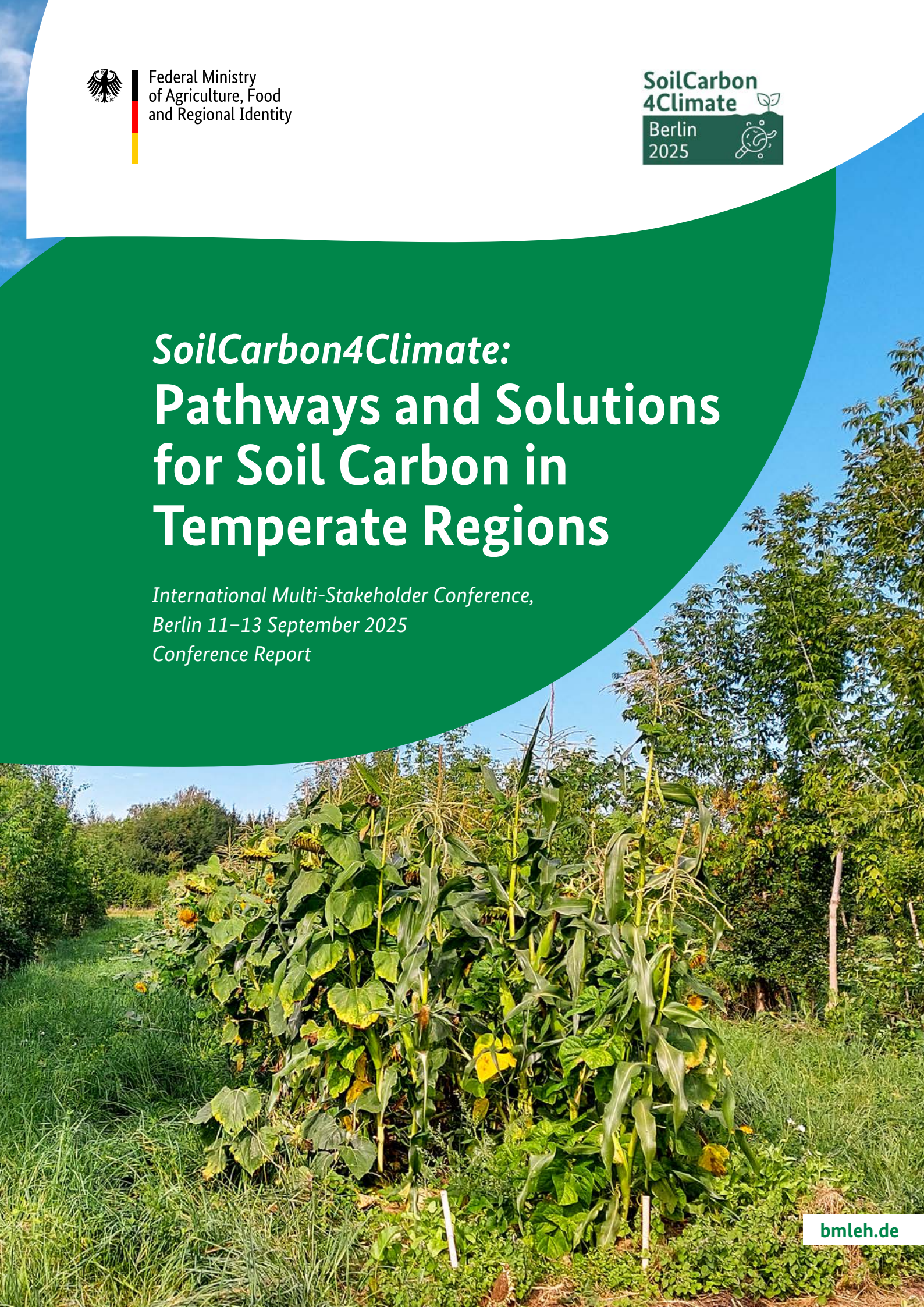
Federal Ministry
of Agriculture, Food
and Regional Identity

SoilCarbon
4Climate
Berlin
2025

SoilCarbon4Climate: Pathways and Solutions for Soil Carbon in Temperate Regions

International Multi-Stakeholder Conference,
Berlin 11–13 September 2025
Conference Report



bmleh.de

"It requires all actors to foster soil health as this is key for making agriculture resilient and productive."

Dear Readers,

Our planet's soils are home to roughly 60 percent of all species. They are the basis of agricultural production, an essential part of good balanced nutrition, and thus a key element of global food security.

However, around half of soils used for agriculture globally are already undergoing degradation. The reasons for this encompass intensive soil tillage, increasing periods of drought, extreme weather events and the growing issue of land sealing.

At the Federal Ministry of Agriculture, Food and Regional Identity, we want to counteract these threats and to better reconcile the needs of agriculture and soil health. This requires all actors – from research, practice, politics and business – to work in concert with one another.

This joint effort was at the heart of our "SoilCarbon-4Climate" Conference, which took place in Berlin last September. At the event, we illuminated current events and developments in soil health in the temperate climate zone, discussed tried-and-true practices being used in Germany, France and many other partner countries, and formulated clear recommendations for future action.

The International "4 per 1000" Initiative is a good example of an international project in the climate-soil protection field. With over 800 partners from more than 100 countries, this initiative is driving investment in humus-rich soils around the world.

Preserving and further building humus is a stated goal of the German Federal Government. For this reason, our Ministry has been supporting the International "4 per 1000" Initiative since its inception ten years ago.

Humus increases the ability of soil to retain water, strengthens its resilience in the face of drought or flood and reduces the need for mineral fertilisers.

My Ministry also launched the Federal Humus Programme back in 2021. Our goal is to gather more insight into how humus can be preserved and increased by agriculture and to bring this knowledge into agricultural practices and further develop it in cooperation with the farmers themselves. To this end, we are supporting a number of agricultural demonstration farms in their efforts to build and preserve humus. These farms collaborate with researchers to identify which measures, if implemented in the field, could bring economic and ecological advantages. We further support forward-looking approaches like agroforestry, agrivoltaics and biochar. In spite of the tightening of the upcoming budget, an increase in humus funding from 12 million to 20 million euros is nonetheless planned for 2026. We aim to use this funding to strengthening ongoing measures.

I would like to thank all conference participants for their commitment. I look forward to continuing to work with you to effectively and consistently protect our soils.

Yours sincerely,

Alois Rainer, Member of the German Bundestag
Federal Minister of Agriculture, Food and Regional Identity

Contents

1. Rationale and Introduction

Healthy and carbon-rich soils are a central lever for climate change mitigation and adaptation and the basis for food production. The Intergovernmental Panel on Climate Change (IPCC) accredits a high mitigation and adaptation potential to increasing soil organic carbon (SOC) stocks, as SOC-positive soil management can lead to greenhouse gas (GHG) removals, while offering benefits, like improved soil fertility, higher water retention, and biodiversity support.

