



## **EUROSOIL 2021 SESSIONS DESCRIPTION**

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**1.01 Achieving soil security through enhanced soil connectivity.**

<b>Session type</b>	<b>PICO</b>
<b>Convenors</b>	<b>Alex McBratney, Damien Field, Titia Mulder, Dominique Arrouays, Laura Poggio</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Soil connectivity is one of the five dimensions of soil security. The others being capability, condition, capital and codification. The goal of soil security is to sustain the world's soil resource for human and planetary wellbeing. The loss of soil connectivity in increasingly urbanised societies is inimical to soil security. In this session we will learn of various approaches to connecting humans to soil and soil to humans via educational social networking, community, governmental and private sector approaches. The goal is to come to conclusions about efficient and effective approaches to increasing soil connectivity and thereby soil security and its impact on sustainable development.

**1.02 Combining indigenous knowledge and frontier techniques of soil management for livelihood security.**

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Uttam Sharma, Sonoko D. Bellingrath-Kimura, M. Datta</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Because of the significance of soil for human and animal life, ecological balance, economic and development activities; planning and management of this resource as well as its optimal, economic and equitable use is of utmost importance. We cannot ignore the experiences of our ancestors in soil management due to their centuries of experience, ingenuity and skills. Improving these systems with state-of-the-art technologies in water and soil conservation would ensure judicious rainwater management, reduction in runoff and soil erosion, and environmental compatibility.

Abstracts are solicited on the following topics:

1. Regional studies on indigenous soil management practices.
2. Impact of indigenous soil management practices on physical, chemical and biological soil properties.
3. Crop productivity under indigenous soil management practices.
4. Impact of indigenous soil management practices on soil erosion/water bodies.
5. Improving indigenous soil management by incorporating frontier state of the art technologies and its impact on soil health.
6. Streamlining indigenous soil management systems in soil management and land use policies.
7. Comparative studies on indigenous soil management vis-à-vis state-of-the-art soil management practices and their combination with respect to soil health, soil erosion, soil degradation, and crop productivity.
8. Transformational studies on resource-depleting Indigenous Management Practices (IMP) to Resource Opulent Vital Ecosystem (ROVE) or 'IMPROVE'.

**1.06 Restoring and sustaining agricultural landscapes: insights for ecosystem services and rural livelihoods.**

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Chinwe Ifejika Speranza, Stephan Rist, Ademola Adenle, Jean-Luc Chotte</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Restoring and sustaining agricultural landscapes are gaining increasing attention as potential strategies to improve the provision of ecosystem services and to enhance rural livelihoods and development, in particular, contribute to poverty reduction. Although, various research and development initiatives on restoring and sustaining agricultural landscapes are ongoing, reports on whether and to what extent they actually enhance ecosystem services and reduce poverty are lacking. Further, indepth insights on the conditions and factors driving the restoration of agricultural landscapes and their sustainable use are needed in order to better inform policy on addressing the trade-offs and synergies between restoring agricultural landscapes on the one hand and on the other hand, sustaining dependent rural livelihoods.

**2.01 Changes in soil profile carbon and nitrogen dynamics by agricultural management practices.**

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Mehdi Sharifi</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Management practices such as organic amendments application and cover crops change the dynamics of soil carbon and nitrogen down the soil profile. This change particularly affects the soil microorganisms composition and function in subsoil. The subsurface soil microorganisms are usually limited by energy source. Organic amendments and cover crops can modify composition and diversity of the subsurface soil microbiome and consequently modify the C and N cycling. The importance of this phenomenon for subsurface C and N dynamics and its effect on crop performance needs to be evaluated. This new knowledge would greatly enhance understanding of organic amendments and cover crops effect on soil health and consequently, the resilience of agricultural production systems. This session would explore the effect of organic amendments and cover crops on soil C and N dynamics in soil profile and the impact of this change on (i) C sequestration, (ii) N management (iii) soil health (iv) crop productivity and (v) losses of N to groundwater.

**2.03 How to close nutrient cycles for future Zero Hunger.**

<b>Session type</b>	<b>PICO and Communication session</b>
<b>Convenors</b>	<b>Else Bünemann, Udert Kai, Wichern Florian</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Nutrient inputs into agricultural systems are essential for sustainable production. Most mineral fertilizers, however, are based either on finite mineable resources, require high energy demanding production and/or have environmental side effects. Recycling of nutrients from various waste streams is thus increasingly important and part of the circular economy which is a high priority to the EU. Recycling of nutrients can occur at different scales and may ultimately contribute to reducing global imbalances of nutrient use in agriculture as well as eutrophication and contamination of natural ecosystems. Many approaches for closing nutrient cycles are under development, but often have trade-offs with respect to effects on soil quality. For example, a focus on the recovery of one nutrient may prevent simultaneous closure of other nutrient cycles. Likewise, the destruction of organic matter during the recycling process facilitates risk assessment with respect to organic pollutants but contributes to the depletion of soil organic matter. The objective of this session is to compare different approaches towards closing nutrient cycles, with a special focus on the effects of recycled fertilizers on soil quality.

**2.05 Processes at the soil-root interface shaping soil functions.**

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Doris Vetterlein, Tino Colombi, Carsten W. Müller, Thomas Keller</b>
<b>Open to call for contributions</b>	<b>Yes</b>

The root-soil interface is a hotspot for interactions between plants, microorganisms and soil. A better understanding of the processes happening at this interface is key to sustainable crop production and secured yields in the face of global change and soil degradation. This includes the adaption of crop root systems to soil-borne abiotic stress such as drought, soil salinity, soil compaction and low nutrient availability, as well as improved carbon, nutrient and water cycling in arable soils. Recent advancements in imaging, high-throughput and high-resolution measurement techniques, as well as modelling allow for detailed studies of the interactions in the plant-microbe-soil system. Today, main knowledge gaps are related i) to the difficulty in linking physical, chemical and biological processes across spatiotemporal scales and ii) to the understanding of how to harness these interactions in order to improve global food security and to reduce environmental impacts of crop production. This session aims at gathering researchers from different disciplines that combine latest developments in soil physics and chemistry with those in plant physiology and microbiome research.

## 2.06 Soil ecological engineering and management of soil biology. A contribution to achieving zero hunger?

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Marcel Van der Heyden, Else K. Bünemann, Klaus Jarosch, Florian Walder, Sarah Symanczik, Natacha Bodenhausen, Sebastian Loeppmann, Christian-Albrechts, Michaela Dippold, Sandra Spielvogel</b>
<b>Open to call for contributions</b>	<b>Yes</b>

"Industrial intensification of agricultural production has been a strategy to keep up with the demand for increased food production in the last century but has had profound and lasting effects on (agro)ecosystems. Consequently, more sustainable forms of agricultural intensification have to be developed, where ecological processes are managed with the aim of reducing anthropogenic inputs such as fertilizers or pesticides while increasing sustainability and resilience. Soil organisms drive multiple ecosystem processes that can improve soil fertility and sustain plant growth. In addition to fostering indigenous microbes, a rise of commercial products (i.e. biostimulants) aiming to increase soil nutrient availability has occurred in recent years. Novel methods allow new insights into the presence of organisms in the soil and their contribution to soil functions.

For this session we invite scientists and stakeholders working on i) biological processes that improve soil quality for sustainable crop production; ii) biostimulants that aim to promote soil biological processes such as nutrient mobilization or beneficial soil life (e.g. mycorrhizae) and iii) farming practices that foster living soils."

## 2.07 Soil management principles in climate-smart conservation agriculture to halt and reverse land degradation.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Wolfgang Sturny, Dominique Flury</b>
<b>Open to call for contributions</b>	<b>Yes</b>

During the past 40 years, the world has lost a third of its arable land, about 430 million hectares. Conservation Agriculture (CA) can prevent such losses while regenerating degraded soils. CA is a response to sustainable soil management, environmental protection, climate change adaptation and mitigation. FAO promotes the adoption of CA principles that are universally applicable in all agricultural landscapes and cropping systems: minimum soil disturbance (i.e. no-tillage), maintenance of a permanent soil cover, and diversification of plant species (crop rotation). It enhances biodiversity and natural biological processes above and below the soil surface, which contribute to increased water and nutrient use efficiency as well as to long-term improved crop production. In that regard, there is limited knowledge on how soil management affects soil quality and soil health, respectively, and how we can actively manage soil functions. Goal of this session is to provide a platform for (i) the impact of soil management (no- and conventional tillage, crop rotation, plant species diversification, fertilizer use, organic and recycled amendment [e.g. CULTAN], weed control with and without chemicals) on soil quality, soil functions and ecosystem services such as agricultural productivity, profitability, life cycle assessment, carbon storage, nutrient cycling and water dynamics, (ii) results of soil physical, chemical, and biological properties - including its temporal dynamics, and (iii) frameworks to evaluate the multi-functionality of CA. Experimental studies are welcome, also and especially on-farm trials, conceptual framework and modelling approaches. The session should be of interest to soil scientists, agricultural scientists and practitioners, environmental scientists, conservationists, the general public.

## 2.08 Soil fertility management strategies for enhancing crop yields to combat world food insecurity

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>John Ryan, Milkha Aulakh</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Traditionally, soil fertility was the major area of soil science as soil nutrients were directly related to crop production. Identification of specific nutrient constraints and fertilizer application methods were the main focus of concern. Much has been learned and put into practice. Consequently, modern agriculture at large is unthinkable without chemical fertilizers. The broad scope of this soil fertility management session centers of developing and future technologies and related issues. The session deals with issues such as sustainability of the soil resource base, conservation agriculture, natural resources management, integrated nutrient management, developments in fertility management such as minimum/no till and fertigation, advances in soil testing, implications for fertilizer use for human health, environment and carbon sequestration in the context of climate change, fertility in relation to organic agriculture, assessing the role of fertilizer nutrients at national and international levels, global resources for fertilizer manufacture, and addressing societal concerns about fertilizer use. An underlying theme is how soil fertility and fertilizer nutrients relate to international efforts to provide adequate food for the world's burgeoning population.

## 2.09 Soil sensing and decision support systems in precision agriculture to achieve SDG2.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Timo Breure, Antonello Bonfante, Anna Brook, Dr. Leonardo Ramirez-Lopez</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Precision agriculture (PA) has potential to contribute to achieving SDG2, especially considering the SDG2 focus on “small-scale food producers, particularly women, indigenous peoples, family farmers and pastoralists”. Applications of more novel sensor technologies that produce large datasets (e.g. UAV and IR spectroscopy) are promising to PA. However, farmers frequently fail to act on information provided or to adopt technologies or practices with production benefits. In this context, Decision Support Systems (DSS) can help farmers to integrate PA techniques in their field management, contributing in decision-making on nutrients, irrigation and plant disease management through the integration of various types of knowledge, including stakeholder expertise and knowledge derived from sensor measurements and model simulations. The aim of this session is to gather the input and views of current work in precision and smart agriculture. From proximal and remote sensing platforms to the operative integrated system (i.e. DSS) which supports the decisions of final users. The session is open to PA and DSS at every spatial and temporal scale in which it is applied. We highlight the importance of viewing state-of-the-art technology relative to simpler on-farm indicators (with a higher level of accessibility). The session should be of interest to different scientific communities (e.g. soil science, remote sensing, plant science) and stakeholders (farmers, consortiums, land use planners). It aims to open the door not only to high tech thinking but also to the implementation of sensing, considering a range of actors involved.

