raise the general public's interest, improve their understanding of soil, and promote casual communication among various stakeholders by using the word "health" that is familiar to everyone to scientifically express the status of soil. Healthy soil is an essential foundation for achieving a sustainable food system. To feed the growing world population while minimizing the anthropogenic environmental load via soil, such as global warming, loss of biodiversity, and disruption of biogeochemical nitrogen and phosphorus cycles, we need to assess soil health using methods that are appropriate for the diverse conditions of soil, climate, crops, diet, culture, economy, etc., among different countries and regions.

In this workshop, we will invite nine experts to give lectures on their soil health studies conducted in different countries and regions. Based on this, we will share the current information and knowledge on soil health and exchange opinions in relation to its definitions, indicators, monitoring strategies, assessment methods, and how to utilize it in actual soil policy and agri-environmental policy. This Workshop will aim at:

- Learn the concept of soil health and its applications in different countries and regions
- Share the current information and knowledge, exchange opinions, and organize our understanding on soil health considering diverse conditions of soil, climate, crop, diet, culture, economy, etc., among different countries and regions
- Make a comparison sheet of soil health among countries/regions to find common ground as well as essential differences between them

This Workshop will contribute to the global activities of "International Decade of Soils 2015–2024" led by IUSS and celebrate the Centennial of IUSS. This Workshop will also contribute to the worldwide activities of the United Nations Sustainable Development Goals in the 2030 Agenda for Sustainable Development.

Website: https://supportoffice.jp/soil-health-2024/en/

Registration: Free of charge. Further information is available in the Workshop website.

Project: Soil Health Research Project (Sept. 2023 ~ Mar. 2024) funded by MAFF
Project execution members (Workshop staff members):
Sadao Eguchi (Soil Inventory and Management Group, Division of Soil Environment Management Research, NIAES)
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Munehiro Ebato (*ibid.*)
Hirotaka Ihara (*ibid.*)
Sho Morimoto (*ibid.*)
Ryo Ohtomo (*ibid.*)
Yuji Maejima (*ibid.*)
Nanae Hirano (*ibid.*)
Saeko Yada (*ibid.*)
Satoshi Kaneda (Agroecosystem and Crop Breeding Group, Division of Hilly and Semi-Mountainous Area Farming Research, Western Region Agricultural Research Center, NARO [WARC/NARO], Japan)
Project supervisor:
Hideo Kubotera (Director of the Division of Soil Environment Management Research, NIAES, Japan)
Project collaborators (experts outside NARO):
Dr. Masakazu Komatsuzaki (Ibaraki Univ., Japan)
Dr. Nobuhiro Kaneko (Fukushima Univ., Japan)
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NIAES International Workshop

Soil Health 2024 Japan Workshop

PROGRAM

Overview of the Workshop from Tuesday 30 to Wednesday 31 January 2024

Venue：Online (Zoom Webinar)

Tuesday, January 30 — *1st day of the Workshop*

08:00 *Staff meeting & preparation*

08:30 Open the Zoom Webinar

Opening Session

09:00 Opening address
Dr. Shori Yamamoto
Director-General of NIAES, Japan

Morning Session: Soil health in America and Oceania

Moderator: *Ryo Ohtomo, NIAES, Japan*
Munehiro Ebato, NIAES, Japan

09:15 【Keynote】Measuring and assessing soil health at scale in across North America
Dr. Cristine Morgan
Soil Health Institute, USA

09:55 Factors of soil health, and how they impact interpretation and benchmarking
Dr. Harold van Es
Cornell Univ., USA

10:30 Soil health in Aotearoa New Zealand: a personal journey
Dr. Matthew Taylor
Soil and Land, Science, Policy and Information, Waikato Regional Council, New Zealand

11:05 Grazing effects on soil health in Australia's extensive rangelands
Dr. David Eldridge
Univ. of New South Wales Sydney, Australia