Recent years have seen great developments in terms of SOC and soil health-related research as well as political momentum for soil-related legislation and initiatives, with the launch of the Resilient Agriculture Investment for Net Zero Land Degradation under the Brazilian COP30 presidency or the adoption of the EU Soil Monitoring Law being the latest prominent examples.

Soil health and soil carbon sequestration need long-term commitment. This commitment needs to be based on science and co-developed with actors in the field, supported by an enabling environment at political level, and on market structures, which favour regenerative and agroecological production. Hence, it is crucial to foster collaboration between actors of all disciplines and sectors, including scientists, policy makers, value chain actors, non-governmental organizations (NGO) and farmers, to make real progress.

As of now, we are still in a situation where 30 percent of the world's soils are moderately to highly degraded and where we are losing rather than gaining soil organic carbon globally, a situation which will be aggravated with increasing impacts of climate change.

Hosted by the Federal Ministry of Agriculture, Food and Regional Identity of Germany (BMLEH), and co-organized by the International "4 per 1000" Initiative and the Federal Humus Programme of Germany, the "SoilCarbon4Climate" conference aimed to promote discussion and exchange around the most prominent solutions and open questions related to soil health and SOC. During three days, over 180 participants from 24 countries explored effective enabling conditions for healthy soils by showcasing innovative policy action, discussing private investments and diving into carbon market design. They debated recent developments in soil biology and monitoring reporting and verification (MRV) and explored different management approaches. Throughout the conference, a prominent space was given to farmers' voices as, in the end, it is on the farm where food production, environmental stewardship and revenue creation is translated into action.

The Federal Humus Programme of Germany builds on this very principle, by co-creating and scaling SOC-positive and economically feasible soil management practices on farms throughout Germany. Lessons learned from various projects under the programme, as well as hands-on experiences on partner farms, added special value to the conference.

When it comes to soils, there is no one-size-fits-all solution. Soil properties and climatic conditions but also the socio-economic setting heavily influence which management decisions will be the most effective to foster soil health –and which will be feasible for farmers. By fostering exchange between actors working under similar conditions, solutions developed and experiences made in one place can be transferred to or inspire actions elsewhere more easily.

Therefore, while being part of the "4 per 1000" regional meetings series, the conference was organized as the first "4 per 1000" regional conference covering temperate climates as a larger agroecological zone. Some of the break-out-sessions, hence, focussed on agroecosystems with high potential for SOC conservation and/or sequestration in temperate zones, like peatlands, grasslands and pastures, and agroforestry systems.

Celebrating the 10th anniversary of the International "4 per 1000" Initiative this year, the conference was a perfect occasion to strengthen Germany's long-standing commitment to the initiative and to build momentum for its implementation in temperate climates and beyond.

This report gives a short summary of the conference proceedings. For more detailed information, the presentations and recordings of the conference are accessible online. → ***wiki.isacore.net***

2. Conference Programme

11th September 2025

12:00	Registration, Poster Exhibition, Welcome Coffee
14:00	**Welcome and Introduction** • Dr. Melinda Crane (Moderator), Journalist & Moderator, Germany
14:05	**Official Opening** • Alois Rainer, Federal Minister for Agriculture, Food and Regional Identity of Germany • Stéphane Le Foll, President, International "4 per 1000" Initiative
14:30	**International Collaboration** • Bernard Magenhann, Director General, European Commission Joint Research Centre (JRC) • Houtan Bassiri, Innovative Partnerships and Finance Manager, UNCCD • Dr. Thorunn Wolfram Petursdottir, General Secretary, FAO Global Soil Partnership (GSP) • Dr. Deborah Bossio, Co-chair, Soil Carbon Futures
15:10	**Introductory Address: From Berlin to Belém and Beyond** • Hon. Dr. Penelope Wensley, AC, Former Ambassador for the Environment and National Soils Advocate of Australia
15:35	**Keynote I: Potential and Limitations of Soil Carbon Storage and Sequestration for Climate Change Mitigation and Adaptation in Temperate Climates** • Prof. Dr. Axel Don, Deputy Director, Thünen Institute of Climate-Smart Agriculture
16:05	Coffee & Posters
16:35	**Keynote II: How Can Private Sector Actors along the Value Chain Drive Sustainable Soil Management?** • Stefania Avanzini (online), Director, One Planet Business for Biodiversity (OP2B)
17:00	**Focus on Implementation: Farmers' Experiences with the Transition to Sustainable Soil Management** • Nils Tolle, Hof Tolle; Consulting for Climate Change and Agriculture (neoKultur) • Carolin Lübbecke, Agrargesellschaft Remplin mbH
17:45	**How Can Farmers Benefit from Sustainable Soil Management?** **Multi-Stakeholder Panel Discussion** • Emmanuel Petel, Environmental Policy Coordinator, EC DG AGRI • Prof. Dr. Beverley Henry, "4 per 1000" Scientific and Technical Committee • Dr. Elisa Vainio, Research Coordinator, Baltic Sea Action Group • Aaron Scheid, Coordinator Agriculture and Soils, Ecologic Institute • Nil Tolle, Hof Tolle; Consulting for Climate Change and Agriculture (neoKultur)
18:45	**Closure of Day 1** • Dr. Melinda Crane (Moderator)
19:30	Conference Dinner

12th September 2025

08:00	Registration
09:00	**More than just Carbon: Soil Health and Soil Biology**
10:15	**Break-out Sessions (1)** • Policy, Regulatory and Market-Based Instruments • Living Labs • Biochar and Circular Economy
12:00	Lunch & Posters
13:30	**Break-out Sessions (2)** • Monitoring, Reporting and Verification (MRV) • Agroforestry
15:15	**Break-out Sessions (3)** • Carbon Farming • Peatlands • Grassland and Pastures
17:00	Coffee & Posters
17:30	**Joint Harvesting**
18:00	**Way Forward – Panel Discussion** • Eduardo Sampaio Marques, Agricultural Attaché, Embassy of Brazil • Dr. Deborah Bossio, Lead Soil Scientist, The Nature Conservancy, Co-chair, "4 per 1000" Scientific and Technical Committee • Dr. Bärbel Tiemeyer, Senior Scientist, Thünen-Institute of Climate-Smart Agriculture • Francis Bucaille, Farmer & Innovation Director, AGRIBOOSTER
18:45	**Conclusion** • Dr. Paul Luu, Executive Secretary, International "4 per 1000" Initiative
19:00	Farewell Cocktail

13th September 2025

Half-Day Excursions
- Gut&Bösel organic farm
- Agrargenossenschaft Groß Machnow
- Organic Farm Klass

3. Conference Proceedings

3.1 Official Opening

Federal Minister for Agriculture, Food and Regional Identity of Germany, **Alois Rainer,** opened the event by underscoring the essential importance of soils for competitive sustainable and future-proof food production, and, hence, as drivers for liveable rural communities. He called for practical, science-based approaches to their protection and restoration and highlighted the need to support farmers through incentives and capacity building. Rainer confirmed the continuity of Germany's national efforts for healthy soils, e.g. under the Federal Humus Programme. He further stressed the importance of peatlands and bogs for climate change mitigation, while altering to national programmes for the rewetting of peatlands, and highlighting the importance of the voluntariness of these measures. Rainer reaffirmed Germany's long-standing support for the International "4 per 1000" Initiative and welcomed the opportunity to host this regional conference in the year of the initiative's 10th anniversary.