## 2.10 The potential of organic agriculture and other agro-ecological approaches to conserve and improve soil quality.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Paul Mäder, Pavel Krasilnikov</b>
<b>Open to call for contributions</b>	<b>Yes</b>

"The aim of the session is to elucidate, how organic agriculture and other agroecological approaches such as conservation agriculture contribute to soil quality while guaranteeing food security and economic resilience. New concepts of soil quality will be reviewed, stressing on the multi-functionality of soils such as food and fibre and fuel production, climate and water regulation, biodiversity maintenance, erosion control and pest and disease control. Key challenges of soil quality in organic agriculture and related management practices will be addressed in smaller groups:

- net carbon balance with respect to system boundaries, carbon imports and carbon mining outside the system,
- identification of key drivers to increase soil organic carbon (eg mixed farming, reduced tillage, residue management and crop rotation), and
- institutional arrangements to support conserving and improving soil quality (e.g. the 4per1000 initiative).

In a final plenary, a synthesis of the working groups will be presented and discussed with invited representatives of various farming systems (organic agriculture, conservation agriculture, agroecology). The session should be of interest for soil scientists, agronomists, economists and sociologists, as well as farmers and NGOs oriented to sustainable agriculture and nature protection."

## 2.12 Can crop production in europe be sustainable and profitable? Insights from the soilcare project

<b>Session type</b>	<b>Fishbowl</b>
<b>Convenors</b>	<b>Rudi Hessel, Jane Mills</b>
<b>Open to call for contributions</b>	<b>No</b>

European crop production needs to remain competitive while reducing environmental impacts, requiring the uptake of effective soil-improving cropping systems (SICS). This session will give delegates an opportunity to learn about and engage with the SoilCare project, which has identified and evaluated promising SICS that have the potential to increase the profitability and sustainability of arable agriculture across Europe. The session will showcase trans-disciplinary research evaluating benefits and drawbacks of different SICS, incorporating a wide range of bio-physical, socio-economic and policy aspects. A multi-actor approach was used to select and test SICS in 16 study sites across Europe. Specific attention was paid to the adoption of SICS. The SoilCare project started in March 2016, and the proposed session will present results to date, soliciting feedback from the audience & discussing key topics such as the role of national versus EU policy in promoting soil health, barriers and enablers to the adoption of soil improving cropping systems, innovations that could improve soil health, and implications for profitability and sustainability as well as for policy and practice. We propose to have quick-fire presentations and videos of the emerging results from the SoilCare project, followed by role play fishbowl with people representing policymakers / farmers / advisers / scientists primed to discuss the effectiveness of soil-improving cropping systems, barriers to the adoption of sustainable land management technologies and approaches, and factors to support adoption/adaptation/learning. We will have a free chair for the audience to participate and ask questions.

### 2.13 Commercial opportunities for microbial soil inputs: integration of business, science and the law

<b>Session type</b>	<b>Panel discussion</b>
<b>Convenors</b>	<b>Michael Warren, Simon Neufeld, Vivian Kaloxilos</b>
<b>Open to call for contributions</b>	<b>No</b>

The panel brings together representatives from the business, soil science, and social science communities in order to discuss interconnected approaches in achieving better soil health around the world. We will present research on the impact of particular strains of bacteria and fungi on food security, carbon sequestration and water conservation. We will also present the business approach we pursued in the agricultural and mining sectors with regards to soil health. Finally, this panel will reflect our interdisciplinary approach, engaging experts from different fields in an enriching dialogue.

### 2.14 How to reach food secure future? – case studies from Ethiopia and Indonesia

<b>Session type</b>	<b>Workshop Young Scientists</b>
<b>Convenors</b>	<b>Taru Sanden, Rachel Creamer, Anna Wawra, Katharina Keiblinger, Rizki Maftukhah</b>
<b>Open to call for contributions</b>	<b>No</b>

This session will be dedicated to the potential capabilities of onboard agricultural vehicle tools and measurement methods allowing a live expertise of the soil characteristics. We will focus on mainly two topics:

- 1) Describing the possible measurement tools and methods as well as the kind of soil characterization we could obtain with it. These measurements can possibly be used for a) live interactions with the machine supporting system and the equipment and b) direct soil mapping for further expertise to improve future agricultural operations.
- 2) The possible decision that can be made with such methods and tools as a) What are the ways of making relevant decision for the agricultural activity being operated: ploughing, tilling, sowing, fertilizing etc., b) What are the agronomic/environmental gains that can be reached with those methods: yield increase, soil protection etc.

### 2.15 Novel methods and approaches for engaging with stakeholders: addressing soil functions relevant to sdg zero hunger

<b>Session type</b>	<b>Workshops / Hands-on / Meet the Expert</b>
<b>Convenors</b>	<b>Julie Ingram, Jane Mills, Francesca Bampa, Lilian O'Sullivan</b>
<b>Open to call for contributions</b>	<b>No</b>

Agricultural soils fulfil fundamental functions relevant to SDG2. The need for researchers to collaborate with stakeholders using participatory approaches and methods in this context is widely understood. Such collaboration enables research to address problems of concern to stakeholders and provide relevant and practical solutions, captures local knowledge and empowers stakeholders. The need for such participation in research concerning soil management is increasingly evident, given the scope and complexity of soil processes, the multiplicity of actors who manage or make decisions about the soil, and the fragmented policy, research and advisory approaches concerned with managing soil functions (synergies and trade-offs) in agricultural systems.

This session aims to use interactive methods to share and reflect on experiences with multi-stakeholder participation, co-production of knowledge, and co-innovation for sustainable soil management in the agricultural context. Specifically, we want to:

- draw on and share our collective experiences with participatory approaches in working with stakeholders in a number of soil research projects
- give the opportunity to other researchers to present and share their novel methods and approaches
- build capacity in the research community for carrying out participatory research to equip them to meet future research challenges with soil management on the context of SDG2

The team of convenors will draw on their experiences\* working with a range of stakeholders in a diversity of ways in the following European projects: SmartSOIL, RE CARE, SoilCare, LANDMARK, and VALERIE. Contributions are also invited from other experts attending Eurosoil from other non-European countries. If you would like to contribute by demonstrating an approach or method, please get in touch with the convenors.

**3.02 Analytical techniques for the molecular-level determination of soil health.**

<b>Session type</b>	<b>Other</b>
<b>Convenors</b>	<b>Nicholle Bell, Margaret Graham</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Soil is a complex mixture of living organisms and organics, minerals and other abiotic components. The complexity is not only important for soils to conduct their ecosystem services, but it also hinders our understanding of the structural-functional relationships underpinning these services. This session will examine the latest advances in our understanding and assessment of soil health from a molecular point of view. It will showcase the latest technologies, current challenges and offer the chance of soil scientists to expand their toolbox for examining soils through topical presentations and practical workshops in which participants can test new methods. It is planned to produce an article summarising the advancements presented in the session. The session will be of particular interest to scientists using advanced molecular methods to assess effects of land-use changes, pollution, remediation and ecological restoration on soil properties and to stakeholders involved in monitoring soil health and land-use management.

**3.03 Applications of soil monitoring: detecting long-term trends.**

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Andreas Gubler, Clément Levasseur, Axel Don</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Would you like to present and discuss results from a soil monitoring program? Do you want to show how you analysed and interpreted data on soil properties (biological, physical, chemical...) and their change over time? Do you want to share ideas how soil monitoring programs might be improved and adapted to future challenges? Then this is your session! This session will focus on the detection of long-term trends in monitoring soil quality. It will be dedicated to experiences in different countries with soil monitoring programs at regional, national, or continental scales, comparing theoretical concepts and expectations with real-world data. The session should be of interest to all scientists involved in soil monitoring as well as policy makers, regulators and other stakeholders using monitoring results.

**3.04 Bioindicators as tools for assessing agricultural soil quality.**

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Janine Wong, Sophie Campiche, Benoît Ferrari, Bettina Hitzfeld</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Plant protection products (PPP) have been applied to field crops and permanent cultures regularly for decades now. With increasing knowledge on the effects of long-term exposure to PPP residues on humans and the environment in general and soil quality in specific, the general concern has risen. Even though not being the target organisms of the PPP, soil organisms can be affected negatively by these applied substances. Consequently, the wide range of processes provided by soil organisms such as organic matter formation, nutrient cycling or supporting soil structure might be impacted and therefore soil ecosystem services and soil quality might be impaired. Furthermore, soil organisms inhabiting agricultural areas are not only exposed to a mixture of diverse PPP, but also to a broad range of additional stressors from soil management practices like ploughing, soil compaction or metals in fertilizers. Development of soil monitoring approaches and methodologies using bioindicators or ecotoxicological bioassays are still needed to evaluate to which extent effects of PPP on soil organisms might impact soil quality in agricultural landscapes. Description or estimation of changes in populations or ecosystems (biodiversity, functional aspects, traits) at such specific landscapes is not often evident, and there is a need to continuously develop, adapt, and update existing tools or concepts of assessment. Furthermore, a multidisciplinary approach combining chemical, ecotoxicological and ecological tools (TRIAD) would be required. This session should aid to get an overview in how far existing bioindicators and ecotoxicological bioassays are adequate to evaluate possible impacts on soil quality in agricultural landscapes, once organisms are exposed to the cocktails of substances used in agricultural practices. We invite presentations about advantages and limits of the proposed indicators, the methodologies and the TRIAD approach. Furthermore, ideas for promising new tools to make the link between effects on soil organisms, potential impacts on the functions they perform, and the assessment of soil quality shall be presented. Ideally, the way bioindicators might enable to distinguish among effects of PPP and other stressors like concomitant effects arising from other soil management practices are discussed as well. This session should be of interest to everyone who is interested in quantifying the impacts of PPP and other stressors on soil quality.

### 3.06 Multi-scale approaches for soil pollution assessment.

<b>Session type</b>	<b>Pico session</b>
<b>Convenors</b>	<b>Simona Vingiani, Maria Manuela Abreu, Stefano Albanes, Miriam Munoz-Rojas</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Recent approaches to soil pollution assessment such as FAO GSOP18 are oriented to site-specific risk assessment based on land use, proximity to urban areas and pollutant transfer to subsoil, groundwater and other environmental compartments. Integration of studies at field (proximal and remote sensing for soil mapping), laboratory (selective chemical extractions applied to define form, mobility and bioavailability of pollutants) and microscopy scales (identification of associations between pollutants and soil components enabling to understand the fate of contaminants) is crucial. The session should be of interest to scientists and practitioners involved in the use of sensors for soil pollution assessment, researchers improving selective chemical extraction techniques for simulation of pollutants behavior in soil and plants, and stakeholders involved in harmonizing methodologies to allow comparisons of results between different countries.

### 3.07 Occurrence, fate and consequences of plastics in soils.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Moritz Bigalke, Montserrat Filella, Gabriel Gerner, Michael Sander</b>
<b>Open to call for contributions</b>	<b>Yes</b>

The occurrence of plastic in the terrestrial environment has raised concerns. While larger plastic items released to soils may have direct negative effects like soil sealing, they may also undergo multiple fragmentation and degradation processes forming micro- and finally nano-sized plastic particles that add to the environmental load of micro- and nanoplastics from other sources (e.g., tire wear, cosmetics). Smaller plastic particles are generally assumed to have a higher bioavailability than larger particles. Yet, their potential effects on soil biota are still poorly studied and understood. Research on the fate of plastics in soils still suffers from analytical challenges and a lack of standardized methods to measure and identify the different polymers and size classes. For this session, we invite contributions that address the occurrence, behaviour and effects of macro-, meso-, micro- and nanoplastics in soils. Studies of analytical methods for plastics in soils, the environmental fate (transfer and transformation processes), effects of plastic exposure to soil organisms and plants, as well as the interaction of plastics with other pollutants are highly welcome.