11:40 General discussion I

12:00 *Group Photo I on the Screen*

Lunch Break

Afternoon Session: Soil health in Asia and Europe

Moderator: *Satoshi Kaneda, WARC/NARO, Japan*
Kei Asada, NIAES, Japan

13:30 Soil health assessment in Kanto, Japan: A long-term study of conservation agriculture trials
Dr. Masakazu Komatsuzaki
Ibaraki Univ., Japan

14:05 Regenerating soil health in smallholder systems of South Asia: Challenges and strategies
Dr. Mangi Lal Jat
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India

14:40 *Coffee Break*

Moderator: *Yuji Maejima, NIAES, Japan*
Sho Morimoto, NIAES, Japan

15:00 【Keynote】Assessing and monitoring soil health in Europe: opportunities and threats
Dr. Edoardo Costantini
President of IUSS
Institute of BioEconomy, National Research Council (CNR-IBE), Italy

15:40 Assessing soil health across Europe – changing the perspective on soil monitoring designs
Dr. Rachel Creamer
Wageningen Univ. & Research, The Netherlands

16:15 Farmer-feasible soil health assessment
Dr. Helen Hughes
Univ. of Edinburgh, UK

16:50 General discussion II

17:10 *Group Photo II on the Screen*

Closing the 1st day of the Workshop

Wednesday, January 31 — *2nd day of the Workshop*

08:00 *Staff meeting & preparation*

08:30 Open the Zoom Webinar

Dialogue & Discussion Session

Moderator: *Hirotaka Ihara, NIAES, Japan*
Sadao Eguchi, NIAES, Japan

09:00 Free dialogue & discussion

- Summary of the 1st day of the Workshop
- Free Q&A with various stakeholders (researchers, policy makers, farmers, private companies, NPOs, etc) on anything about soil health
- Short comments by foreign/Japanese experts in relation to, e.g.,
  - soil health comparison sheet among countries (see below*1)
  - soil health in rice paddy system (rotation with upland crops)
  - soil health in tea cultivation field
  - subsurface/subsoil soil health (compaction, aeration, drainage)
  - and/or anything else about soil health…

*1 Key factors or aspects (candidates) to be compared among countries are: definition, indicators, monitoring strategies, assessment methods, actual applications in soil policy (agricultural/agri-environmental policy) and more?

Closing Session

11:30 Closing remarks

Mr. Keiji Hirose
Deputy Director, Sustainable Agriculture Division, Crop Production Bureau, MAFF, Japan

11:45 *Group Photo III on the Screen*

Closing the Workshop

Abstracts

January 30, Tue 9:15-12:00

Morning Session: Soil Health in America and Oceania

Measuring and Assessing Soil Health at Scale in Across North America

Cristine L.S. Morgan

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ABSTRACT

A science-based, widely applicable, and universally accepted soil health evaluation program is needed because land managers must be able to assess the current state of their soils' health and monitor progress at improvement to optimize productivity, economic, and environmental benefits. Developing a standard measures program is hindered by the complexity of inherent soil properties, cropping systems, management practices, and climatic factors, which all influence interpretation. To address this complexity and develop such a program, the Soil Health Institute has recommended a minimum suite of soil health measurements that are relatively inexpensive and accessible by commercial labs in North America. Making data useful and interpretable by land mangers requires a scalable means of contextualizing soil health indicator values, or benchmarking. Using this minimum suite of indicators, we present a framework for identifying soil groups with similar potential health. Within these soil health groups, we share our approach to benchmarking baselines and potential soil health. We share the outcome of sampling multiple land resource areas in the United States and Canada and present how the message is delivered to row crop farmers and crop advisors.