Alois Rainer, Federal Minister of Agriculture, Food and Regional Identity of Germany

Bernard Magenhann, Director General, European Commission Joint Research Centre (JRC), and Stéphan Le Foll, President, International "4 per 1000" Initiative signing the declaration of intent.

Subsequently, **Stéphan Le Foll,** President of the International "4 per 1000" Initiative, reflected on the initiative's origins at COP21 in Paris and emphasized the key role of humus-rich soils in addressing climate change and global food security. In light of current geopolitical and environmental crises, he stressed the importance of continued international cooperation. Le Foll thanked Germany for its committed support and called on governments, institutions, and the private sector to contribute to the initiative's ongoing work. He concluded by launching the 10th anniversary strategic review, inviting the audience to dive deeper into the initiative's achievements during the first decade of its existence. → ***4p1000.org***

The session concluded with a signature ceremony during which the **European Commission** through its JRC formally joined the International "4 per 1000" Initiative, marking a strong signal of commitment for soil health and the initiative's work at the European level.

3.2 International Collaboration

The session on international collaboration brought together international key actors, who introduced recent efforts to foster healthy soils for climate, biodiversity, and food security.

Bernard Magenhann, Director General, European Commission's Joint Research Centre (JRC), pointed to the EU's commitment for soil health, e.g. through the soil monitoring law, the CRCF framework and the mission soil. He highlighted the JRC's efforts to build the scientific basis for policy processes in the EU and drew attention to tools like the EU Soil Observatory. He stressed the EC's alignment with "4 per 1000" and affirmed that "4 per 1000" and the JRC are "natural partners."

Houtan Bassiri, Innovative Partnerships and Finance Manager, UNCCD, called soils a powerful, yet underused, tool to meet the goals of all three Rio Conventions and called to make use of complementary soil-related targets, especially regarding the UNCCD's current focus on rangelands. He emphasized the need for international collaboration in science, finance, and policy – urging global stakeholders to "follow the EU's comprehensive approach and go global."

Houtan Bassiri, Innovative Partnerships and Finance Manager, United Nations Convention to Combat Desertification (UNCCD)

Dr. Thorunn Wolfram Petursdottir, General Secretary, FAO Global Soil Partnership (GSP)

Dr. Thorunn Petursdottir, General Secretary, FAO Global Soil Partnership (GSP), presented the GSP's inclusive framework and introduced practical tools which aim to support different stakeholder groups, such as the Global Soil Sequestration Potential Map and the RECSOIL programme. She announced the upcoming second edition of the World Soil Resources Report in December 2025 and called for support for a UN Decade on Soil Health (2031–2040).

Finally, **Dr. Deborah Bossio,** Co-chair, Soil Carbon Futures, introduced the Soil Carbon Futures initiative, which developed out of the International Research Consortium on Soil Organic Carbon. It aims to strengthen soil carbon research by creating a global science community, enabling data sharing, and developing a global research agenda and harmonized MRV systems. She encouraged broad participation: "The power of this effort lies in the people behind it."

3.3 Introductory Address:
From Berlin to Belém and Beyond

Hon. Dr. Penelope Wensley, Former Ambassador for the Environment and National Soils Advocate of Australia, reflected on her thirty years of international climate diplomacy, starting with COP1 in Berlin in 1995 and looking ahead to COP30 in Belém, Brazil.

Dr. Wensley welcomed the growing recognition of and focus on soil health and soil carbon in policy and science, citing national policies from Canada, Africa, and Australia, and highlighted global initiatives like "4 per 1000" and the Coalition of Action for Soil Health as key players. She identified three main priorities: improving the measurement of soil carbon through reliable, cost-effective methods, scaling up soil-friendly land management practices, and developing credible carbon markets to incentivize soil stewardship.

She concluded by calling for optimism and collective action, urging participants to link local solutions to global impacts, echoing Humboldt's observation that "everything is connected."

Hon. Dr. Penelope Wensley, AC, Former Ambassador for the Environment and National Soils Advocate of Australia

3.4 Keynote I:
Potential and Limitations of Soil Carbon Storage and Sequestration for Climate Change Mitigation and Adaptation in Temperate Climates

Based on data from the German agricultural soil inventory, **Prof. Dr. Axel Don,** Deputy Director, Thünen Institute of Climate-Smart Agriculture, highlighted that there is no relevant technical upper limit for soil carbon sequestration in soils. Nevertheless, political targets for soil carbon sinks seem quite ambitious. He explained that biomass availability will be the limiting factor for soil carbon sequestration, which is why they didn't find higher soil carbon stocks on organic farms.

Don highlighted the importance of agroforestry systems and hedge rows, as well as permanent vegetation cover and root biomass, to increase carbon stocks. He called for a comprehensive greenhouse gas assessment to determine the climate effect of agricultural practices, and highlighted the effect of local conditions, drawing attention to their current work on a greenhouse gas calculator at farm scale.

3.5 Keynote II:
How Can Private Sector Actors along the Value Chain Drive Sustainable Soil Management?

Stefania Avanzini, Director, One Planet Business for Biodiversity (OP2B), explained that the private sector is increasingly investing in regenerative agriculture to build resilient supply chains. Companies need clear metrics and aligned incentives to support farmers. Key challenges include costly monitoring, fragmented funding, and an unclear business case. She called for public-private cooperation and better finance tools to scale the transition.

3.6 Focus on Implementation:
Farmers' Experiences with the Transition to Sustainable Soil Management

The panel showcased two innovative regenerative farm enterprises, operating in different production systems and at different scales. It shed light on the motivation, challenges and political requirements to sustain the transition by entering into conversation with two farmers participating in the Federal Humus Programme.

Carolin Lübbecke, Agrargesellschaft Remplin mbH, runs a 2,600-hectare arable farm in Mecklenburg-Vorpommern (Germany). Shaped by glacial activity, the land she and her husband manage is characterized by uneven terrain, high heterogeneity in soil properties, and threats from soil erosion. Since 2006, they have been focusing on direct seeding, intercropping and composting to improve soil quality. **Nils Tolle,** Hof Tolle, on the other hand, manages a 60-hectare organic mixed farm in Hesse (Germany) together with three friends. Building on his parents' early shift to organic methods, they foster soil health through cover cropping, intercropping, inclusion of animals and a recently established agroforestry system.