### 3.11 Trace elements and their species in soils: detection, transformation processes, and fate in the critical zone.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Adrien Mestrot, Marc Benedetti, Ruben Kretzschmar, Eduardo Moreno-Jimenez, Marie Muehe, Matthias Wigganhauser</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Many trace elements (TE) are toxic (e.g., As, Hg, Sb) and/or essential (e.g., Cu, I, Se) to soil microbiota, soil biota (plants and animals) as well as other organisms along the food chain, including humans. To understand the behavior, fate and impact of TE in soils, it is crucial to not only quantify them precisely but also to determine their speciation. This entails the distribution of TE between specific chemical forms in terms of electronic or oxidation state, molecular structure or complexes formed with various ligands. Indeed, the partitioning, transport, bioavailability, bioaccumulation and toxic or beneficial effects of TE largely depend on their speciation. The goal of this session is to highlight recent advances (1) in methodologies, using elemental, molecular, isotopic and/or spectroscopic techniques, allowing the identification or quantification of TE and their species in soils (2) in the understanding of the (a)biotic transformation processes affecting TE and their species in soil solution and solid phases (e.g., alkylation/dealkylation, oxidation/reduction, colloid formation and sorption/desorption) and (3) in the comprehension of the biogeochemical cycling of TE in terrestrial (agro)ecosystems, their transfer within the critical zone as well as from the pedosphere to the hydro-, atmo- and biosphere. Contributions to the session may include fundamental and applied research based on laboratory work, field experiments and/or modeling approaches. Presentations looking at the potential effects of on-going and future global changes, such as climate change, eutrophication or healthy food production on the fate of TE and their species in soils are also strongly encouraged.

### 3.12 Challenges of assessing and managing diffuse soil pollution in urban areas.

<b>Session type</b>	<b>Hackathon / Shared Brain</b>
<b>Convenors</b>	<b>Christiane Wermeille, Dietmar Müller-Grabherr, Esther Goidts</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Diffuse soil pollution is a major problem implying several degraded soil functions, often hampering urban development. Managing it is a cross-cutting issue demanding exchange and coordination between scientists, authorities and other stakeholders. In the framework of the European COMMON FORUM network information has been collected to gain an overview on how diffuse pollution is handled in different European countries. Many questions have been identified that need to be addressed in order to make further progress in this complex issue, relating among others to the definition of background conditions, pollutant and exposure pathways (oral ingestion, transfer soil-vegetation), risk analysis, threshold values, remediation methods, potential land use restriction, and liability questions. Participants of this session are invited to define together in a hackathon the necessary steps towards a suitable approach for managing diffuse soil pollution in urban environments.



### 3.13 Emerging soil contaminants: challenges for policy and regulation

<b>Session type</b>	<b>Workshop with invited introductory presentations</b>
<b>Convenors</b>	<b>Johan P. Ceenaeme, Dirk Dedecker, Griet Van Gestel</b>
<b>Open to call for contributions</b>	<b>No</b>

Nowadays, innumerable emerging contaminants are detected everywhere in our environment. Soils are polluted by a wide range of local and diffuse sources. Some of the polluting substances are well-known and treated by policies for soil management and remediation. Others, such as perfluors, pesticides, pharmaceuticals, nanoparticles, are not yet included, causing human and eco-toxic risks. They can spread through aquifers and surface runoff, and by translocating excavated soil. Lack of knowledge on their (eco)toxicity and their fate and transfer behaviour pose strong problems for soil and land management. Especially for the reuse of excavated soils, for land reclamation and soil remediation practices due to the absence of practically feasible threshold values. The challenges posed by emerging contaminants in soils are urgent and require concerted actions and collaboration. There is a need for monitoring data, for scientific data underlying transfer and risk assessment models, but also for awareness raising and new policies and governance models to deal with emerging contaminants in soils. The session should be of interest to scientists, policy makers, problem owners and consultants.

### 3.14 Reuse of organic wastes as soil amendments

<b>Session type</b>	<b>Fishbowl</b>
<b>Convenors</b>	<b>Remigio Paradelo Núñez, Asher Bar-Tal, Rihab R. Weghlani, María Teresa Barral Silva</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Soil amendment with solid organic wastes is a beneficial mean to counteract depletion of soil organic matter and other soil degradation processes. In addition, it is a simple and efficient way to manage organic wastes in a period where the increase in the production of wastes is coupled with the rise of urban population. Composts and other organic amendments produced from waste generally have positive effects on the soil environment, improving conditions for plant growth, supplying nutrients for plants, decreasing erosion risk, increasing biological activity and reducing the mobility of some pollutants. Also, however, contamination of soil, food products and the environment can take place by organic waste-associated pollutants, such as potentially toxic trace elements, high nitrate and phosphorus loads, organic pollutants, plastics residues or pathogens. The main goal of this session is to present recent findings in amending soils with organic wastes, discussing the causes of and mechanisms for the potential positive and negative effects of organic wastes application on soil properties and crop performance. We also aim for cutting edge methods and technologies, as well as new fields of application for organic wastes, to be presented and discussed. The session should be of interest to soil scientists, agronomists, environmentalists and stake holders.

### 3.15 Emerging soil pollutants: detection, risk assessment and treatment.

<b>Session type</b>	<b>Workshops / Hands-on / Meet the Expert</b>
<b>Convenors</b>	<b>Violette Geissen</b>
<b>Open to call for contributions</b>	<b>Yes</b>

The goal of the workshop is to exchange knowledge on actual pollution of the agro-environment with emerging pollutants such as pesticide residues, antibiotics and microplastics. The main questions are: How high is the actual pollution in agro-ecosystems? Are monitoring programs going on? What are the needs to assess the state of pollution? What can we conclude from existing data? What is known about the risks related to emerging pollutants for the environment and human health? Which procedures for risk assessment exist and what is needed? Which remediation techniques exist to clean soils suffering from diffuse pollution by emerging pollutants? What is needed to clean the soils? The session should be of interest to soil scientists, agronomists, water managers, industry, biologists, environmental protection agency, farmers associations and other stakeholders.

**4.01 Coupling of soil carbon, nitrogen and phosphorus cycles and its consequences for ecosystem services.**

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Daniel Wasner, Lucia Fuchslueger, Maria Mooshammer, Jörg Schneckner</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Biogeochemical cycles of carbon (C), nitrogen (N), and phosphorus (P) are tightly coupled, on molecular to global scales. Human activities such as land use change and fertilization increasingly alter these cycles. The consequences of such actions for the structure and functioning of ecosystems remain largely unknown. In particular, the role of soil microbial communities and micro-scale processes in coupled C, N and P cycles has become an area of great interest, as they can drive macro-scale responses on ecosystem-level, such as ecosystem productivity and net carbon budgets.

This session will bring together empirical and conceptual contributions to advance our understanding of C, N and P cycles and their interactions in soil. We invite presentations on, but not limited to, (1) consequences of nutrient imbalances on microbial communities and ecosystem services, (2) response of microbial activity to changes in resource stoichiometry, and (3) application and theory of ecological stoichiometry. The session should be of interest to soil and ecosystem scientists, microbial ecologists, agronomists, as well as stakeholders and policy makers interested in nutrient sustainability of land-use management, soil and water management and mitigation of greenhouse gas emissions.

**4.02 Degradation and management of peat soils and peatlands.**

<b>Session type</b>	<b>Rapid Fire</b>
<b>Convenors</b>	<b>Stephan Glatzel, Emma Shuttleworth, Gareth Clay</b>
<b>Open to call for contributions</b>	<b>Yes</b>

When degrading, peat soils change their properties more strongly than most other soils. Unfortunately, almost all management techniques have been associated with the degradation of peatlands. Due to their high organic matter and water content and unique soil physical properties, there are strong interactions between peat soils and the atmosphere and hydrological cycle. They also host specialized and rare biota. Recently, the ecosystem services provided by peat soils have been recognised, and more sustainable management techniques that aim to combat peatland degradation are becoming popular. The session should be of interest to soil mappers, ecologists, hydrologists, greenhouse gas researchers, soil biologists and plant nutritionists, as well as farmers, water managers, spatial and landscape planners. We are looking for contributions on degrading, degraded or restoring peat soils and management practices that control soil degradation and restoration. Challenges on peat soils include but are not limited to degradation and management of i) blanket bogs, ii) intensively used fen soils, iii) soils in peat extraction areas, iii) soils under forest management.

**4.04 Nutrient dynamics in forest ecosystems**

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Jaane Krüger, Friederike Lang, Jörg Luster</b>
<b>Open to call for contributions</b>	<b>Yes</b>

The soil function of providing nutrients is essential to primary production. Yet climate change and the development from a S- and N-dominated emission regime to nearly pure N-dominated emissions impact underlying processes and interactions. The nutrient supply of plants in forest ecosystems strongly depends on mobilization processes like desorption of nutrients from the solid phase, weathering, or mineralization, but also on atmospheric deposition of essential macro nutrients (e.g., nitrogen and sulfur). To sustain sufficient nutrient supply not only single soil – organism interactions are relevant, but interactions and feedback reactions among different groups of organisms and their abiotic soil environment are essential.

In this session, we would like to highlight controls of ecosystem nutrition including current change of chemical and physical climate, and to introduce and explain long term response of nutrient dynamics to those changes in forest ecosystems. The session comprises of contributions on experimental and conceptual studies that include ecosystem-based knowledge on nutritional processes as well as long-term studies analyzing ecosystem resilience against disturbances and forest nutrition under changing environmental conditions.

#### 4.06 Soil biodiversity and ecosystem functioning: linking network and food web perspectives for understanding global changes.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Wim van der Putten, Madhav Thakur</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Many studies consider the relationship between soil biodiversity and global changes from the perspective of individual taxonomic groups. However, in soil all taxa interact in competitive, facilitative, predator-prey or other type of interactions, which can be studied using network and food web approaches. Here, we consider these myriad biotic interactions in soil food webs in their full context, as this is crucial for a better understanding of soil biodiversity in a changing world. In this session, we will provide an overview from historical developments to recent advances in food web and functional network approaches that are being applied to soils. We then extend the application of these developments for understanding aboveground-belowground interactions in a changing world. Our overall aim is to integrate and synthesize soil biodiversity approaches, show how global changes impact on terrestrial ecosystems through their influences on soils, and to propose novel approaches to adapt and mitigate to human-induced global changes.

#### 4.07 Soil biodiversity and ecosystem functioning: microbial biodiversity and soil functions, recent advances.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Ellen Kandeler, Marion Schrumpf</b>
<b>Open to call for contributions</b>	<b>Yes</b>

The goal of the session is to improve our understanding of biodiversity and functions of soil organisms as drivers of different ecosystem services in agricultural and natural ecosystems. Most soil microbial communities have been found to be sensitive to changes in soil management, plant cover, nutrients or temperature, but so far evidence of the underlying mechanisms are often not completely clear. In order to develop novel, predictable strategies for a sustainable management of soils, it is therefore essential to identify (1) key biogeochemical reactions, (2) the types of bacteria and fungi involved, and (3) their environmental controls and feedbacks under different management strategies. Consequently, it is the objective of this session to learn more about different European and national initiatives to use different properties of soil biota as early indicators of changes in element cycling and in stabilisation of soil structure. Presentations of new methods in molecular soil ecology are also highly welcome.