Keywords: soil health, benchmarking, soil health indicators, measurement

Factors of soil health and how they impact interpretation and benchmarking

Harold van Es*, Joseph Amsili, Valentina Rubio, and Deborah Aller

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ABSTRACT

Increased sustainability of crop production includes multiple goals, including soil health enhancement, improved carbon and greenhouse gas management, and increased water quality. New York State (USA) recently passed Soil Health and Climate Resiliency legislation that required the development of benchmarks and goals for soil health. The adoption of soil health assessment in recent years has created databases that allow insights into the factors that affect soil health and guide benchmarking schemes. These factors can generally be organized into three groupings. The first relates to inherent properties of the soil as impacted by the commonly understood soil forming factors (parent material, climate, topography, etc.), which are mostly unchangeable. The second relates to land use, including cropping systems, where the level of cycling of carbon and nutrients appears to be a critical element. This factor is mostly fixed over time and only in rare cases changed (like from natural to human-managed, or from agricultural to urban). The third factor relates to how a land use system is managed, like through tillage practices, crop rotations, organic amendments, etc. This factor is most suitable for interventions. Soil health interpretations and benchmarking need to account for these differences to help identify soil resource concerns and intervention options.

Soil health in Aotearoa New Zealand: a personal journey

Matthew Taylor

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ABSTRACT

Whakataukī (Indigenous Māori proverb)
Te toto o te tangata he kai, te oranga o te tangata, he whenua, he oneone
"While food provides the blood in our veins, our health is drawn from the land and soils"

Soils are neither good or bad but they may be suited or unsuited for the provision of specific services, and they can be degraded. Researchers were considering issues that we would consider as part of soil health from the 1930's and likely earlier. Māori (the indigenous people of Aotearoa New Zealand) hold perspectives on the environment that emphasise the indivisible connection between the wider environment, ecosystems, and human health. Indeed, we stand on the shoulders of giants.

The development of soil health monitoring in New Zealand, as I have observed it, is presented. A large step forward was the development of soil quality monitoring from the mid 1990's, which lead to the current State of the Environment reporting on soil quality. Soil quality and soil health are closely related. Soil quality is generally used in relation to land-use, e.g. good soil quality for growing pine forest may be poor soil quality for potatoe growing, while soil health more broadly refers to the condition of the soil and whether the soil has been degraded. Other forms of current soil monitoring contributing to the soil health picture are included.

What will a future State of the Environment soil health monitoring programme look like? All chemical, physical and biological properties are linked to soil quality and soil health, and no one property alone can describe a soil's state. Importantly, who and what is "soil health" for? Soil health that is beneficial to a wide range of biological organisms may not be beneficial for arable crop production. Highly nutrient rich soils may lead to poor water quality/health, e.g. algal blooms. All environmental domains are connected and related, and any future soil health monitoring assessment needs to consider these connections.