Panel discussion with (from left to right) Nils Tolle (Hof Tolle; Consulting for Climate Change and Agriculture (neoKultur), Germany), Dr. Melinda Crane (Journalist & Moderator, Germany), and Carolin Lübbecke (Agrargesellschaft Remplin mbH, Germany)

The discussion showed that increasing and conserving soil health is possible under very different conditions. Nevertheless, local conditions determine which measures are feasible, as every decision needs to be economically viable and based on a clear risk calculation. Due to the extent and heterogeneity of her fields, adapted farm equipment and technical solutions are a central lever to sustainable soil management and targeted fertilizer application for Carolin Lübbecke. For Nils Tolle, the integration of livestock in the production system is key for on-farm nutrient cycling. The position of his farm close to urban settlements further allows him to diversify farm income to weather-independent sources like a farm café and on-farm sale of vegetables.

Investing in soil health is seen as a central lever to future-proof their farms against the effects of climate change and to sustain soil fertility for both of them. Yet taking on the responsibility of being stewards of the land sustains their motivation.

High upfront investments in new machinery or the establishment of agroforestry systems, as well as uncertainties related to, e.g., investing in seeding materials for intercrops, though, prove challenging to both farms. The panel clearly highlighted the importance of reliable and long-term funding schemes which support the transition and balance risks. It further applauded the close collaboration between farmers and scientists, as implemented under the Federal Humus Programme.

3.7 Multi-Stakeholder Panel Discussion: How Can Farmers Benefit from Sustainable Soil Management?

The panel highlighted on-farm benefits from sustainable soil management and explored how policies and market-based approaches can support farmers to engage in regenerative practices.

Dr. Elisa Vainio, Baltic Sea Action Group (Finland) and **Prof. Beverley Henry,** Queensland University of Technology (Australia), shared their experiences regarding more reliable yields, improved water availability and reduced soil erosion under regenerative agriculture on farms in Finland and Australia alike. Corresponding to the previous session, they highlighted farm resilience as a major motivation for sustainable soil management.

Emmanuel Petel, EC DG AGRI, explained how the EU's Common Agricultural Policy (CAP) seeks to balance mandatory environmental requirements with incentives, emphasizing the importance of a shared vision among all stakeholders as motivation behind the strategic dialogue around the next CAP cycle. He stressed the commission's efforts to evaluate the effectiveness of CAP instruments and pointed to the importance of the soil monitoring law to improve data availability across Europe. He further highlighted support options for holistic approaches under the next CAP.

Aaron Scheid, Ecologic Institute, called to make sustainable soil management a key element of the agricultural business model. He highlighted the need to elaborate a meaningful integration of CAP and carbon market funding, as CAP funding cannot suffice to finance interventions at landscape level. Due to the short funding cycle, the CAP funding would be well-suited for management-related, activity-based finance. High-cost, long-term measures at landscape level, on the other hand, could well be supported by results-based payments from carbon markets, as they are usually additional and have a lower risk of reversibility. Supported by **Nils Tolle,** Hof Tolle, he stressed the importance of providing guidance to farmers while leaving them flexibility to design innovative measures which pay due regard to the individual farm context.

According to Elisa Vainio, flexibility regarding situational and site-specific conditions has to be safeguarded in market-oriented carbon farming as well, possibly fostered by results-based schemes. She calls to account for avoided losses and co-benefits from carbon sequestration, while ensuring that the risk of market-based approaches is not left to the farmer.

Beverley Henry shared insights on the compensation-oriented, government legislated and implemented carbon farming initiative in Australia. While the initiative did not achieve the envisaged compensation, increased investments in soil sciences as well as buy-in from outside companies helped to extend soil data and benefits many farmers in and outside the scheme.

Overall, the experts agreed that while carbon markets hold promise, key challenges – such as risk-sharing, reliable metrics, questions of credit ownership and profitability – still need to be addressed to drive meaningful transformation.

4. Thematic Deep-Dives

4.1 More than just Carbon: Soil Health and Soil Biology

Moderated by Dr. Paul Luu, International "4 per1000" Initiative, the session shed light on the influence of environmental conditions and management practices on soil biology and corresponding SOC stocks, and showcased how this relation is being addressed in agricultural advisory services.

Prof. Francesca Cotrufo, Colorado State University (USA), called to move beyond carbon sequestration and towards soil health stewardship. She highlighted the importance of understanding the controls of POM (particulate organic matter) and MAOM (mineral associated organic matter) fractions in the soil to decide on management practices and called for carbon not to be labelled by turn-over time but by the mechanisms that retain it. She suggested preferentially aiming for POM accumulation, e.g. through increased root biomass, and highlighted the importance of taking into account the interaction between organic and inorganic carbon in arid systems. Lastly, she stressed that incorporating the composition and activities of the microbiome into process-based models will increase model reliability.

Introducing the results of a large-scale study in Poland, **Prof. Monika Skowrońska,** University of Lublin (Poland), showcased that high rates of synthetic fertilizers and corresponding high pH levels reduce soil carbon stocks and sequestration potential, unless combined with conservation agriculture. Fertilization with manure, on the other hand, had the best results regarding SOC buildup. She called for the gross nitrogen balance to be considered as well as an adequate supply of other nutrients, especially phosphorus and potassium, to foster SOC and sustain soil health.

Dr. Konrad Egenolf, Chamber of Agriculture of North Rhine-Westphalia (Germany), introduced their efforts to develop practical advisory services for SOC build-up. He stressed that traditional soil organic matter (SOM) balancing approaches often fall short in delivering results. Instead, he suggested focusing on decreasing carbon losses through improved crop rotational planning to ensure the right timing of priming effects for carbon turnover, while nurturing not only the plants but also the soil and ensuring carbon stabilization. He stressed the need for easy, cheap and scalable biological indicators, which allow the effectiveness of management practices to be assessed in shorter timer periods.

4.2 Policy, Regulatory and Market-Based Instruments

Moderated by Dr. Wolfgang Zornbach, Honorary Vice President, International "4 per 1000" Initiative, the session explored policy and market-based instruments to foster soil health by introducing approaches from global partners ranging from regulatory frameworks to incentive-based approaches.

Prof. José Martínez, Institute for Agricultural Law, University of Göttingen (Germany), highlighted that SOC today is both an environmental necessity and an economic opportunity. To achieve a balance between SOC as a public good and a market asset, he called for a smart interplay of political ambition, robust regula-

tion and market incentives anchored in transparent monitoring and strong stakeholder participation. He highlighted that success will depend on clear targets, enforceable standards and credible, accessible market solutions.

Emmanuel Petel, EC DG AGRI B2, outlined how the EU's Common Agricultural Policy (CAP) supports soil health through a combination of mandatory requirements and voluntary incentives like eco-schemes. He introduced the new green architecture suggested for the next CAP cycle, which will merge eco-schemes and environmental actions for regional development under the "agri-environmental and climate actions" pillar. Member states will inter alia be obliged to offer actions to support the transition towards resilient production systems. He highlighted the commission's efforts to improve impact monitoring through a set of more targeted performance indicators and drew attention to the conversion of the Farm Accountancy Data Network (FADN) into the Farm Sustainability Data Network for better assessment and recognition of sustainable farming systems.