#### 4.10 Soil biodiversity and ecosystem functioning: the spatial ecology of soil organisms across scales.

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Naoise Nunan, Ellen Kandeler, Hannes Schmidt</b>
<b>Open to call for contributions</b>	<b>Yes</b>

The importance of space and spatial heterogeneity in ecosystem functioning is widely recognised. For example, habitat heterogeneity contributes significantly to the emergence and maintenance of species diversity and altering the species-environment spatial relationships can affect species diversity. Although soil is a highly spatially structured environment, where many functions are limited, or enhanced, by the spatial organisation of both the biotic and abiotic components and their relationships, comparatively little attention has been paid to spatial aspects of the ecology and functioning of soil organisms. The scale at which the spatial organisation of the system and the spatial relationships affect the distribution, diversity and functioning of organisms depends very much on the organisms of interest. The aim of this session is to advance our understanding of the spatial ecology of soil organisms and how spatial relationships between species and their environment and among species affect species distributions and functioning. Experimental, methodological or modelling contributions are all welcome.

#### 4.12 Sustainable soil and water management under changing climate and land use.

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Idefonso Pla Sentís, Giuseppe Lo Papa</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Water, that is often the main limiting factor of plant growth, is also the main factor directly or indirectly responsible for soil and land degradation processes. These processes are strongly affected by unfavorable changes in the hydrological processes responsible for the soil water balance and for the soil moisture regime, which are influenced by the climate conditions and variations, and by the changes in the use and management of soil and water resources. The previewed climate changes may also affect water availability, because there is a strong link among soil degradation, climate change and water resources. Changes in population, both in total number, distribution and development, are also strongly affecting the quantity and quality of the available freshwater, and the land use and management. To the increased demand of water for agriculture there must be added the demands for urban and industrial uses and for energy generation. Water resources must be managed not only to satisfy people's direct needs, but also for nature conservancy. The combination of different economic, environmental and social pressures often results in increased water use competition and pollution, generally associated to inefficient water supply practices.

Specifically, we ask for contributions dealing with recent changes in the use and management of large areas of lands to allow agro-industrial production of food and energy crops and how these changes affect soil and water resources. In particular, we seek studies looking at soil degradation processes and negative effects on the quantity and quality of available water, and propositions for land conservation practices to mitigate these processes and effects.

#### 4.13 Targeting land degradation neutrality!

##### Degradation, restoration and conservation of soil functions in a changing global environment.

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Miriam Muñoz -Rojas, Paulo Pereira, Eric Brevik</b>
<b>Open to call for contributions</b>	<b>Yes</b>

As an integral part of terrestrial ecosystems, soils provide numerous ecosystem services and support critical ecosystem functions that include supplying essential nutrients, water, oxygen and support for plants. Fully functional soils support biodiverse ecosystems, essential for the stability of ecosystem functions, while also providing sources of genetic resources. Moreover, although soils are the result of natural processes, these processes are exceedingly slow, and soils need to be regarded as a non-renewable resource from the perspective of human life times. Inappropriate land uses such as intense land management may critically reduce the ecosystem services and functions provided by soils and result in land degradation through processes such as erosion, sealing or pollution. Sustainable land management and the conservation and restoration of degraded ecosystems is therefore key to maintain functional soils that can provide multiple ecosystem services.

In this session, we welcome contributions covering inter- and transdisciplinary research on soil degradation, conservation and restoration in the context of a changing global environment through observational, theoretical and applied studies. Topics of interest include but are not limited to: 1) soil degradation by unsustainable land use and inappropriate land management practices, and 2) Soil conservation measurements and restoration actions for maintaining ecosystem services and functions (including research, management, education and policy).

#### 4.18 Targeting land degradation neutrality! Monitoring, assessments and decision support

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Jean-Luc Chotte</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Over the past few decades the awareness on the impact of land degradation has become increasingly recognized. Target 15.3 of the UN SDGs 2030 stresses that “By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world”. Land Degradation Neutrality is achieved if new degradation is balanced by reversal of degradation elsewhere in the same eco-region by restoration or rehabilitation (Cowie et al. 2018). The primary instrument for achieving LDN is through sustainable land management (SLM) approaches and technologies introduced in the management of the complex socio-ecological systems in which land is used. Three indicators have been adopted by UNCCD Parties to assess and monitor actions on the ground; soil organic carbon stock, land productivity changes, land cover/land use change.

Posters and oral presentations will share experiences addressing LDN through innovation in land evaluation, methodological and management approaches, typology of land degradation drivers, metrics for LDN indicators, multi-scale approaches, example soil organic carbon assessments, and implementation strategy.

#### 4.19 Understanding tropical soils biogeochemistry to tackle food production and environmental challenges.

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Stephanie Grand, Jean-Thomas Cornélis, Laurent Caner, Karen Vancampenhout</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Tropical soils have on average sustained a longer weathering history than their temperate counterparts. Their geochemistry and mineralogy thus tend to differ from temperate soils yet remain highly diversified, with important consequences for element cycling in tropical ecosystems. In this session, we welcome insights into the biogeochemistry of different types of tropical soils in natural and human-affected ecosystems. Of particular importance are soil physico-chemical and microbial processes controlling the biogeochemical cycling of carbon, plant nutrients and potentially toxic elements, and the interconnection between elements cycles. Studies that link soil biogeochemical processes to food production, environmental quality or biodiversity issues will receive first consideration. Finally, we would like to highlight works that address the challenge of communicating advances in tropical pedology to stakeholders of rural areas. This session should be of interest to soil scientists interested in tropical pedogenesis and biogeochemistry as well as agronomists, land use planners and natural resource managers working in tropical areas.

#### 4.20 Wetland and floodplain ecosystems, soil management, and water quality.

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Jose Navarro-Pedreño, Jörg Luster</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Wetlands and floodplains cover a small percentage of earth surface yet fulfil important ecosystem services such as protecting the quality of ground and surface waters, temporarily storing floodwater, providing habitats for a wide variety of wildlife, providing an array of recreational opportunities and serving as fertile agricultural land. The functions of wetland and floodplain soils strongly depend on their status (natural, restored, managed for specific land-use, artificial). In particular, their effectiveness as filter protecting water resources from excess nutrients or pollutants in upland run-off or flood sediments is in addition closely linked to soil management in these upland areas.

In this session, we would like to look at such dependencies and linkages (i) for wetlands and floodplains covering a wide range of seasonal soil water saturation and non-saturation, emphasizing the importance of salinity, redox and sedimentation dynamics for soil properties and functions, and (ii) for different situations in terms of geology, connected water bodies (river, lake, sea), and (iii) upland land use (agriculture, forest, natural parks and recreation). We particularly welcome contributions comparing effects on different and potentially conflicting ecosystem services.

#### 4.21 Approaches for quantitative evaluation of soil functions.

<b>Session type</b>	<b>Communication session with extended discussion</b>
<b>Convenors</b>	<b>Ute Wollschläger, Rachel Creamer, Christopher Collins</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Soils provide many essential functions which are indispensable for terrestrial ecosystems and the health of human societies. Beyond the production of biomass, these functions include e.g. nutrient cycling, filter and buffer for water, storage of carbon and habitat for an overwhelming biodiversity. To date, there are several concepts addressing the quantitative evaluation of soil functions known e.g. as "soil health", "soil quality", "soil security", "soil function assessment" but there may be several other innovative concepts and ideas. This session aims to bring together scientists and stakeholders to present their concepts and to discuss how these concepts can be implemented into decision making.

#### 4.22 TBC

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Armin Keller, Madlene Nussbaum, Lucie Greiner, Laura Poggio, Fabrizio Ungaro</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Sustainable soil management requires spatial explicit information on soil functions. Digital soil mapping provides soil property maps as a basis for soil function assessments like water retention capacity, buffering of pollutants or habitat for rare species. Soil has multiple functions in terms of regulation, habitat, and production, so multiple soil functions (rather than one general soil function) must be taken into account. Each country or region, however, has its own scope of fulfillment on these soil functions and usually different stakeholder demands on soil resources have to be met.

We invite submissions on implementation of soil function assessments at local, regional or national context to support sustainable soil use and management. Submissions dealing with the development of new soil function assessment methods are also welcome. In particular, authors reporting on the process chain of digital soil mapping and subsequent soil function assessments for policy making are also encouraged to contribute to this session. Ideally, this session should be of interest for both researchers and policy makers.

#### 4.24 Ecosystem functions and services of soils in relation to human and environmental health.

<b>Session type</b>	<b>Fishbowl</b>
<b>Convenors</b>	<b>Sandra Spielvogel, Rainer Horn</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Soils play a critical role in delivering ecosystem services (ES). Their soil functions support (i) provisioning services (e.g. food security), (ii) regulating services (e.g. climate, floods, diseases), (iii) cultural services (e.g. recreational) and (iv) supporting services (e.g. nutrient cycling, biodiversity), which are indispensable to human wellbeing and environmental health. Despite of its crucial role in ecosystem functioning, soil is still an overlooked component in ES studies. One reason for this is that the choice of soil attributes to assess soil status and use potential as well as methodologies used for evaluating and mapping of ES are diverse and inconsistent, e.g. because of the complexity and site-specificity of soils. This session addresses contributions that (i) define soil ES, based on available and surveyed soil data; (ii) define appropriate indicators for soil health assessment and the functions underpinning the soil ES; as well as studies that (iii) assess, map and model soil potential contributions to multiple ES.

#### 4.25 Global soil erosion: assessment, modelling and policy.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Jae E. Yang, Pasquale Borrelli, Christine Alewell, Panos Panagos</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Soil erosion is one of the major soil threats that can affect the ecosystem and human health by removing the topsoil that plays the important roles in crop production and sustaining the ecosystem services. Soil erosion control is a key to the sustainable soil management strategy which is closely connected to food security and the UN SDGs. Soil erosion researches have conventionally been focusing on the measurement and modeling of the erosion processes within a limited spatiotemporal scale using the model specific to each country. However, soil erosion control is the critical issue to be resolved at the global level and needs to outsource the technologies to be developed in other disciplines such as information and communication technology (ICT). This symposium will provide the platform to discuss several issues on soil erosion such as assessment, modeling, impact analysis and policy implementation. This symposium will be the 4th of the series of the soil erosion modeling symposia that are previously held in EC JRC (Italy), Seoul (Korea) and Rio (Brazil). The symposium will provide the scientific knowledge and perspective to researchers, policy makers and general public.

#### 4.26 Interactions between soil structure, soil biota and soil functions.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Claire Chenu, Naoise Nunan, Kai-Uwe Totsche</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Good soil structure is essential to soil functioning and soil functions and ecosystem services. It is a soil property that is perceived directly by farmers on the field as well as studied by scientists, the latter requiring an interdisciplinary approach. Yet it is still difficult to quantify soil structure and to predict its changes and impacts on soil functions. A number of approaches have been developed to assess it, from aggregate fractionation approaches to a diversity of visualization techniques at different scales. In this session we integrate the description of structure and its dynamics, using new imaging techniques, with the ecological, functional and physical consequences of the spatial arrangement of soil constituents. A strong interdisciplinary approach is thus required, merging soil physicists, chemists and ecologists. The ultimate aim is to understand how soil structure, from micro-architecture to macropores, emerges from interactions within soil and how it determines the outcome of soil processes, in order to create models of soil functioning that integrate structure dynamics.