Grazing effects on soil health in Australia's extensive rangelands

David J Eldridge

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ABSTRACT

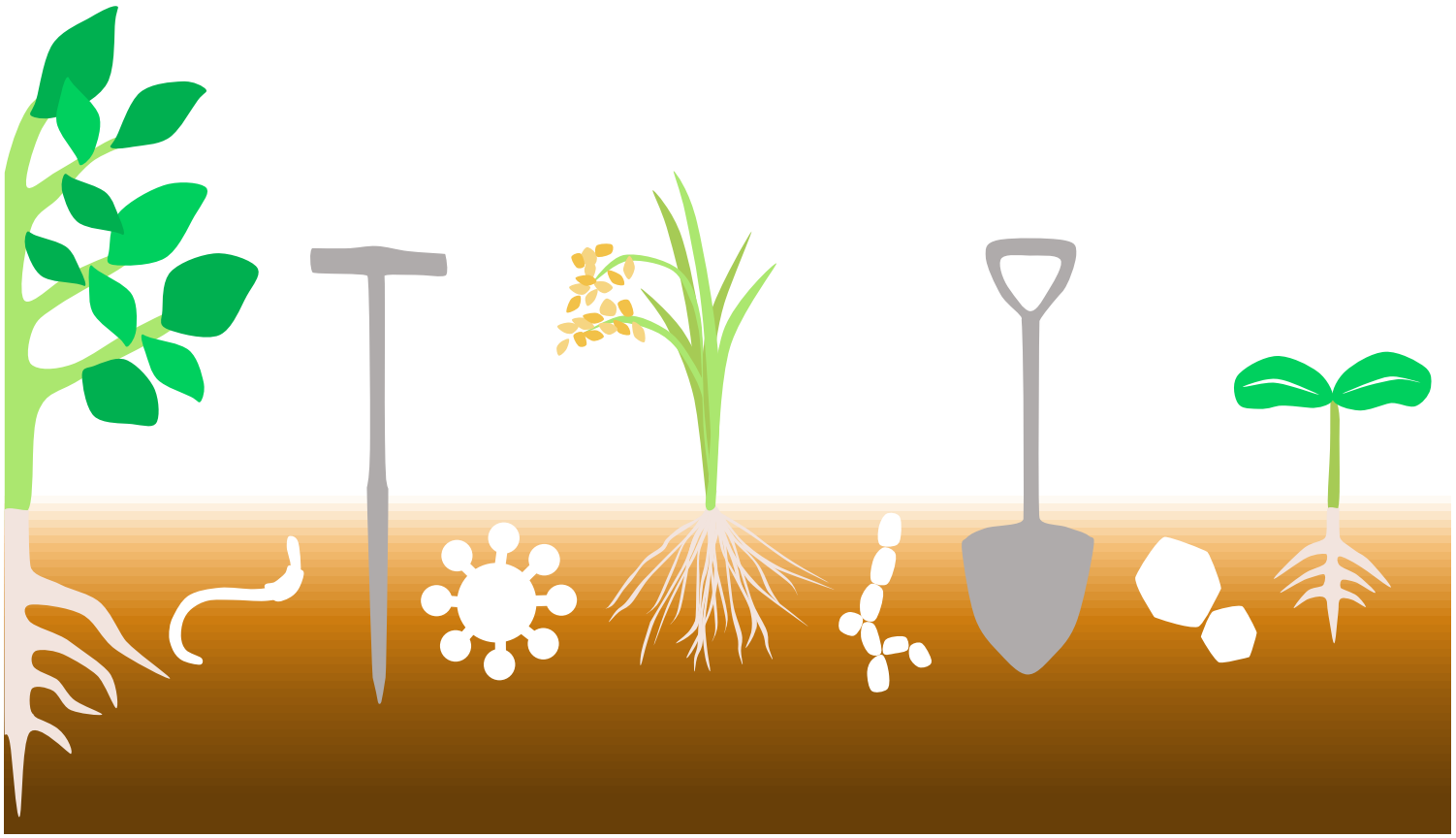
There are many ways of assessing soil health, ranging from physical and chemical to biological. Grazing by livestock and native animals has multiple effects on soils and soil health, some direct (physical or engineering effects) and others indirect, via changes in vegetation structure and composition. Australia's rangelands occupy about three quarters of the terrestrial land area. Therefore, methods to assess soil health need to be relatively rapid and cost-effective. Here I outline a major study where we assessed the impacts of livestock grazing on soil health using a range of morphological and chemical features of the soil that are indicative of how well soils function. I describe two complementary rapid assessment approaches that combine an evaluation of the distribution and structure of vegetation in rangelands with an assessment of condition or morphology of the soil surface. I draw on evidence from a global study in drylands showing how two surface components; structural integrity of the surface soil and the degree of incorporation of organic matter, are valuable proxies of soil multifunctionality. I conclude that these rapid assessment methodologies are extremely useful for assessing soil health across a range of environments including rangelands. They are easy to use with appropriate training, low cost and intuitive, and enable land managers to rapidly assess soil condition over extensive areas.

