Tisztelt Társasági Tagok!

Elsősorban: Boldog Újévet kívánok mindenkinek!

Az idei első hírlevél témája a közelgő "nagy" konferenciák (EGU és EUROSOIL).

Az EGU 2020 honlapja:
https://www.egu2020.eu/

Több szekció szervezésében is szerepelnek magyar kollégák, néhányra az alábbiakban hívom fel figyelmüket:

Session : **Digital Soil Mapping and Assessment**

Lead: Laura Poggio

Co-conveners: Titia Mulder; Alessandro Samuel-Rosa, Jacqueline Hannam, **Laszlo Pasztor**

Spatial soil information is fundamental for environmental modelling and land use management. Spatial representation (maps) of separate soil attributes (both laterally and vertically) and of soil-landscape processes are needed at a scale appropriate for environmental management. The challenge is to develop explicit, quantitative, and spatially realistic models of the soil-landscape continuum to be used as input in environmental models, such as hydrological, climate or vegetation productivity (crop models) while addressing the uncertainty in the soil layers and its impact in the environmental modelling. Modern advances in soil sensing, geospatial technologies, and spatial statistics are enabling exciting opportunities to efficiently create soil maps that are more consistent, detailed, and accurate than previous maps while providing information about the related uncertainty. The production of high-quality soil maps is a key issue because it enables stakeholders (e.g. farmers, planners, other scientists) to understand the variation of soils at the landscape, field, and sub-field scales. The products of digital soil mapping should be integrated within other environmental models for assessing and mapping soil functions to support sustainable management. Examples of implementation and use of digital soil maps in different disciplines such as agricultural (e.g. crops, food production) and environmental (e.g. element cycles, water, climate) modelling are welcomed. All presentations related to the tools of digital soil mapping, the philosophy and strategies of digital soil mapping at different scales and for different purposes are also welcome.

Session: **Soil sustainability and security for reaching land degradation neutrality**

Lead: Dominique Arrouays

Co-convenors: Titia Mulder, Laura Poggio, **Laszlo Pasztor**, Alex McBratney

Successfully achieving global Land Degradation Neutrality (LDN) by 2030 requires good governance. Governance bodies should be provided with reliable, functional and easy-to-interpret data. This allows making scientifically-based policy decisions on SDG measures, taking into account trade-offs and synergies between LDN and other key ecosystem services,

including social components. Spatio-temporal information on soil properties are key to provide baseline information for addressing LDN. Links with digital assessment of soil and their functions are fundamental but also the assessment and propagation of their uncertainties. This session is of interest for all soil scientists and policy makers who want to present and discuss products and approaches for reaching LDN at different scales.

SSS6.10. **Recent advances and challenges in soil hydrophysical characterization**

Co-organized by HS13.26

(Co-)conveners: Aurore Degré, Gerben Bakker, Wolfgang Durner, **Attila Nemes**, Martine van der Ploeg

The hydrophysical properties of soils play a major role in current societal issues such as agricultural productivity, the preservation of water resources, both in quantity and quality, gas exchanges between soil and atmosphere and even the protection of settlements and people. However, the methods used to characterize the hydrophysical properties of the soil (mainly the water retention and hydraulic conductivity curves), both in the laboratory and in the field, remain questionable as to their representativeness. They require very long measurement times. Besides, standardisation and harmonization are issues of concern.

While many pedotransfer functions exist to estimate these characteristics, they remain globalizing approaches, based on available data. Their accuracy and precision have to be assessed. Furthermore, their usefulness is limited when it comes to assessing the impact of innovative practices that bring about changes in soil structure and therefore in water, solute and gas flows in the soil.

In this context, this session acknowledges that Soil Structure Matters and invites contributions presenting new approaches to characterizing the physical properties of soils like new sensors, new field and/or lab measurement techniques, as well as contributions illustrating comparative approaches between methods and/or laboratories. Discussions on sample sizes and sampling schemes are also welcome.

https://meetingorganizer.copernicus.org/EGU2020/abstractsubmission/35070

Az EUROSOIL 2020 honlapja:

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Üdvözlettel:

Bakacsi Zsófia

EGU 2020 – SOPHIE session

#SoilStructureMatters

SSS6.10

Recent advances and challenges in soil hydrophysical characterization

Co-organized by HS13.26

Aurore Degré, Gerben Bakker, Wolfgang Durner, Attila Nemes, Martine van der Ploeg

Abstract submission

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The session is part of the SOPHIE initiative (Soil Program on Hydro-Physics via International Engagement)

https://www.wur.nl/en/article/Soil-Program-on-Hydro-Physics-via-International-Engagement-SOPHIE.htm

SDG1 - NO POVERTY

1.01 Achieving soil security through enhanced soil connectivity.
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.
"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'."