Dr. Penelope Wensley, Former National Soils Advocate of Australia, presented Australia's National Soil Strategy, a 20-year plan launched in 2021, with a 5-year review cycle. Elaborated by a multi-stakeholder consultation process, it aims to prioritize soil health, empower innovation, and improve soil knowledge and capability. The strategy is translated into 5-year action plans, the first one focusing on the establishment of a consistent soil data and information system, and on building a skilled soil work force, as a sound base for future activities. She also highlighted the country's advanced carbon credit scheme and the new certification scheme for soil practitioners on SOC.

Plenary hall filled to capacity

Dr. Lizzie Sagoo, British Soil Sciences Society (United Kingdom), explained how in post-Brexit policy, the UK has shifted from area-based payments to action-based payments for environmental benefits through the Environmental Land Management Schemes (ELMS), following the principle of public money for public goods. The government has ambitious targets to bring a large portion of agricultural soils under sustainable management by 2030, but challenges remain around defining sustainable soil management, measuring progress, and rebuilding farmer trust after the sudden pause of a major payment scheme. Despite these challenges, there is growing recognition of soil health's importance and increased willingness of farmers to engage in these initiatives.

Daniel Silveira and **Agustín de Prado Pieroni,** Ministry of Livestock, Agriculture and Fisheries, (Uruguay), presented Uruguay´s national soil conservation policy with mandatory soil management and use plans for agricultural land at its core, especially aiming to prevent water erosion. The plans are designed by accredited agronomists, and are based on scientific models, and strictly monitored by the ministry. The system is currently being expanded to include soil carbon balance estimates—making it a unique example of regulatory, science-based public policy for soil protection with strong involvement from farmers, technicians, and researchers.

Simon Krämer, European Alliance for Regenerative Agriculture (EARA), presented data from 78 regenerative farms in Europe, showing they achieve similar yields to conventional farms while using significantly fewer inputs – 61% less nitrogen, 75% fewer pesticides, and mostly local feed – resulting in higher profits and increased climate resilience. He called for EU policies to support these practices with performance-based payments, less bureaucracy, and transition risk insurance.

Ramona Stossberger, GIZ, (Germany), presented the "Healthy Soils, Resilient Systems" policy brief, developed by the ProSoil programme and partners. Drawing on 10 years of experience across 7 countries, the brief outlines six key levers for integrating soil health into agricultural policy and practice, ranging from empowering women and improving extension services to fostering innovation and investment. To break silos and build synergies, the Soilutions flagship initiative was announced by UNCCD and the Federal Ministry for Economic Collaboration and Development of Germany (BMZ) this year, and will officially be launched at UNCCD COP17.

4.3 Living Labs

Moderated by Linda Homann, Federal Office for Agriculture and Food (BLE), the session discussed examples of different approaches to living lab design for SOC-positive soil management, highlighting the importance of farmer engagement, knowledge transfer, and collaboration between researchers, policymakers, and industry.

Linda Homann, Federal Office for Agriculture and Food (BLE) (Germany), presented the philosophy behind the German model and demonstration projects, which prioritize farmer involvement over traditional R&D. The focus here is on scientific support for farmers to implement humus-building measures, and to provide opportunities for peer exchange to foster practical knowledge transfer from research to implementation.

Anna Sauer, Julius Kühn-Institute (JKI) (Germany), discussed the challenges and opportunities of implementing humus-building measures in specialty crops like apples, vegetables, wine and hops. She emphasized the importance of tailored knowledge transfer to effectively reach and engage farmers in these sectors.

Dr. Rolf Sommer, Bund Ökologische Lebensmittelwirtschaft e.V. (BÖLW) (Germany), discussed the "HumusKlimaNetz" project's progress on 150 arable farms across Germany, focusing on demonstrating practical approaches to humus buildup. He stressed that farmer involvement and peer exchange are key to scaling up soil health practices in mainstream agriculture.

Sonia Pietosi, European Institute of Innovation & Technology (EIT) Food, introduced the European project LILAS4SOIL, which was launched in 2024 across six countries, aiming to establish 19 different Carbon Farming Practices (CFPs). The project engages farmers, industry, academia, administration and policymakers. A key initial challenge was engaging farmers in different languages and collecting relevant data.

Prof. Elke Noellemeyer, Universidad Nacional de La Pampa (Argentina), reported on a certification program for sustainable soil management in Argentina. She highlighted the commitment of Argentine farmers to SOC-positive soil management, independent of financial compensation, and presented findings regarding the differences between conventionally farmed soils and those managed using conservation practices.

Dr. Roland Kröbel, Department of Agriculture and Agri-Food (Canada), discussed the Canadian Living Labs initiative, focusing on efforts to help farmers reduce greenhouse gas emissions. He introduced Holos, a whole-farm model for estimating and managing farm-level emissions, and emphasized the role of indigenous land stewardship in maintaining soil carbon.

4.4 Biochar and Circular Economy

Moderated by Prof. Claudia Kammann, Hochschule Geisenheim, this session focused on the role of biochar and the circular economy, exploring both scientific insights and practical applications in agriculture, with an emphasis on long-term carbon sequestration and soil fertility enhancement.

Prof. Bruno Glaser, Martin-Luther-University (Germany), highlighted the key properties of biochar, emphasised its proven long-term carbon sequestration potential and introduced its role as a stable, carbon-negative technology with significant ecological benefits. He presented scientific evidence supporting biochar's effectiveness, practical applications in Europe, and the importance of integrating biochar into agricultural systems alongside emission reductions. While biochar contributes to climate solutions, he concluded that it cannot solve the climate crisis alone and highlighted the need for standardized certification and realistic expectations.

Prof. María Rosa Mosquera-Losada, University of Santiago de Compostela (Spain) highlighted the influences of source materials on biochar properties and soil fertility. She discussed how the type of forest biomass – coniferous vs. broadleaf – affects biochar's carbon and nitrogen content and emphasized that the effectiveness of biochar varies depending on tree species, the plant parts used, and the pyrolysis conditions, with implications also for nitrate leaching. Mosquera-Losada also shared ongoing research on commercially available biochars and upcoming future projects to explore biochar's role across diverse soils and land uses in Europe and beyond.

Dr. Lucas Helwig Kohl, Justus Liebig University (Germany), presented research showing that combining biochar with regenerative organic farming practices can improve soil carbon stocks and maintain microbial health, especially in the deep soil layers and even under challenging weather conditions. He emphasized the importance of accurate soil measurement methods and highlighted economic and climate resilience as key factors for farmers. He also pointed to future studies using AI to explore long-term biochar effects on soil.

Prof. Claudia Kammann, Hochschule Geisenheim (Germany), conducted research into the long-term effects of biochar on soil health, particularly in relation to its interaction with enhanced weathering. Her research shows that biochar can increase soil organic carbon, reduce nitrate leaching, and improve soil health, with effects that last over many years. She also noted that while combining biochar with rock powder (enhanced rock weathering) has mostly neutral or additive effects, it helps to buffer the impact of pesticides on soil organisms, which highlights the potential of using biochar for sustainable agriculture.