Keywords: drylands, soil surface conditions, soil health proxies, soil surface morphology, rangelands

Abstracts

January 30, Tue 13:30-17:10

Afternoon Session: Soil Health in Asia and Europe



Soil health assessment in Kanto, Japan: A long-term study of conservation agriculture trials

Masakazu Komatsuzaki

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ABSTRACT

The introduction of no-till farming as a conservation agriculture practice has garnered substantial attention in Western countries, but its verification and comprehensive assessment in the Asian context have been notably scarce. Our study sought to address this knowledge gap by conducting an extensive comparative analysis, drawing on peer-reviewed international publications from various Asian nations. Their investigation primarily aimed to elucidate the implications of no-till farming on soil carbon sequestration and crop productivity in relation to conventional tillage methods. The research outcomes shed light on the repercussions of implementing no-till practices within the Asian agricultural landscape. Furthermore, the long-term field study delved into the intricate interplay between no-till systems and cover cropping, with a specific focus on the distinct soil type as Andosols. The research aimed to discern the synergistic effects of these agricultural practices on soil organic carbon (SOC) dynamics and broader soil health indicators. Over the course of two years, meticulous data collection efforts were undertaken at the Center for International Field Agriculture Research and Education, located at Ibaraki University, Japan. The research revealed compelling evidence of noteworthy enhancements across multiple soil health parameters, encompassing SOC, total nitrogen content, available phosphorus levels, exchangeable potassium-magnesium content, cation exchange capacity, bulk density, soil penetration resistance, and substrate-induced respiration. These findings notably manifested when employing no-till farming strategies in conjunction with cover crop management, particularly during soybean cultivation. Notably, the combination of no-till farming and the incorporation of rye cover crops emerged as a particularly effective strategy in augmenting SOC levels and bolstering overall soil health within the Andosol context.

Keywords: no tillage, cover crop, soil health, soil carbon, greenhouse gases

Regenerating soil health in smallholder systems of South Asia: Challenges and strategies

M.L. Jat

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ABSTRACT

South Asian Countries feeds a quarter of global population with 14 per cent of cultivable land indicating high pressure on land. Impressive achievements in food production in South Asia through, is a grand success but there is growing evidence that conventional agricultural strategies in the region, (i) fall short of eliminating hunger and malnutrition, (ii) enhance exposure of the most vulnerable groups to volatile food prices, and (iii) fail to recognize the long-term ecological consequences (land degradation, GHGs, water, non-point air pollution etc). Therefore, meeting the future food demand for the growing population in the region is a major challenge in the face of mounting pressure on natural resources, degenerating soil health, and growing climate crisis. Depletion of soil organic matter, a widespread problem in the region, is exacerbated by soil degradation and a major cause for degenerating soil health. Most soils have extremely low (< 0.50%). Long-term sustainability of agricultural production depends on the health of the soil. Land use and land cover change has resulted in substantial losses of carbon from soils. Globally, agricultural land use has resulted in the loss of 133 Pg C from the soil. Given this 133 Pg soil carbon deficit that has accrued over time, from the beginning of 21st century, proposals for repaying this carbon debt through enhanced farming practices, began to emerge as a regenerative and climate mitigation strategy. Sustainable intensification, regenerating soils and building resilience through low-emission innovations and strategies in smallholder agriculture are critical for secured future towards food & nutrition security and improved livelihoods in South Asia. Science evidence on Regenerative Agriculture practices developed and tested over decades have shown potential for addressing the critical challenges on climate change, soil health, water and farm profits in smallholder systems of South Asia. However, discourses of Regenerative Agriculture are limiting its transformative potential. This essentially need a discourse coalition for scaling regenerative agriculture for impact at scale.

Keywords: Regenerative Agriculture, Carbon Credits, Climate Change, Greenhouse gases, Soil health

Assessing and monitoring soil health in Europe: opportunities and threats

Edoardo A.C. Costantini

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ABSTRACT

The concept of soil health emerged in the early 2000s as an evolution of the soil quality concept. Historically, the term "soil quality" has been used both in the singular, "soil quality," and in the plural, "soil qualities," differentiating it from the concept of "soil fertility," which has always been used to describe the soil's ability to provide water and nutrients to plants and, more generally, a favourable environment for the production of agricultural and forestry biomass. The concept of soil health has increasingly gained prominence as interest and knowledge about the relationships between soil biology and its functionalities have developed. Indeed, the concept of soil health emphasizes the analogies between the physical-biological ecosystem of the soil and living organisms.