1.03 Ethnopedological knowledge of agricultural and non-agricultural soils:
contribution to sustainable management of natural resources.
Soil indigenous knowledge is undoubtedly one of the niche focuses due to its recognized potential to improve practical relevance of technical soil science knowledge. Literature shows that ethnopedological knowledge improves practical relevance of soil data. This section aims to cover ethnopedological knowledge of both agricultural and less studied but equally important non-agricultural soils. Central to this theme is the understanding of local soil theories underpinning ethnopedological knowledge for rural land/soil use. These include theories associated with land suitability classification, ethnopedological soil classification and mapping, soil quality assessment, soil/land symbolic and practical health care, non-agricultural uses necessary to identify sustainable management approaches of land use. How has this knowledge improved practical relevance of soil information? As we move towards a bottom-up approach, this theme will also have a special focus on initiatives around development of effective methodologies (theoretical and practical) for integration of soil indigenous knowledge to aspects such as soil classification, land suitability, soil-cropping systems, soil fertility assessment, etc.

1.04 From baseline soil information to spatiotemporal soil functioning for sustainable socio-economic development.
This session welcomes contributions from studies focusing on the use of soil information to enhance sustainable socio-economic development. These studies may consider either the collection of baseline soil data or more advanced spatiotemporal modelling of soil functions. Particular interest will be given to research using and/or developing novel data integration techniques to obtain a better understanding on the regional dynamics of multiple soil-derived ecosystem services (e.g. climate regulation, food security) and trade-offs & synergies in a socio-economic context. Studies using remotely sensed data to investigate soil process dynamics across a range of spatial scales (soil pore - continental) are encouraged to submit to this session. Special attention will be given to the communication of research outcomes to local stakeholders and the policy implication for regional sustainable development, including

GIS-based strategic planning and decision support tools. This session should be of interest to soil scientists embracing both physical and social contexts as well as NGOs, businesses, farmers and national governments.

1.05 Managing soils for livelihoods: which scale, which tools?
This session should be of interest to soil scientists engaged in tropical soil management, policy makers involved in research for development, scholars, students and land managers interested in geospatial tools, and decision guides that are science based and integrate local goals and knowledge. The overall objective of the session is to explore the challenges posed by multiple scales and different perspectives on soil, nutrient and farm management. We will hear from highly experienced scientists based in the field, and how to bridge the gap between soil heterogenity, farm livelihoods and conservation of resources. Spectral analysis and soil chemical based decision guides are emerging as the basis for fertilizer blends and recommended crop nutrient management, in Malawi and nearby countries. At the same time, soil topology and locally adapted fertilizer and integratement management approaches are also being adopted in Ethiopia and other countries. As these approaches complementary, involve different scales or do they provide fundamentally different pathways to profitable agricultural systems and sustainable soil management?

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

SDG2 – ZEO HUNGER

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

2.02 Green house soils
"Greenhouses are gaining ground in many European countries. As a result, fertile agricultural land is increasingly covered. This can cause problems, not only in terms of energy or water use, but also in terms of land consumption.
Depending on the construction and cultivation method, the soils below greenhouses are influenced differently. The construction phase, for instance, can lead to soil compaction; pure hors-sol production influences the biological activity in the soil; degradation, leaching or enrichment of agrochemicals behaves differently under greenhouse conditions than in open field soils.
With this session, we would like to present new insights in order to support the long-term fertility of greenhouse soils with the help of sustainable cultivation practices. Contributions on physical, biological and chemical properties of greenhouse soils are welcome. We are interested in how greenhouse soils differ from normal arable soils, what the latest research has to offer, and where open questions remain."