Four different types of plant-based charcoal on display, each made from distinct raw materials: straw and grass, fast-growing wood, corn and wheat husks, and wood chips (from left to right, top to bottom

Dr. Hans Marten Paulsen, Johann Heinrich von Thünen Institute (Germany), emphasized the importance of circularity in all farming systems, but highlighted the importance for organic farming. He showed how biogas systems can improve nutrient cycling and crop yields and discussed innovative uses of cycling biomass which help to supply high-quality proteins to livestock and humans. Ultimately, he concluded that organic farming systems need to focus on nutrient and area efficiency, exploring ways to better use biomass and improve soil health within their natural and regulatory boundaries.

4.5 Monitoring, Reporting and Verification (MRV)

Moderated by Samuel Fournier, ChrysaLabs, the session introduced recent developments and novel approaches to soil carbon MRV at different scales, from remote sensing to in-field spectroscopy.

Prof. Bruno Basso, Michigan State University (USA), highlighted the challenges related to in-situ soil sampling for MRV of SOC, and suggested soil sampling across yield stability zones as well as depth-corrected sampling to improve data accuracy and for model validation. He sees remote sensing as a solution to monitor practice adoption but not SOC changes. He instead suggests to focus on multi-model ensembles as the go-to solution. This approach will facilitate model benchmarking, establishment of dynamic baselines and model development. Lastly, he calls for models to be tested against different variables, to assess the greenhouse gas balance of practice, especially with a view to N2O emissions.

Julian Kremers, Seqana (Germany), discussed the opportunities and limitations of using remote sensing for MRV in soil carbon projects, emphasizing its potential to scale monitoring while reducing costs. He noted that remote sensing, when combined with machine learning, can offer economically viable solutions, though reliable soil samples remain essential for model training and validation. Kremers also highlighted their current progress regarding the integration of remote sensing in the methodology of popular standards for the voluntary carbon market.

Dr. Paulina Rajewicz, University of Helsinki (Finland), discussed the role of proximal sensing technologies for improving MRV systems for carbon farming in the EU and drew attention to a comparison survey of proximal sensing technologies for carbon farming produced by the Credible project. She highlighted proximal sensing's potential to provide high-resolution, real-time, and cost-effective SOC data. She stressed the need to overcome challenges like calibration and data complexity for broader adoption and policy integration, bridging the gap between traditional lab analysis and remote sensing.

Chris Tolles, Yard Stick PBC (USA), presented their in-field VisNIR (visible near infrared) spectroscopy technology as a low-cost, high-accuracy solution for SOC measurement at farm scale, aiming to bridge the gap between expensive lab analyses and less accurate remote sensing data. He emphasized the importance of accurate carbon quantification for credible carbon markets, and the need to challenge the assumption that lab data is error-free.

Dr. Marcus Schiedung, Johann Heinrich von Thünen Institute (Germany), presented early findings from the first re-sampling campaign of Germany's national agricultural soil inventory. Based on about 600 resampled sites, the results suggest a national trend of carbon loss over a 10 to 12-year period, where croplands lost ~1 ton/ha (2%) and grasslands ~5 tons/ha (6%) of SOC in the top 30 cm of soil. The findings emphasized the need for measures that focus on mitigating carbon loss in addition to promoting sequestration, depending on the local situation.

Dr. Laura Sofie Harbo, Johann Heinrich von Thünen Institute (Germany), shared the results of a preliminary analysis of drivers for SOC changes in Germany, noting that climate change – especially warming and drought – is likely a key factor, while an analysis of the effects of land management practices is still ongoing. A comparison with other European monitoring networks showed that SOC losses in Germany are consistent with general trends across Europe, particularly in grasslands. Nevertheless, many changes remain inconclusive, as only a minority of EU agricultural land is currently covered by repeated monitoring.

4.6 Agroforestry

Moderated by Dr. Stephen Wirth, Potsdam Institute for Climate Impact Research (PIK), the session focused on the role of agroforestry in addressing both agricultural and environmental challenges, with an emphasis on its potential for climate change mitigation, biodiversity enhancement, and soil health improvement.

Constantin Muraru, European Agroforestry Federation (EURAF), highlighted agroforestry as a time-tested solution to modern agricultural and environmental issues. He emphasized the need for coherent EU policies, legal clarity, and better support mechanisms to scale agroforestry, as well as stronger advisory services and updated education programs for future land managers. Muraru advocated for a future agricultural landscape where trees are an integral part of productive farmland.

Dr. Maren Langhof, Julius Kühn-Institute (Germany), explained that agroforestry—combining trees with crops or livestock— can significantly mitigate climate change by increasing carbon storage in biomass and soils, while reducing greenhouse gas emissions through sustainable management. She also highlighted its climate adaptation benefits, such as reducing erosion, heat stress, drought impacts, and pest pressure, with evidence showing that agroforestry can stabilize or even increase crop yields during extreme weather events. However, she noted that more long-term studies are needed to fully confirm these benefits across diverse conditions.

Dr. Stephen Wirth, Potsdam Institute for Climate Impact Research (PIK) (Germany), presented a study on the large biophysical potential for carbon dioxide removals of agroforestry in Germany. The model results suggest average carbon dioxide removals over the plantation cycle of 3–5 teragrams of CO_2 equ. annually, highlighting that removal rates are dependent on the agroforestry system established. He stressed that in their scenario, crop yield loss is also relatively low. However, barriers like high costs, increased management, and legal issues limit adoption. Overcoming these challenges with incentives and private capital from carbon markets is key to unlocking agroforestry's climate mitigation potential.

P**rof. Lukas Beule,** South Westphalia University of Applied Sciences (Germany), highlights that agroforestry in Germany improves soil health by enhancing microbial biomass, diversity, and activity, as well as fostering beneficial soil fauna like earthworms and spiders. This leads to better nutrient cycling, reduced greenhouse gas emissions, and stronger pest control due to increased functional biodiversity. Overall, agroforestry creates spatially diverse habitats that, beyond the positive carbon balance, support healthier and more resilient soil ecosystems.

Jan Große-Kleimann, Family Farm Große-Kleimann (Germany), implemented a 10-hectare apple agroforestry system alongside traditional pig farming to enhance ecosystem services, biodiversity and economic potential. Despite challenges like tree protection, weed management and labour intensity, the project has fostered community engagement, educational initiatives and an aspiration for sustainable, diversified farm income.

4.7 Carbon Farming

Moderated by Dr. Deborah Bossio, The Nature Conservancy, the session addressed current debates around the integration of carbon farming in carbon markets, focusing on policy development around certification, exploring private standards and introducing an approach for a harmonized Monitoring, Reporting and Verification (MRV) framework, as well as approaches to dealing with non-permanence.