#### 4.27 Linking soil mineralogy to soil properties and functions.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Benjamin Butler, Steve Hillier, Bruno Lanson, Sofia Lessovaia</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Minerals are the major component of most soils. Through direct inheritance from the parent material and subsequent alteration by weathering, soil mineralogy can be spatially diverse - reflecting the many soil forming factors. Soil minerals are related to soil properties and functions, and, thus, are implicitly associated with all sustainable development goals (SDG's) related to soil.

For example, soil mineralogy controls the sources, availability and behaviours of most major and micro plant nutrients, which in turn determine the potential for biomass production and its quality - key components of the 'Zero Hunger' and 'Good Health and Well Being' SDG's. Other examples include carbon sequestration, soil contaminants, and mineral-microbe interactions. Relating mineralogy to soil properties, functions and SDG's in this way is key to ensuring that soil mineralogy research helps advance the process-based understanding of the soil environment to better inform policy, land management and decision making.

This session should be of interest to all who study soil mineralogy and seeks to provide an opportunity to communicate recent advances in the understanding of mineral contributions to soil properties, soil functions, and SDG's. Presentations are sought from all branches of soil mineralogy, but particularly those employing advanced or new approaches.

#### 4.29 New Governance approaches to foster stewardship of soil health.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Kris Van Looy, Nele Bal, Anna Krzywoszynska</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Current sustainability challenges (e.g. food security, climate) require new ways of understanding, acting in and caring for the land & soil. The concept of stewardship is increasingly used in research, policy and practice to articulate responses to these challenges. Ways of dealing with responsibility to build in care for soils into policy, raising understanding and awareness of sustainability in practices of sustainably treating soils, and finally bringing the expertise and science in the right narrative to give soil protection its place in legislation and policies. Many ecosystem services and soil functions are connected to stewardship for soil health can be seen as crucial and even central instrument for this goal.

Topics for this session:

- Engaging society with prevention of soil degradation
- New governance models and instruments for institutionalising soil care;
- New tools for building a shared understanding and knowledge sharing of soil health and the soil-food-energy nexus.
- New approaches to understanding and designing interactions between experts, decision makers and communities to enhance the uptake of sustainable soil management.

#### 4.30 Physical soil protection.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Matthias Stettler, Thomas Keller, Philippe Ruch</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Soil compaction due to vehicle traffic adversely affects soil functions and ecosystem services, and causes high ecological and economic costs to landowners, land users and society. Furthermore, soil compaction intensifies collateral damage outside the affected areas due to increased erosion with associated material deposits, and increased risks of flooding. Protection of soil from physical degradation caused by compaction is therefore of high importance. Efficient protection requires knowledge of management practices and technical options, but also a deep understanding of soil mechanical behaviour, soil-vehicle interaction, stress propagation and soil deformation under the impact of vehicle traffic.

Soil compaction can be caused by agricultural machinery, forest vehicles, military vehicles, earth-moving equipment and construction machinery, or other off-road vehicles, and concerns arable land, grassland, lawns, forest soils and natural ecosystems. Although dealing with similar questions, different fields use different approaches and frameworks to evaluate and avoid soil compaction, and there is generally little exchange between them.

We welcome contributions from all fields of application (agriculture, forestry, construction, military, recreation) that advance our knowledge on soil-vehicle interactions, soil compaction, rut formation, trafficability and mobility, including experimental and modelling studies. Furthermore, we are looking for innovative concepts in undercarriage engineering, possible benefits through adapted soil management, new trends in controlled traffic farming and other promising prevention strategies. We also welcome presentations of decision support tools for predictions of trafficability or compaction risks.

#### 4.31 Soil ecosystem services: putting theory into practice.

<b>Session type</b>	<b>Pico Session</b>
<b>Convenors</b>	<b>Christian Walter, F. Terribile, Denis Angers</b>
<b>Open to call for contributions</b>	<b>Yes</b>

The concept of soil ecosystem services was initially developed to increase recognition of the multifunctional role of soils. From this broad idea gradually emerged a consolidated theoretical corpus albeit still discussed and a set of methods of SES evaluation. SES assessment is progressively integrated into complex decision-making chains such as the appraisal of agricultural production systems, land management or territorial planning.

The objectives of the session are twofold. We seek contributions which will (i) show how soil ecosystem services may be assessed by biophysical approaches, (e.g. direct measurements, modelling, proxies) or by users perception and participatory approaches; (ii) analyse how SES assessment may be introduced into decision-making chains concerning management practices or territorial planning.

The session should be of interest to scientists from several disciplines (biophysical, social sciences) interested by SES applications and by stakeholders eager to integrate soil preservation in their projects.

#### 4.32 Soil information for sustainable soil management and protection.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Borut Vrščaj, Pásztor László, Rainer Baritz</b>
<b>Open to call for contributions</b>	<b>Yes</b>

The session hosts contributions and best-case practice examples primarily related to the effective soil data collection, advanced soil data processing, digital soil mapping, soil 'number crunching' algorithms, soil web GIS and data dissemination methods, soil property modelling, soil legacy data, and effective use of soil information. The session welcomes contributions on the following topics: Methods of collection of soil and soil-related data (e.g. proximal soil sensing, digital soil mapping, etc.); Soil data modelling, interpretation and elaboration of focused soil information; Application of soil information in sectors (e.g. agriculture, forestry, planning, natural resource management, climate change mitigation, etc.); Regional and cross-border soil data harmonization and use; National, regional soil information systems and data standards; and Global soil information initiatives.

#### 4.33 Soil loss assessment: coupling prediction techniques with observations and measurements.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Christine Alewell, Pasquale Borrelli, Panos Panagos, Katrin Meusburger</b>
<b>Open to call for contributions</b>	<b>Yes</b>

As soils are the most basic resource in nourishing a globally growing population, soil loss and concomitant soil nutrient depletion is an imminent and direct threat to SDG2 Zero Hunger. As such, prediction and mapping tools as well as observations and measurements of soil degradation in high temporal and spatial resolution will be of utmost importance on local, regional and global scale for promoting effective land use management and guided policy decisions.

This session invites contributions predicting and mapping soil loss (e.g. modelling, remote sensing) which are coupled to validation or support from observations or measurements. The latter might include high resolution optical tools (e.g., down scaling with remote sensing imagery), visual ground truth measurements as well as radio-isotopic determination (e.g.  $^{137}\text{Cs}$ ,  $^{239+240}\text{Pu}$ ,  $^{210}\text{Pbex}$ ,  $^7\text{Be}$ ), and other direct or indirect measurement approaches such as sediment trapping and fingerprinting (including Compound-Specific Isotope Analysis, geochemical tracers etc.) to detect and quantify soil degradation. Studies on soil erosion by wind and water as well as livestock or management damage, gully erosion or land sliding are welcome.

#### 4.34 Soil Organic Matter - a useful and versatile probe to elucidate the physico-chemical, biological and environmental soil equilibria; from molecular approaches to land management.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Riccardo Spaccini, José María García-Mina Freire, Anna De Marco, Fekete Istvan, Chiara Bertora, Marios Drosos</b>
<b>Open to call for contributions</b>	<b>Yes</b>

The session will encompass the comprehensive role of soil organic matter (SOM) in the maintenance of soil functions and fertility in agro and forestry ecosystems. As highlighted in the FAO Global Symposium on Soil Organic Carbon, the SOM is a keystone component for the understanding of either effectiveness or threats (e.g. loss of biodiversity and productivity, erosion, pollution) of soil functionalities as related to land use and cropping systems. In this respect, the molecular approaches are useful tool to investigate the mechanisms of interaction with soil, plant and microorganisms as well as to underline the main physical, biological and environmental processes. The inferences made available by research activities may channel the devising of reliable technical and policy instruments to support the adoption of sustainable SOM managements able to face at larger scale level the main targets associated to the SDG-15 Life on Land.

#### 4.35 Soil structure as key to understand soil functions.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Hans-Jörg Vogel, Nicholas Jarvis, Thomas Keller</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Soil structure is recognized to control many processes in soils. It regulates water retention and infiltration, gaseous exchanges, soil organic matter and nutrient dynamics, root penetration, and susceptibility to erosion. Soil structure also constitutes the habitat for a myriad of soil organisms. As an important feedback, soil structure is actively shaped by these organisms. In agricultural fields, soil structure is heavily shaped by tillage and also by the choice of crops with their specific root systems. Thus, soil structure is not static but steadily changing affecting the multitude of soil functions. A deterioration of soil structure is implicated in all forms of soil degradation. Combating further soil degradation and restoring degraded land is therefore considered vital to meeting many of the UN Sustainable Development Goals. In this session we ask for contributions on (i) the impact of soil structure on soil functions including fertility, carbon storage, nutrient cycling and water dynamics and (ii) methodological advances how to quantify soil structural properties including their temporal dynamics by natural processes or in response to agricultural soil management.



#### 4.38 Towards the recognition of soil change: impact of global changes on soil processes and retroaction of the delivery of soil functions and services.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Sophie Cornu, David Montagne, Jean-Thomas Cornelis</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Soils contribute to major ecosystem services, providing food and fibers, regulating water and geochemical cycles and delivering cultural services. Global changes that include climate change, land cover changes or changes in agricultural management practices have recently been shown to induce soil changes on decadal to century time scales in all the soil characteristics (mineral and organic constituents, physico-chemical parameters, horizonation and soil structure). The direction, intensity and spatial distribution of these soil changes and their consequences on the delivery of soil services and finally on human well-being remain however largely unknown. This session propose to examine the impact of climate, land-use or management change on soil processes (dissolution/precipitation, sorption/desorption, acido-complexolysis, aggregation, bioturbation, argilluviation) and their consequences on the delivery of soil functions or services (biomass production, carbon sequestration, climate regulation, nutrient recycling, water purification...). Studies dealing with the interactions between human- and climate-induced soil changes are particularly welcomed.

#### 4.39 Understanding and managing mountain soils, and related ecosystem services.

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Michele Freppaz, Silvia Stanchi, Clemens Geitner</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Mountain soils perform a wide range of useful ecosystem functions and services for human beings, but at the same time are subject to several threats related with disturbances and management. The session will explore the issue of mountain soils focusing on:

- properties and functions of mountain soils
- mountain soils and ecosystem services
- mountain soils management: threats, challenges and perspectives

The session will keep a wide, transdisciplinary approach on the topics.

#### 4.41 Developing a framework of soil functions to address un sustainable development goals

<b>Session type</b>	<b>World Café</b>
<b>Convenors</b>	<b>Gina Garland, Emily Oliveira, Judith Riedo, Alice Johannes, Anna Edlinger</b>
<b>Open to call for contributions</b>	<b>No</b>

Overview (format for information on website needs to be discussed):

Our idea for this session is to have a hands-on workshop aiming to develop a set of primary soil functions to measure in future “multifunctionality” studies that will provide a holistic understanding and assessment of how well a particular ecosystem (i.e. agricultural system, grassland, forest, etc.) is contributing to the UN Sustainable Development Goals. To accomplish this goal, we are proposing to have an expert panel on soil functioning or ecosystem multifunctionality discuss what soil functions are, and how they are measured and assessed in order to get an overview of the functioning of a particular ecosystem. We will then break the participants into groups and discuss potential soil functions that can be measured to address each of the UN SDG highlighted in this conference using the World Café approach (<http://www.theworldcafe.com/key-concepts-resources/world-cafe-method/>). Each panel member will also lead the group discussions at each table/topic. At the end of this World Café activity, the panel will reconvene to share the results from the participants and transfer the main soil functions or comments into a new sheet of paper, and thus further clarify the framework proposed by the workshop.