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

2.04 Innovations in land evaluations to achieve zero hunger: from quantification to action.
Do we still need 'land evaluation' ? And if so, how to advance to make concrete use of it, namely for addressing the 'zero hunger' SDG also in face of climate change? The purpose of this session is to assess ‘state of the art’ and potential of land evaluation, crop suitability and similar approaches. These rely very much on soil sciences but span across disciplines. They may nowadays benefit from a vast range of techniques such digital soil mapping, remote and proximal sensing, crop modelling, big data and analytics, among others. The number of applications is also broadening. Quoting a ground-breaking paper of the nineties from van Diepen,

van Keulen and others entitled ‘Land evaluation, from intuition to quantification’, we would like to take the perspective further, especially to address the zero hunger SDG objective. The focus of the session will be on input data (on soils but also climate, crop and agronomic info, best fit practices, land use, farming and household systems data), but especially on methods for reconciling them; also on models and tools, visualisation techniques, application of participatory approaches and ultimately on their possible application domains.

2.05 Processes at the soil-root interface shaping soil functions.
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?
"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.
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.
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.
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.

"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:

a) net carbon balance with respect to system boundaries, carbon imports and carbon mining outside the system,

b) identification of key drivers to increase soil organic carbon (eg mixed farming, reduced tillage, residue management and crop rotation), and

c) 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."

2.11 Vehicle onboard soil characterization methods.

"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 manily 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, sewing, fertilizing etc., b) What are the agronomic/environmental gains that can be reached with those methods: yield increase, soil protection etc."

SDG3 - GOOD HEALTH AND WELL-BEING

3.01 Agromining of metals on trace element-enriched soils:
metal harvesting and recovery and its economic and ecological evaluation.

Some so-called hyperaccumulator plants have the potential to be used for trace element (TE) phytoextraction on TE-enriched soils. This holds in particular for nickel (Ni). Some hyperaccumulators accumulate Ni to concentrations higher than 1% in the dry plant biomass and to yield Ni harvests exceeding 100 kg ha-1. Processing the harvested biomass in an incinerator results in a bio-ore, which can be used for recovering Ni as a metal or producing Ni-products. This process is called phytomining or agromining. By optimizing biomass yield, plant Ni accumulation, agricultural efforts and costs for recovering Ni from the ash, Ni agromining can be economically attractive process, both from the perspective of the farmers cultivating agromining crops and the biobased industry. The cropping of Ni hyperaccumulator plants may also contribute to improve soil quality and provide further ecological and socio-economic benefits. All technological, economic and ecological aspects – e.g. in relation to SDG 15 –need thorough assessment though before Ni agromining can be recommended for application on larger scales in practice.

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

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 tool box 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.

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.

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.

3.05 Formation and fate of non-extractable pesticide and biocide residues in soils.

Soils are major recipients of plant protection products (PPP). Besides extractable and mineralizable residues, also non-extractable residues (NER), which are formed via biological and physical-chemical processes, end up in soil. Ageing due e.g. to redistribution of PPP from weaker to stronger adsorption sites, slow chemisorption, and covalent bond formation promote the formation of NER. Also, microorganisms incorporate carbon or nitrogen from PPP for synthesis of cell constituents. After cell lysis, these compounds are incorporated into soil organic matter (microbial NER). In some soils, the accumulation of NER has been found to exceed the concentrations of extractable residues, with unknown ecotoxicological consequences. Hence, there is growing concern about potential NER release from soil. Moreover, unravelling the structural composition of NER is still an analytical challenge, and the formation of microbial NER can often not be determined due to a lack of appropriate methodology. This session will address (i) novel analytical methods for NER quantification and structural characterization, (ii) the environmental fate of NER (e.g. re-mobilization, biodegradation), and (iii) the formation of microbial NER.

3.06 Multi-scale approaches for soil pollution assessment.

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.

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.

3.08 Poly- and perfluorinated alkyl substances – challenges, remediation and future steps for science, industry and authorities.

Poly- and perfluorinated alkyl substances (PFAS) are a diverse class of more than 4000 known chemicals which are used in a wide range of products since the 1950s. As they are highly resistant against degradation, they are now present ubiquitously in the environment, and the number of incidents worldwide concerning PFAS water and soil contamination is increasing steadily. Remediation and disposal options are urgently needed, and authorities are seeking guidance and data on these substances. Currently there are no soil remediation options for these compounds. Landfilling is a risky option due to possible leaching. Thermal degradation of PFAS is under investigation. Data on plant uptake and PFAS behaviour in soil is still scarce. The session will provide a platform for stakeholders and scientists to review the current knowledge and discuss research needs and treatment options.