The European Union, in the recent Proposal for a Directive of the European Parliament in 2023 concerning soil monitoring and resilience, defines soil health as "the physical, chemical, and biological condition of the soil that determines its ability to function as a vital system and provide ecosystem services." The European Commission has defined seven soil functions that refer to the provisioning, regulation, and support of ecosystem services.

The Directive Proposal establishes measures related to soil health monitoring and assessment, sustainable soil management, and the inventory and recovery of contaminated sites. Monitoring activities are based on soil health descriptors and criteria. Soil is considered healthy when the values of all soil descriptors meet the established criteria.

This lecture summarizes and comments on some of the activities that Member States will need to undertake to implement the directive.

Keywords: mission soil, soil policy, soil erosion, soil organic matter, water retention capacity

Assessing soil health across Europe – changing the perspective on soil monitoring designs

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ABSTRACT

In Europe. a joint assessment undertaken by the Soil Health and Food (SH&F) mission board and the Joint Research Centre (JRC), states that 60-70% of soils in Europe are currently considered unhealthy due to e.g. pollution, excess nutrients compaction and soil degradation (A Soil Deal for Europe (European Commission, 2022a)). In light of this worrying figure, the SH&F mission has set the goal to have 75% of European soils healthy or significantly improved by 2030. This is in line with other important European initiatives such as the Green Deal and EU Farm-to-Fork Strategy, as well as with preparations for a new EU law on the protection of Soil Health that aims to protect soils on the same legal basis as air and water. Meanwhile, the private sector too, is proposing explicit visions of sustainable regenerative food systems in which monitoring of soil health will be implemented.

Monitoring Soil Health by definition, should assess the capacity of a soil to support a range of soil functions/ecosystem services. This is evaluated traditionally by measuring a range of soil properties which reflect soil biological, physical and chemical characteristics of a given soil. However, monitoring of a set of soil properties does not necessarily provide information on the capacity of that soil to support a range of soil functions. This can only be achieved by defining which processes are involved in the delivery of the soil functions. This forms the basis of a research project BENCHMARKS. The BENCHMARKS project will create a framework for assessing soil health across a range of scales, land-uses and for application across a range of climatic zones across Europe.

Keywords: soil health, processes, soil biology, scale appropriate, monitoring

Farmer Feasible Soil Health Assessment

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ABSTRACT

Within a global food system that is under many stresses, soil health is an area of increasing interest for farming communities, researchers, industry and policy-makers. This talk will explore requirements for soil health assessments (SHAs) that empower farmers and agronomic advisors to make decisions on a field level and also allow distant stakeholders, such as supply chain actors, to understand and support soil health management. The focus is SHAs that may be feasible for farmers of varying income levels and also suitable for broad geographic application.