We believe that such an activity is important for early career researchers who are just beginning to dive into this area of research, where it is often unclear which function or functions will give the best assessment of a particular system. This will also give a good insight into how multi- and trans-disciplinary research can best be achieved in such studies. Furthermore, pictures of the final papers and framework will be good for social media coverage and promotion of the SDGs. Pre-registration would not be required.

#### 4.42 Global soil partnership: sustainable soil management for all

<b>Session type</b>	<b>Workshops / Hands-on / Meet the Expert</b>
<b>Convenors</b>	<b>Yusuf Yigini, Ronald Vargas</b>
<b>Open to call for contributions</b>	<b>No</b>

The Global Soil Partnership was established in December 2012 as a mechanism to develop a strong interactive partnership and enhanced collaboration and synergy of efforts between all stakeholders. The mandate of the GSP is to improve governance of the limited soil resources of the planet in order to guarantee agriculturally productive soils for a food secure world, as well as support other essential ecosystem services, in accordance with the sovereign right of each State over its natural resources. In order to achieve its mandate, the GSP addresses five pillars of action to be implemented in collaboration with its regional soil partnerships. GSP Secretariat would like to meet with the experts and scientists from all disciplines to discuss soil related issues at global scale.

#### 4.43 Revisiting the relation with soil datasets: panel discussion to direct future action

<b>Session type</b>	<b>Panel discussion</b>
<b>Convenors</b>	<b>Timo Breure, Jacqueline Hannam</b>
<b>Open to call for contributions</b>	<b>No</b>

Soil data sets are cause to nightmares and dreams, (very) large amounts of money and energy are dedicated. Hence it is important that efforts of collection are discussed extensively within the soil science community. The soil science community involved with datasets is not limited to academia but also include decision makers and other stakeholders that make use of available datasets. Successes and failures should be analysed and discussed holistically. The EUSOIL2020 provides a good platform for this in terms of format and number of attendants.

This session aims to place the complex topic of soil datasets into an appropriate discussion to reflect on past effort and direct future action. The main objective of the session is to deliver action points that have the potential to improve efforts within next generation soil data collection. We realize that the key to success of this session is:

- a.) appropriate selection of questions, discussion points and session format
- b.) an appropriate selection of panel members
- c.) keynotes to attract the public

The session should be of interest to consultancy, academia, the government, private bodies or NGOs. This list includes intra-national organizations such as the JRC or national bodies involved in soil dataset collection such as the NSI or the Swiss Nabodat. Notes of the session will be written up formally and disseminated throughout the conference attendants and the network of session conveners.

### 5.02a Managing urban environment: Technologies and methodology for the management and reuse of soils and sediments (a)

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Fabienne Favre Boivin, Géraldine Bullinger, Nazaria Marchi</b>
<b>Open to call for contributions</b>	<b>Yes</b>

The session is organised firstly as a communication session (session 1a) with presentations about management of urban environment, and in a second time, this session is planned as a workshop (session 1b), allowing direct contact and discussion between delegates from different origin, function and background.

The session 1a addresses the question of soil multifunctionality in urban context, with special focus on sustainable cities, resource conservation and liveability, reuse of soil and creation of new soils through the desealing, as well as water and heat regulating functions. It is organised around main issues/difficulties of urban management through soils and reconstituted soils for the different technicians who have to deal with it (architects, engineers, soil scientist.).

The first part is dedicated to communications on real cases on the behavior of soils or reconstituted soils in urban environments.

In a second part, the session 1b is “meet the expert/mini workshops”-oriented around main questions (a list of questions will be established by the organizers of the session, see below). An expert of each “addressed question” will animate the discussion, collect the experiences of the participants, and identify with the audience the needs in terms of research. A final discussion in plenum is planned in order to synthesize all mini-workshops.

The list of questions is prepared by the organizers: each person who wants to submit a paper or participate in the session is asked to complete a questionnaire, the list may also be completed with other questions coming from the participants during the registration time. The organizers synthesize the more frequent questions (5-6 max), and select/propose facilitators among those who submit a paper or register for the session.

### 5.02b Managing urban environment: Technologies and methodology for the management and reuse of soils and sediments (b)

<b>Session type</b>	<b>Workshops</b>
<b>Convenors</b>	<b>Fabienne Favre Boivin, Géraldine Bullinger, Nazaria Marchi</b>
<b>Open to call for contributions</b>	<b>No</b>

The session is organised firstly as a communication session (session 1a) with presentations about management of urban environment, and in a second time, this session is planned as a workshop (session 1b), allowing direct contact and discussion between delegates from different origin, function and background.

The session 1a addresses the question of soil multifunctionality in urban context, with special focus on sustainable cities, resource conservation and liveability, reuse of soil and creation of new soils through the desealing, as well as water and heat regulating functions. It is organised around main issues/difficulties of urban management through soils and reconstituted soils for the different technicians who have to deal with it (architects, engineers, soil scientist.).

The first part is dedicated to communications on real cases on the behavior of soils or reconstituted soils in urban environments.

In a second part, the session 1b is “meet the expert/mini workshops”-oriented around main questions (a list of questions will be established by the organizers of the session, see below). An expert of each “addressed question” will animate the discussion, collect the experiences of the participants, and identify with the audience the needs in terms of research. A final discussion in plenum is planned in order to synthesize all mini-workshops.

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### 5.03 Soil quality and quantity: Innovative approaches of land use planning and urban development for a sustainable use of soils

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Fabrizio Ungaro, Silvia Tobias, Reto Camenzind, Eduardo Oliveira</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Soil sealing for urban development is a major threat to soils, and the goal of no net land take by 2050 (COM (2011) 571) asks for limiting as much as possible further losses of agricultural and natural lands in new urbanisation plans, and for adopting policies of mitigation and compensation whenever new land take is unavoidable.

The consequences of soil sealing are various being the dilapidation of all ecological soil functions the most salient one. Urban growth, i.e. development of the built environment to house urban populations and their multifunctional activities, occurs on the expense of most fertile agricultural land, natural habitats and recreation spaces. Inside the cities, the consequences of soil sealing, such as urban heat islands and floods, are sensible for the inhabitants. At urban level, the identification of multiple soil services areas and the understanding of their spatial patterns and connectivity may provide a strong basis to support land planning and management, making clear where and to which extent different services are potentially provided by different soils and how those are impacted by planning decisions.

Land and soil scientists, spatial planners, architects as well as investors, public and private agents, are challenged to develop innovative approaches of land use planning and urban development for a sustainable use of soil.

This session addresses the following topics:

- Maintaining and enhancing soil quality and functions in the urban space
- Integrating soil functions and services assessments in spatial planning
- Spatial planning instruments for mitigation and compensation of soil loss and for cropland protection
- Urban growth and densification and green infrastructure management
- Innovations in brownfield redevelopment and soil unsealing
- Economic incentives, public private partnerships for reducing and compensating for soil sealing
- Improving communication and knowledge exchange: spatial planners, soil experts, citizens
- Best-practice examples in the fields mentioned above.

### 5.04 Suitma-20 years of advances in research on soils of urban, traffic, mining and military areas

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Jean-Louis Morel, John Kim, Wolfgang Burghardt</b>
<b>Open to call for contributions</b>	<b>Yes</b>

SUITMA is an active group of the IUSS which has contributed to the development of soil science for anthropized environments. The core of the session will be based on the recent book "Soils within cities" (2017). SUITMA is a generic term for representing soils in highly anthropogenic environments. It is also an IUSS group established in 1998 that leads international research on these issues. After twenty years of existence, SUITMA has enabled the creation of international networks on urban soils and stimulated research and teaching activities in this field. The session will aim to present a summary of the scientific progress made during this period. The synthesis proposals will form the backbone of the session, which will address: (i) Composition, properties and functions of urban soils; (ii) Pedogenic evolution of urban soils; (iii) Classification of urban soils; (iii) Urban soil surveys; iv) Urban soil management; (v) Ecosystem services, including provisioning, regulating and cultural (e.g. art).

## 5.05 Living in cities: ecosystem services and soil policies

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Jaroslava Sobocká, Geoffroy Sere</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Urban areas concentrate specific environmental issues (e.g. urban heat island, local food supply, limit water absorption, flooding, loss of biodiversity). However, soil sealing, contamination, compaction, landscape fragmentation as examples of human-induced impacts contribute to undesirable conditions which considerably reduce functions and ecosystem services of urban soils. As a consequence, whereas urban soils shall be considered as part of the nature-based solutions, they are predominantly and in a partly unfunded manner perceived through their constraints. To address this gap, a change of paradigm is therefore required to consider, assess and manage the ecosystem services that could be provided by existing and engineered urban soils. To put it simply, the development of sustainable cities requires soil scientists, biologists and agronomists and not only architects and urban planners.

- Development of methods and results about the evaluation of ecosystem services provided by urban soils;
- The construction of Technosols capable to provide high level of ecosystem services in relation with the urban environmental issues;
- Development of instruments promoting ingenious and scientific design and decision-making processes in terms of environmental territorial planning
- Inclusion of urban soils in urban planning regarding their underestimated potential in terms of ecosystem services

The session is looking for instruments promoting clever and scientific design and decision-making processes in terms of environmental territorial planning. Tools will become as baselines for measures focusing on conservation of the environmental quality of soil and land in the context of adaptation to climate change. The theme is very actual and connect with current situation of land take and living standard of urban population in Europe. Theme is particularly interesting for stakeholders and public as it promotes soil awareness.

## 5.08 Our common soil: towards a new project

<b>Session type</b>	<b>Workshop coupled to a field trip</b>
<b>Convenors</b>	<b>Paola Vigan, Martina Barcelloni, Antoine Vialle, Marine Durand</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Developed during one and a half days, this session aspires to address the “Sustainable Cities and Communities” topic from an interdisciplinary perspective involving urbanists, landscape urbanists, practitioners, soil scientists together with local inhabitants and associations. During the first morning, three parallel panels (four speakers each, selected via open call) will launch the “soil as a resource and as a common” topic, which will be actively addressed (afternoon) through a set of thematic walks. Urbanists and soil scientists will meet local experts and inhabitants, not only as a “hands-on”, but literally as a “feet-on” occasion. An open debate will close the session during the morning of the second day.

This session proposes an innovative approach to “meet the experts” and local actors directly in the field, where a moment of exchange around concrete situations will help to imagine new spaces and practices. The topic of “urban soils” will be addressed in the frame of the contemporary city’s new form and of the transition (ecological, economic etc.) that cities and communities will have to address in the coming years. Urbanists, soil scientists, but also associations and municipalities should come together to build a new understanding of the city and its soils, of its forms and uses, with the aim of conceiving a new Project for “our common urban soil”.