Christian Holzleitner, EC DG climate action, presented an overview of the Carbon Removal Certification Framework (CRCF), a key part of the EU's strategy to reach climate neutrality by 2050. The CRCF aims to provide reliable, certified carbon credits from carbon removals, including carbon farming activities. He explained the approach of temporary carbon credits certified under the scheme, and announced that the first methodologies will be published by the end of 2025, while the establishment the EU wide registry is expected to be completed by 2028. He also encouraged public-private certification rules, to link to existing standards. Regarding the demand side, he highlighted the link to voluntary corporate sustainability claims and referred to their current study on market design of an emission trading system for the agriculture and forestry value chain.

Dr. Flora Desmet, Agroscope (Switzerland), discussed the climate impact of non-permanence in carbon farming projects. She explained how different scenarios of carbon release affect radiative forcing and temperature anomalies, stressing that a release of carbon after the project phase will still lead to global warming in the long term and cannot be eliminated by discounts in certification schemes. She highlighted that non-permanent sequestration only benefits temperature targets if some carbon is still sequestered after the peak warming of global temperatures and suggested exploring whether non-permanent sequestration in carbon farming is more suitable to compensate for short-lived greenhouse gas emissions.

Dr. Ahmad Al Bitar, Centre national de la recherche scientifique (CNRS) (France), introduced their approach to a harmonized MRV framework for soil carbon in croplands, as recently published in the "Cookbook for assessment in different MRV context". He emphasized the need for cost-effective, scalable, and context-specific approaches that integrate remote sensing, modelling, and field measurements. He stressed the importance of collaboration between public research and the private sector, as well as international cooperation to develop a truly standardized global soil data set.

Dr. Carolina Lisboa, VERRA, shared VERRA's experience in certifying carbon farming projects under the Verified Carbon Standard, highlighting their approach to challenges related to project development, MRV, climate co-benefits and methodology development. She emphasized the importance of early MRV planning, methodological innovation combining measurement methods and recognizing co-benefits, to improve accuracy and efficiency in carbon farming certification. She further introduced VERRA's new Scope 3 Standard for value chain accounting.

4.8 Peatlands

Moderated by Dr. Bärbel Tiemeyer, Johann Heinrich von Thünen Institute, the session highlighted the importance of rewetting peatlands and developing paludiculture as promising sinks for greenhouse gases. It addressed regulatory, technical, and financial challenges to scale these efforts across Europe.

Dr. Wiebke Schuster, Stiftung Naturschutz Schleswig-Holstein (Germany), presented the Klimafarm project, which focuses on rewetting drained peatlands in Northern Germany to reduce greenhouse gas emissions. By harvesting biomass from rewetted sites and developing local value chains, the project combines ecological restoration with economic viability, addressing technical and financial challenges faced by farmers.

Dr. Douglas McMillan, Green Restoration Ireland Co-operative Society Ltd (Ireland), outlined the challenges and solutions for peatland restoration in Ireland. He emphasized peatlands' huge carbon storage potential and the need for clear communication about water table management. The projects offer farmers flexible options to reduce emissions while maintaining farming through Paludiculture. Barriers include farmer awareness, land complexity, distrust of carbon markets, and the need for long-term government support. Ireland's experience offers lessons for Europe's goal to rewet one million hectares annually up to 2050.

Jan Peters, Succow-Stiftung (Germany), introduced Germany's legal and policy framework for peatland restoration. He emphasized the need to accelerate land availability, improve coordination, and build alliances between policymakers, local stakeholders, and businesses to create markets for peat-based products and scale restoration efforts.

Dr. Bärbel Tiemeyer, Johann Heinrich von Thünen Institute (Germany), highlighted that paludiculture in Germany aims to improve the productive use of rewetted peatlands to conserve peat and reduce CO_2 emissions. Despite promising research showing significant carbon sequestration potential, challenges remain in water management, complex regulations, and funding, especially for large-scale adoption. Long-term policy support, streamlined legal frameworks, and practical innovation are crucial to making paludiculture a viable climate solution alongside agricultural production.

4.9 Grasslands and Pastures

Moderated by Dr. Katrin Kuka, Julius Kühn-Institut, the session focused on the role of grasslands for soil carbon storage and sequestration, as well as the provision of ecosystem services across the temperate climate zone, ranging from highly managed pastures in Europe to extensive grassland and rangeland systems in South America and Australia.

Dr. Katrin Kuka, Julius Kühn-Institut (Germany), emphasized that grasslands – covering 28 % of Germany's agricultural land – are vital for both food production and ecosystem services, particularly soil carbon storage, nutrient cycling and biodiversity support. However, climate change, livestock intensification, and reduced importance of pastures threaten these benefits. Her research shows that extensive, low-input grasslands support root development, reduce nitrogen emissions, and increase climate resilience. Intensive systems on the other hand produce higher yields but are more vulnerable to climate pressures and are subject to higher nitrogen losses. This highlights the need for adaptive management of grasslands, which balances productivity and ecosystem services.

Dr. Hélène Chambaut, Institut de l'Élevage (France), presented a study on how ruminants influence soil carbon stocks under lowland and mountainous conditions in France, highlighting that higher SOC stocks were found on ruminant pastures in high altitudes. Nevertheless, she showed that well-managed livestock farms with long-term grassland use have increased soil carbon over recent decades under lowland conditions, with median gains of +0.15g C/kg soil/year. While national ruminant numbers and grasslands are decreasing in some areas, targeted practices—like improved grazing, legume mixes and manure use—can enhance carbon sequestration, especially when supported by advisory tools and farmer engagement.

Dr. Annette Freibauer, Bavarian State Research Center for Agriculture (Germany), presented grasslands as an important lever to reduce the overall GHG balance of dairy farms, while maintaining high levels of milk production. She stressed that especially well-managed pastures provide high-quality feed and reduce the dependence on external feed sources, reduce emissions from manure management and hold high carbon stocks. She highlighted the importance of avoiding emissions from feed production on drained organic soils, and called for site- and farm-specific calculation of GHG emissions to develop the optimal management system, highlighting the LfL Climate Check calculator. Carbon sequestration in grasslands, on the other hand, played a minor role in the overall GHG balance, and is hence not considered in many GHG calculator tools.

Dr. Virginia Pravia, National Agricultural Research Institute (INIA) (Uruguay) emphasized that the temperate grasslands of South America, especially in Uruguay, are rich in long-standing soil carbon stocks that are often overlooked in carbon accounting. Her research shows that rotationally integrating pastures with croplands is an effective approach to preserving ancient carbon stocks and avoiding carbon losses, while allowing for food production. Carbon sequestration through grassland management, though, only happens in degraded systems. She called for policies that recognize and reward the conservation of still intact carbon-rich grassland ecosystems, instead of focusing mainly on their restoration.

Prof. Beverley Henry, Queensland University of Technology (Australia), reflected on the potential of extensive grasslands and rangelands in Australia to contribute to Australia's climate targets. She emphasized that while SOC sequestration from improved management is rather modest, the extent of areas concerned still make it a valuable effort. She further stressed the need for protecting existing carbon stocks in grasslands and highlighted the importance of sustainable management of grazed landscapes for environmental and economic co-benefits, as described in a recent publication by the Scientific and Technical Committee of the International "4 per 1000" Initiative.