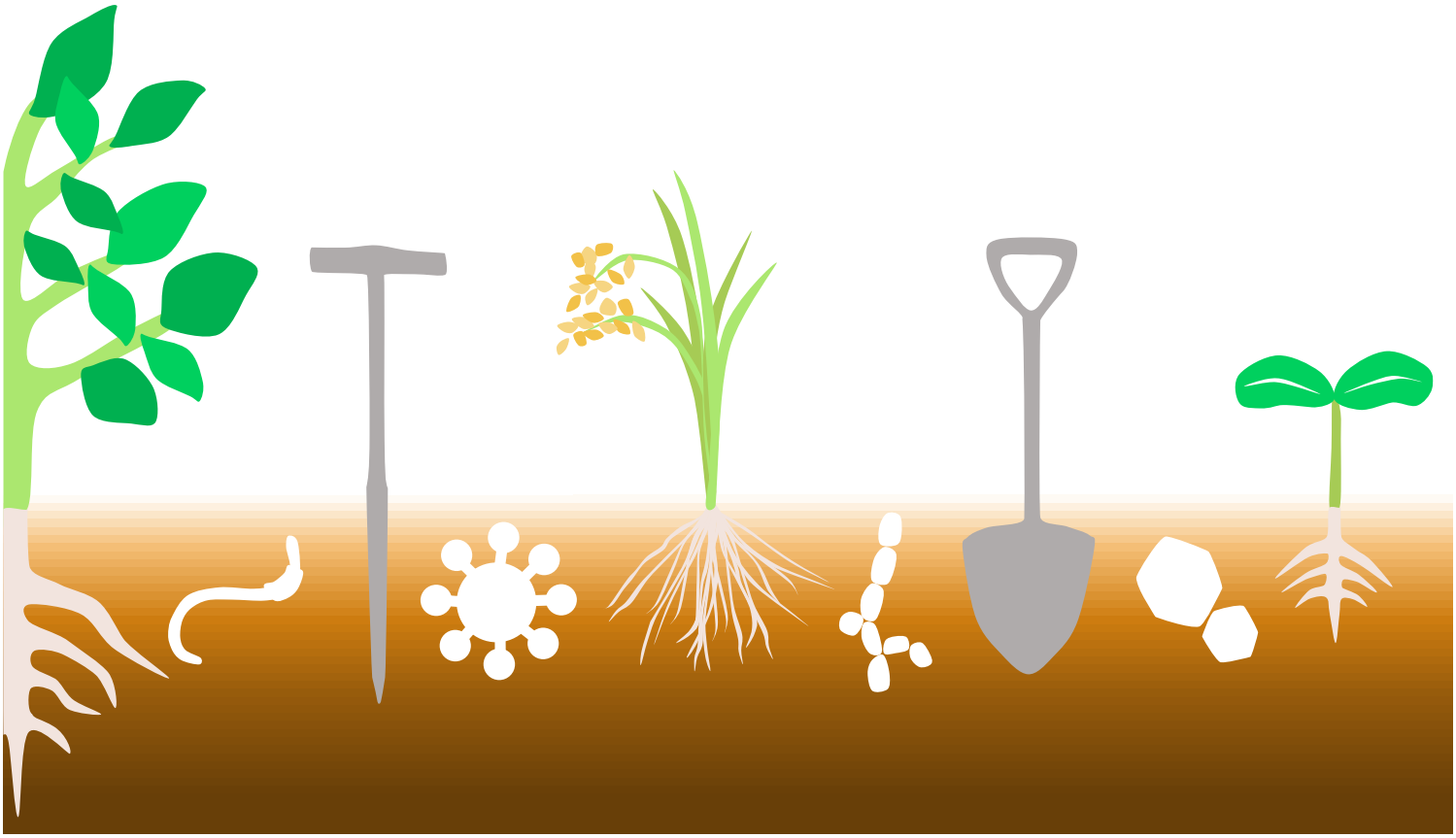
A recent review paper considered existing SHAs from scientific research, science-led projects and farmer-focused projects and found no approaches that met these requirements. Key barriers were assessment cost, logistics, defining soil indicator baselines and a lack of standardised methods. The most feasible SHAs were developed locally in conjunction with farmers, who have been frequently shown to assess the health of their soils accurately, typically using relatively simple, observable metrics.

Considering perspectives of farmers and supply chain actors, I will explore obstacles and opportunities to move towards a joined-up SHA framework. The framework should effectively translate soil management between global and local as well as science and practice. Priorities for progress include a focus on sufficiency, standardised methods and, most critically, cross-industry collaboration including farmers.

January 31, Wed 9:00-11:30

Dialogue & Discussion Session:

- Summary of the 1st day
- Free Q&A
- Comments from experts



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and future challenges