- Topic 1 – “Soil as public space” and structure of the 21st century city-territory.  
Towards a new type of public space, actively working with soil’s functionality (ecosystem services production).
- Topic 2 – “Taking care of the soil”. Soil as a common and a resource to be maintained.  
The role of urban soil’s maintenance and the introduction of new urban practices (“the gardeners of tomorrow”), jobs/knowhow aimed at urban soil’s regeneration and activation of a new metabolism (role of inhabitants, associations, schools).
- Topic 3 – “Urban Soils for Climate”. Climate change as agent of soil regeneration.  
New spaces and practices enabling climate change mitigation/adaptation measures (desealing, conservation agriculture etc.)

## 5.10 Soil sealing degree and effects versus how much soil needs the city

<b>Session type</b>	<b>Workshops</b>
<b>Convenors</b>	<b>Wolfgang Burghardt, Thomas Nehls</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Soils are sealed for residential and business purposes. Income, economical wealth and the majority of the European gross domestic product is generated by soil sealing and by using sealed soils [2, 3].

Soil consumption by sealing occurs particularly in cities. There, a strong competition between built up sites and sites with uncovered soils occurs. To protect these soils, we need to understand, value, possibly monetarize and communicate the serious importance of soils for human life in modern urban areas.

In this context we also should be aware that

(i) soil sealing is still one of the most urgent topics of urban soil policy in the world. See also Thematic Strategy for Soil Protection of the European Commission, 2004 [1].

(ii) recently, soil sealing increased dramatically [3], and will further increase due to the current housing and business park policy in Europe,

(iii) we need areas of unsealed soils to compensate disadvantageous effects of soil sealing [4,5]. Therefore, soil science must deliver the information about the benefit and output of not sealed soils. We should know, how much soil is needed in cities, and what the values of unsealed soils are concerning economy and housing, and for the reduction of health and social costs.

Main questions are:

(i) what are the benefits from functions of unsealed soils in cities, and how much soil do we need for these purposes?

Besides the many benefits of urban green growing on soils there are also important contributions of soils itself for mitigating health threats and heat waves in cities, and for dilution of hazardous substances and for collecting dust by soils.

(ii) which soils are consumed by sealing,

(iii) what are the functions still fulfilled by sealed soils and how do they contribute to urban life?

E.g. sealed soils can be penetrated by tree roots, and can be used for subsurface infiltration of storm water to keep the storm water in the city.

(iv) which are the political, administrative, management, planning, engineering and construction options to improve the availability and quality of unsealed soils in urban areas, to minimize sealing, and to mitigate sealing effects?

(v) How can be soil sealing-reduction targets achieved. Where and how can soils be de - sealed?

The session will be of interest for soil scientists, planners, construction engineers, medical doctors and politicians.

## 6.01 Agricultural fields. Opportunities and limits of carbon and water storage

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Marques MJ, Melgarejo P, Roggero PP, Luu P</b>
<b>Open to call for contributions</b>	<b>Yes</b>

This session on soil organic carbon (SOC) sequestration in agricultural land is framed in SDG 15 to promote sustainable use of terrestrial ecosystems, combat desertification, and halt and reverse land degradation.

SOC sequestration is a tool for an effective transition to sustainability and climate change adaptation and mitigation. This is challenging in regions with water scarcity, as the process and benefits may be not that evident. The session pretends to answer the following questions:

- How long does it take to recognize the benefits of increased SOC?
- How SOC sequestration in soils improves the ability to withstand droughts?
- What are the limits of SOC sequestration in a given edaphoclimatic context?

Answers will help to design financial aid to accompany land users in their transition to land sustainability.

This session should be of interest to scientists, and policy and decision-makers. It is supported by two multi-stakeholder networks: Desertnet International (<https://www.desertnet-international.org/>) and the 4p1000 Initiative (<https://www.4p1000.org/>). They will promote the participation of their members and associates and will look for testimonies of policymakers and land users.

## 6.02 Biochar based fertilisers: interactions with plants and soils

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Samuel Abiven, Hans-Peter Schmidt</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Biochar is one of the most promising solutions proposed to mitigate global change in agroecosystems. It consists in pyrolysing organic residues into a charcoal-like material that can subsequently be added to the soil. This material is particularly stable and so can store carbon efficiently. It may also, especially when enhanced with organic nutrients (named biochar-based fertilisers) increase the soil fertility. Indeed, changes in soil biology, physics and chemistry have been reported when biochar has been premixed with other types of organic matter. It can also modify plant physiology, in particular root architecture. However, we still know very little about the potential interactions between biochar, organic fertilisers, soils and plants. In this session, together with Hans-Peter Schmidt (Ithaka Institute), we would like to invite contributions presenting works that focus on the effect of these biochar based fertilisers on soil properties and plant characteristics, their formulation and characterisation, as well as their contribution to holistic carbon solutions to mitigate climate change.

## 6.03 Carbon dynamics in grassland soils under different management intensities in a changing climate

<b>Session type</b>	<b>Communication session</b>
<b>Convenors</b>	<b>Noelia Garcia-Franco, Arezoo Taghizadeh-Toosi, Martin Wiesmeier, Christopher Poeplau</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Grasslands cover approximately 40% of the earth's land surface and represent about 70% of the agricultural area. Soils support key environmental functions and have a great influence on carbon (C) and nitrogen (N) cycles on both mineral and organic soils. Climate change along with changes of grassland management is likely to alter the C and N balance of these soils, which can have subsequent effects on the loss of soil C and N as greenhouse gases such as carbon dioxide (CO<sub>2</sub>) and nitrous oxide (N<sub>2</sub>O). There is an immediate need to improve understanding of soil organic matter dynamics and underlying processes of soil C and N turnover in grassland systems. Therefore, the objective of this session is to identify main drivers of soil organic matter dynamics as well as greenhouse gas budgets in grassland soils. Furthermore, the development of climate-smart management strategies as key scientific and socio-economic aspects is discussed.

We seek for any contribution related to aspects of C and N cycling in both mineral and organic soils under grasslands with different management strategies. Any methodological approach is welcome too.

#### 6.04 From source to storage - understanding soil organic matter cycling in space and time using molecular tools

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Guido Wiesenberg, Boris Jansen, Karen Vancampenhout</b>
<b>Open to call for contributions</b>	<b>Yes</b>

In the last decades we have seen a drastic shift in the scientific perceptions surrounding soil organic matter cycling. The paradigm of soil organic matter stabilization being linked to complex molecular composition has come under increasing scrutiny. Instead, external factors such as environmental conditions and ecosystem composition are increasingly seen as being of overriding importance: any part of soil organic matter can and will be broken down under the right circumstances. In this session we hope to discuss this fascinating topic together with a wide range of scientists from various fields, but all focusing on soil organic matter turnover. We want to cover topics from soil organic matter cycling at the ecosystem scale in various ecosystems and environments, to details of soil organic matter interactions at the molecular scale including molecular composition and compound-specific isotopes. From those focusing on field observations, through those using advanced characterization techniques in the laboratory, to those using modeling approaches. Thus we hope to fuel a discussion about linking the various processes of soil organic matter cycling.

#### 6.05 Identifying processes and management practises for sustained usage of organic soils

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Andreas Schellenberger, Sonja Marit Paul</b>
<b>Open to call for contributions</b>	<b>Yes</b>

In Europe organic rich soils are widely used for forestry and agriculture leading to high emissions of GHG and other environmental impacts. Over the past years several attempts to reduce negative impacts were developed including rewetting for nature conservation, alternative use under wet conditions (Paludiculture), and conventional use under improved conditions (water management, such as submerged drains, soil additions (such as sand, ash, peat inversion or soil covering.) The Session illustrates the current state of scientific knowledge of GHG reducing measures, changes in soil properties, biogeochemical processes, and C dynamics induced by drainage and rewetting / management. Studies from field, laboratory, as well as modelling are welcome. Furthermore, we especially invite stake holders to share their ideas, attempts or solution in implementing organic-rich soils in their national soil strategies.

#### 6.07 Managing soils functions to mitigate and adapt to climate change

<b>Session type</b>	<b>Pico session and Communication session</b>
<b>Convenors</b>	<b>Martin Hartmann, Frank Hagedorn, Andreas Gattinger</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Martin Hartmann, Frank Hagedorn, Andreas Gattinger Healthy soils play a key role in mitigating climate change by sequestering carbon and reducing greenhouse gas emissions. Sustainable soil management aims at providing optimal physical and chemical conditions to promote soil biological activity that not only minimizes atmospheric greenhouse gas concentrations, but also maximizes soil functions that confer adaptation to climate change events (e.g. drought, temperature/rainfall extremes, pest invasion. This session aims at presenting and discussing the latest research on how soils can be managed to provide the necessary functions that contribute to mitigation and adaptation to climate change. Such strategies include management options to improve climate relevant soil functions (e.g. improved tillage systems and crop rotations, liming, biochar/composting, organic farming) and avoid detrimental effects on soil that will further accelerate climate change (e.g. soil compaction, tillage, excess fertilization). The session should be of interest to a broad audience including scientists from various disciplines as well as stakeholders such as farmers, foresters, and policy makers.

#### 6.08 Mitigation of greenhouse gas emissions from organic soils

<b>Session type</b>	<b>Pico</b>
<b>Convenors</b>	<b>Bärbel Tiemeyer, Hanna Silvennoinen, Jens Leifeld</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Globally, 10–20% of peatlands have been drained for agriculture or forestry, and these emit 6% of global CO<sub>2</sub> emissions. Some European countries have more than 60% of their agricultural emissions originating from cultivated organic soils, and the fate of South-East Asian peatlands is of global concern. Besides classical re wetting measures addressing nature conservation goals, innovative mitigation measures that sustain economically viable biomass production while diminishing environmental impacts and supporting ecosystem services are increasingly studied. However, implementing innovations in practice and into national GHG inventories remains a challenge. The session should be of interest for soils scientists and stakeholders in the field of climate change mitigation, nature conservation and agriculture. We invite both hydrological and biogeochemical studies addressing all approaches to mitigate greenhouse gas emissions from organic soils. Laboratory, field and modelling studies are all welcome. We are also looking forward to contributions that address policy coherence and identify policy instruments for initiating and implementing new management practices on organic soils.



### 6.09 New frontiers in soil carbon storage: optimizing interactions between biotic and abiotic properties across scales

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Elly Morriën, Franciska de Vries, Boris Jansen, Erik Cammeraat, Albert Tietema</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Increasing soil carbon storage is a promising hotly debated route for mitigating climate change by reducing CO<sub>2</sub> concentrations in the atmosphere. In addition, increasing soil carbon has other, often-underemphasized benefits, from aiding restoration of degraded land to halting soil biodiversity loss. Therefore, we urgently need to shed light on the processes underlying soil carbon stabilisation. These have recently undergone a paradigm shift towards a dominant role of the interactions between soil organisms and the soil mineral phase. This session will include cutting-edge science on the mechanisms through which interactions between biotic and abiotic factors influence soil carbon storage on a range of scales, from a single aggregate to entire landscapes. We aim to include talks that quantify carbon flow into soil microorganisms, and carbon stabilisation in the mineral soil on a range of scales, as well as talks that show a clear link with real-world management strategies. This session is young, connects soil sciences with soil ecology and connects scales. The session should be of interest to soil ecologists, soil scientists and stake holders.