5. Closing Session

5.1 Closing Panel

The closing panel picked up on some of the most dynamic and relevant fields that need to be addressed to improve soil health and unlock the potential of soils for climate change mitigation and adaptation.

Developing effective business models, which involve finance from public and private sources, including carbon markets, remains a crucial task to support regenerative farming. As UNFCCC COP30 presidency, Brazil aims to support this process by launching the RAIZ (Resilient Agriculture Investment for Net Zero Land Degradation) initiative, which was introduced by **Eduardo Sampaio Marques,** embassy of Brazil. Inspired by Brazil's traditional concept of mutirão (community-based cooperation), the program seeks to attract private and public investment for land restoration, focusing on productivity, carbon sequestration, and climate resilience, while ensuring strong monitoring and compliance mechanisms.

Eduardo Sampaio Marques, Agricultural Attaché, Embassy of Brazil

Dr. Deborah Bossio, The Nature Conservancy, highlighted that despite the current limitations, voluntary carbon markets are the only global ecosystem service market so far, pointing also to the youth of the markets. If shaped with scientific rigor, experience in voluntary carbon markets will help governments to integrate agriculture in compliance markets. She highlighted that if we do not include agricultural land in climate solutions, we exclude half of the land area from the solution space.

Designing sustainable soil management practices requires better understanding and increased recognition of the soil microbiome. **Francis Boucaille,** AGRIBOOSTER (France), highlighted that fertilization and pesticide use need to be designed carefully to foster and protect the microbial community in the soil. He called to reduce nitrogen inputs and fungicides, as fungi are even more efficient at storing carbon than bacteria.

Lastly, to explore the full potential of soils for climate change mitigation, protecting and rewetting peatlands must be addressed by agricultural policies. **Dr. Bärbel Tiemeyer,** Johann Heinrich von Thünen Institute, noted that peatlands remain underappreciated and often have a negative connotation in public perception. She advocated for peatland protection, as well as restoration through rewetting and the establishment of paludiculture (the wet use of peatlands). However, she pointed out that policy fragmentation, social impacts on rural communities, and insufficient funding slow down progress.

Together, the panel underscored that fostering soil health depends on integrating science with practice, responsibly developing carbon markets, and creating long-term, well-funded policies that balance environmental needs with farmers' livelihoods.

5.2 Conclusion and Way Forward

The SoilCarbon4Climate conference shed light on pressing challenges and promising developments and solutions around soil health and soil carbon in temperate regions. It assembled a diverse range of stakeholders from across the globe and stimulated an inspiring exchange between the participants. Throughout the event, speakers emphasized the need for integrated approaches that bridge science, practice and policy, and underlined the importance of creating an enabling environment for farmers to engage in regenerative agriculture. The discussions clearly illustrated how collaboration across sectors and disciplines is essential to drive meaningful change, as well as the value of in-person meetings.

Dr. Paul Luu, Executive Secretary, International “4 per 1000” Initiative

The discussions during the conference were further marked by a strong call to action. It became clear that the transition to regenerative agriculture is not only an ecological necessity, but also an economic opportunity – provided that political frameworks and economic incentives align.

In his closing remarks, **Dr. Paul Luu,** International “4 per 1000” Initiative, emphasized that despite global efforts, carbon stocks are still decreasing rather than increasing. He stressed that regenerative agriculture and agroecology are not just tools to combat climate change, but also the key to a fairer and more sustainable agricultural system and urgently called for action by all stakeholder groups. Luu highlighted the need for science and education around soil health and praised the approach of practice-oriented research, e.g. in living labs. He stressed the need for flexible but reliable policies, which enable farmers to be stewards of the land. He called for an increase in climate finance, especially for smallholder farmers, and encouraged further exploration of feasible approaches to soil carbon markets.

Overall, the conference provided an important platform for reflection on current and future challenges as well as the diverse opportunities that arise from transforming agriculture, highlighting the role of healthy soils as crucial entry points. Germany is committed to continue its efforts to foster healthy and carbon rich soils, both nationally as well as through international action.

The International “4 per 1000” Initiative stands ready to support all stakeholders and continue in its role as advocate for healthy and carbon rich soils in its next decade.

Group photo of all conference participants

6. Excursions

The conference programme was completed by three half-day excursions to innovative farms around Berlin that engage in SOC-positive soil management.

Organic Farm Klass is a Bioland-certified organic farm. The farm focuses on climate-positive production and circular economy approaches. Various arable crops and potatoes are cultivated in an integrated system, including chicken rearing and on-farm compost management, cover-cropping and conservation tillage.

Gut&Bösel Organic Farm is a pioneer in regenerative agriculture, situated in an area of rather poor and sandy soils. The farm established a syntropic agroforestry system, and is invested in the holistic management of pastures, as well as composting, intercropping and conservation tillage.

Agrargenossenschaft Groß Machnow eG (AG GM) demonstrates how conventional farms can play a vital role in climate and nature protection. Besides its engagement for soil organic matter formation and soil conservation, AG GM is actively involved in peatland protection and wetland conservation.

Participants of the excursion to Gut&Bösel on a trailer

Gut&Bösel organic farm as well as Agrargenossenschaft Groß Machnow are partner farms in the HumusKlima-Netz, a model and demonstration project for humus build-up and preservation in arable soils under the Federal Humus Programme of Germany.

Farmer Sebastian Klass kneeling in the hole of the excavated soil profile. He cultivates very sandy soils. A challenge is the significant variation in soil quality over just a few meters.

Root system of *Silphium perfoliatum*, a drought-resistant energy plant for biogas. It thrives on sandy soils, offering high biomass and biogas yields, with its economic viability tested in the HumusKlimaNetz project.

Abbreviations

C	Carbon
CAP	EU Common Agricultural Policy
COP	Conference of the Parties
CRCF	Carbon Removal Certification Framework
DG	Directorate General
EC	European Commission
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GHG	Greenhouse Gases
IPCC	Intergovernmental Panel on Climate Change
LfL	Bavarian State Research Centre for Agriculture
MRV	Monitoring, Reporting and Verification
RAIZ	Resilient Agriculture Investment for Net Zero Land Degradation Initiative
SOC	Soil Organic Carbon
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change

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10117 Berlin, Germany
521@bmleh.bund.de

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Cover: Syntropic agroforestry system at the Gut&Bösel farm. A variety of trees and shrubs were planted on the field, in narrow strips ten meters apart. The rows of trees perform important ecosystem services, such as improving the microclimate, strengthening biodiversity, and storing carbon in the trees and soil. In this case, part of the field was used to grow beans, sweet corn, and pumpkins. The grass-alfalfa mixture is mowed and swathed along the tree strips, which prevents the soil from drying out and makes irrigation of the trees and shrubs obsolete.

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