### 6.10 Permafrost soils under climate change connecting soil functions and human activity

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Julien Fouche, Yannick Agnan, Marie Alexis, Christopher Peoplau, Andreas Richter and Carsten W. Mueller</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Climate change is modifying boreal and polar regions at unprecedented rate. The thawing of permafrost has strong effects on hydrological and biogeochemical cycles, possibly increasing trace gas emissions and inducing a positive feedback on global climate change. Although climate change impacts on the permafrost carbon are intensively studied, our understanding of the complex interactions between biogeochemical cycles (i.e., N, P, Si, Hg) is limited due to the lack of integrative studies across frozen-ground landscapes. Modifications of high-latitude ecology and hydrology will interplay with the soil functioning affecting nutrient availability, weathering, carbon stabilization, and contaminant mobilization. But climate change also affects geophysical and hydrological processes such as increased thermokarst formation and coastal erosion, strongly impacting local communities that face an unprecedented change of their livelihood. An increase in agricultural activity is one example of potential anthropogenic adaptation to changing patterns of permafrost distribution, which might additionally affect biogeochemical cycles. Thus, soils of the Arctic are of ample importance for global matter cycles and possible extension of arable grounds.

This session aims to bring together scientists working on soils in high latitudes, reaching from hydrology, biogeochemistry, microbiology and geomorphology. Besides the soil functioning we also explicitly invite work on new avenues in Arctic agriculture and land management. Let's come together and share results, views and concepts to better connect the knowledge of soils and biogeochemical cycling at the poles and human activity.

### 6.13 Soil archives to understand future changes of climate, landscapes, and the pedosphere

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Tobias Sprafke, Daniela Sauer, Maria Bronnikova</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Soil is the living skin of the Earth that forms through time from local parent material. Climate determines the environmental conditions under which pedogenesis occurs. Soil carries a palimpsest-like memory of past ecosystems. Paleosols inform about regional landscape responses to global climatic changes and are themselves regional records of paleoclimate. Fossil soils and relict features of surface soils provide essential knowledge to predict future ecosystem and pedosphere response to climate change. This session invites researchers that use soil as record of climate and landscape evolution. We welcome contributions from the landscape scale to the (sub-)microscopic scale, work that uses qualitative observations to increase our understanding of soil forming processes through time as well as quantitative approaches using e.g. molecular or isotopic proxies of past climate and paleoenvironments in (paleo)soils. We specifically encourage references to the United Nation Sustainable Development Goal 13 Climate Action.

## 6.17 Estimating the carbon sequestration potential of soils: scales and approaches

<b>Session type</b>	<b>Hackathon / Shared brain</b>
<b>Convenors</b>	<b>Claire Chenu</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Given the huge size of the soil organic carbon pool compared to that in the atmosphere, increasing net soil C storage by even a few per cent would represent a substantial attenuation of climate change. Rendering soils « climate smart » requires however an understanding and assessment of the organic carbon storage and sequestration (i.e. net storage of C in long lived pools) potential of different soils. This session will focus on how to estimate the organic carbon sequestration potential of soils, using soil databases and maps, biogeochemical modelling or carbon saturation concepts, at various spatial scales. other convenors: E Lugato JRC. A. Don Thunen institute

## 6.19 Soil temperature and soil heat storage, and its meaning for climate, health and technical management

<b>Session type</b>	<b>Workshops</b>
<b>Convenors</b>	<b>Wolfgang Burghardt, Ralph Meissner</b>
<b>Open to call for contributions</b>	<b>Yes</b>

Global warming has until now a focus on soil organic carbon as sink for atmospheric carbon dioxide. But there are also other capacities of soil to mitigate global warming which have found only minor interest.

This concerns the capacity of soils to store heat. Soils can influence the climate by uptake and release of heat. Basically, quantity of soil heat is dependent from soil temperature and soil water content.

Besides this, soil temperature and heat have a strong effect on many other natural soil properties and benefits such as weathering, decomposition, soil water balance, thawing of frozen soils, microbial population, vegetation, land use by agriculture and forestry.

Recently heat storage properties of soil became of interest for technical purposes such as use for heating and cooling of buildings, heating of greenhouses and heat dissipation of electricity underground cables which grow warm.

There is also the health aspect of soil heat storage. In sealed urbanized areas soil heat storage contribute essential to mitigate extreme heatwaves in summertime.

The session should be of interest for scientists, planners, politicians and engineers who are engaged in soil, climate, health and technical tasks.

## 6.20 Carbon credits for soil carbon sequestration to mitigate climate change and enhance soil fertility

<b>Session type</b>	<b>Controversies</b>
<b>Convenors</b>	<b>Markus Steffens, Adrian Müller, Jens Leifeld</b>
<b>Open to call for contributions</b>	<b>No</b>

We will shortly introduce how the policy instrument “Carbon credits” work, where it comes from and why it is increasingly promoted in agriculture and for soil carbon sequestration in particular. We will then focus on the key challenges of carbon credits for soil carbon sequestration, which are Measurement/Reporting/Verification; Additionality; Permanence; and Leakage. We will then in small groups address each of these issues in more depth, guided by one of the session convenors and additional experts as needed to assure small groups of 5 to 7 people. A synthesis, final plenary discussions and concluding remarks close this session.

**O2a Soil science skills for the future**

<b>Session type</b>	<b>Hackathon / Shared Brain</b>
<b>Convenors</b>	<b>Yves coquet, Chekifi, Antonia Ulmann</b>
<b>Open to call for contributions</b>	<b>Yes</b>

We would like to call for short key inputs for the hackathon: Let's bring soil science to classrooms – together we plan a school project on "soil means life".

The presentations should only last 5 – 10 minutes and present existing or planned school projects about soil. They are meant to make everyone familiar with the setting and act as a catalysator for developing more ideas together.

We encourage everyone to apply, especially since we would like to have projects from different countries and for different school levels and ages, if possible. Convincing ideas about how to promote projects and get in contact with key persons like teachers are also highly welcomed. It is also possible to propose more than one project.

The description of your proposal (600 – 800 words) should include the following aspects:

About the project:

- name of the project and, if possible, link to a website
- nation
- age of the targeted children
- scale (a class, a school, a contest with different schools...)
- type of project (experiments, outdoor classes, indoor classes, art...)
- promotion: How did you bring your project into the classrooms?
- What challenges did you face? How did you overcome them?
- In which sense was the project successful?
- What might be special about it? What are key components?
- Do you have plans for further development of the project?

About you:

- What is your profession / background? How do you engage in education?

Please note that the majority of the participants of the hackathon will not present a key input, since we will only choose 3-5 presentations.

Please register in addition separately for the hackathon.

**O2b Soil science skills for the future**

<b>Session type</b>	<b>Workshops</b>
<b>Convenors</b>	<b>Yves coquet, Susan Thieme, Eike von Linder, Christian Walter</b>
<b>Open to call for contributions</b>	<b>Yes</b>

**O3 Cultural understanding of soils. Results from an inter-cultural project**

<b>Session type</b>	<b>Communication Session</b>
<b>Convenors</b>	<b>Nikola Patzel</b>
<b>Open to call for contributions</b>	<b>Yes</b>

This symposium will focus on understanding the human soil interaction as a cultural phenomenon. In all societies, soil is inescapably perceived in a cultural context which forms a web of meaning given by religious or secular myths, beliefs and ideas. These patterns act as orientational knowledge for the human soil relationship. They can have effects being in line or in conflict with ecological conditions, scientific views, and agricultural practices. We see a need to deal inter-culturally with different sources and types of knowledge regarding soil, to extend soil awareness and care through inter-cultural dialogues. For this purpose, IUSS founded a working group on cultural patterns of soil understanding which produced a book on this issue with case studies from all continents. We are also interested in how elements of human psyche, being unconscious or part of consciousness, seem to combine in molding soil understanding in the past to the present. We are striving to (re-)connect contemporary cultural issues with older cultural findings and make them both more accessible for scientific discussions in soil science and related areas, and with bridge-builders from other professions.

## O5 Connecting people with soil by co-producing films: identifying potentials and limitations

<b>Session type</b>	<b>Workshops / Hands-on / Meet the Expert</b>
<b>Convenors</b>	<b>Patricia Fry</b>
<b>Open to call for contributions</b>	<b>No</b>

The goal of this session is to identify the potentials and limitations of co-produced films to connect people with soil. Introduction: Prof. Susan Thieme, University of Bern (tbc): Differences between film and text. Dr. Patricia Fry, Wissensmanagement Umwelt: Co-producing transformation knowledge for sustainable soil management with 'social learning videos'. Dr. Eike von Lindern, Dialog-N, Zürich (tbc): State of the art from social science, psychology and communication sciences with respect to theories for changing behaviour. Workshop 'world café': Several "Social learning video" projects from Switzerland which address farmers and the broad public serve as a nucleus to analyse and discuss the outcome for sustainable soil use. In all these cases a transdisciplinary approach was used by working with a multistakeholder discussion group and finding and sharing soil related transformation knowledge for selected target groups by means of film. For the world café selected "social learning video" projects will be presented, viewed and discussed in small groups addressing following questions: How were the films used during the last 10 resp. 3 years? What was the outcome? How has sustainable land use changed on the selected farms/in Switzerland? In the final discussion the potential for how to connect people with soil by means of film is derived and limitations are identified. This session should be of interest to soil scientists, experts working for public administration as well as practitioners interested in enhancing sustainable soil use.

## O6 Could soil-related food labels be good tools to promote sustainable soil management?

<b>Session type</b>	<b>Controversies</b>
<b>Convenors</b>	<b>Claire Chenu</b>
<b>Open to call for contributions</b>	<b>No</b>

Since a few years and since the international year of soils the awareness on soils their importance and fragility has increased in the general public. In parallel consumers are increasingly preoccupied of food quality and of the social and environmental impacts of the food they buy. Could food labels testifying for a sustainable and climate- smart soil management be a solution? Could they be linked to payment to farmers for ecosystem services? what is the efficiency of food labels? Are there pitfalls? Are consumers ready for new labels? Are there other systems for informing consumers on the impacts of the food chain on the environment? A debate will gather actors from food companies from farmers union or associations, an economist and a soil scientist.

## O7 Soil of the year: spreading soil knowledge

<b>Session type</b>	-
<b>Convenors</b>	<b>Simon Amrein</b>
<b>Open to call for contributions</b>	<b>No</b>

## O8 Sounding soil: an acoustic, ecological and artistic investigation of soil life

<b>Session type</b>	<b>Exhibition</b>
<b>Convenors</b>	<b>Marcus Maeder</b>
<b>Open to call for contributions</b>	<b>No</b>

Soils present themselves to us mostly as differently composed surfaces, with that which is underneath escaping our perception. Soils are highly sensitive to any disturbances, i.e. human impact by farming systems or forest management. There seems to be a basic perception problem behind such environmental issues; the pedosphere and its functions or state of health cannot easily or instantly be translated into a sensual experience. Sounding Soil is an inter- and transdisciplinary research and art project that investigates the acoustics of soil ecosystems. In the project, methods to record and measure the acoustic activity and composition of soil organisms are being developed with the objective of assessing biodiversity in soils rapidly and affordably by acoustic means. Recordings of the soil fauna are part of a participatory art installation and a citizen science project. The project aims to create a firsthand experience of soil ecosystems and increase soil awareness in broader parts of society. The session should be of interest to soil ecology scientists as well as the public.

## O9 Eurosoil2020 Small interdisciplinary grants for early career researchers

<b>Session type</b>	-
<b>Convenors</b>	<b>Xavier Portell-Canal</b>
<b>Open to call for contributions</b>	<b>No</b>