3.09 Protection and assessment of soil biodiversity and functions.

The protection of the structure and functioning of soil ecosystems is a central aim within current pesticide regulations in the EU (EFSA 2017). In order to reach this goal, soil biodiversity has to be protected. However, the biodiversity of many European soils, including the reaction to stressors, is not well known. Knowledge gaps exist in terms of species composition of many “non-charismatic” meso- and microfauna groups. On the other hand, many novel DNA techniques and modelling approaches have been developed recently that are increasing our knowledge of species diversity as well as our understanding of ecological interactions. Using this information will also improve our ability to assess the impact of stressors on soil ecosystem structure and functioning, including the identification

of protection measures. The session should be of interest not only to soil scientists but also to colleagues from biological and environmental sciences, regulatory agencies and industry.

3.10 The silent risks of naturally occurring radioactive materials (NORM): site-specific risk assessment of NORM-contaminated sites.

The main focus of radiation protection initiatives has been on nuclear test sites and nuclear accident areas, where acute exposures to high doses of radiation occur. Much less attention has been paid to areas, such as uranium mine areas, where ecosystems and humans are exposed to low doses of radiation emitted by naturally occurring radioactive materials (NORM), combined with many other multiple stressors, in particular metals. The increasing world demand for uranium to fuel nuclear power plants will increase the exploitation of this mineral resource in many countries, imposing potential threats to humans and ecosystems. Furthermore, there are many abandoned sites around the world for which risks have never been assessed properly, not only due to political constraints associated with the geostrategic importance of uranium explorations, but also due to difficulties in assessing the risks of combined chemical and radiation exposures. Thus, the aim of this session is to focus on the risk assessment of sites contaminated with NORM both to humans and ecosystem functions and services, highlighting new approaches to assess multiple site-specific exposures and taking particular account of non-target effects such as radiation-induced adaptive responses, bystander effects, and multigenerational effects.

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

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.

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 pollutants: detection, risk assessment and treatment.

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.

3.14 Reuse of organic wastes as soil amendments

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.

SDG6&15 - CLEAN WATER AND SANITATION & LIFE ON LAND

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

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.

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.

4.03 Economic valuation of soil ecosystem services.

Soils provide multiple ecosystem services including provisioning services such as food and fibre, regulating services such as water filtration and climate regulation in addition to supporting and cultural services. This session invites presentations that focus on economic valuation of soil ecosystem services from many perspectives. We invite: Studies that focus on valuation methods and methodological advances including economic assessment, MCDA, EROI and dynamic modeling linked to economic valuation; critical appraisal of economic valuation of soil ecosystem services; studies on policy relevance of economic valuation of soil ecosystem services; studies comparing the value of soil ecosystem services under different management regimes in agriculture (organic, industrial etc.); economic valuation of cultural services from soils; in addition to case studies at different scales (plot, region, nation, multiple nations) where soil ecosystem services are valued economically as well as studies where value pluralism is practiced.

4.04 Ecosystem Nutrition – a process and interaction-based approach of evaluating the function of soils to provide plant nutrients.

The soil function of providing nutrients is essential to primary production. The nutrient supply of plants in close to natural ecosystems strongly depends on mobilization processes like desorption of nutrients from the solid phase, weathering, or mineralization. To sustain sufficient nutrient supply not only single soil – organism interactions are relevant, often interactions and feedback reactions among different groups of organisms and their abiotic soil environment are essential. The wholeness of these processes has been termed ecosystem nutrition and integrates different scales and ecosystem compartments. In this session, we would like to highlight ecosystem nutrition approaches focusing on close-to-natural ecosystems such as forests and grasslands. We particularly invite reports on experimental and conceptual studies that include ecosystem-based knowledge on nutritional processes in (i) evaluating the conservation state of ecosystems, (ii) assessing human impact on ecosystem functioning, (iii) land use management, (iv) analyzing ecosystem resilience against disturbances (e.g., harvest, wind throw, climate change, N-deposition), or (v) quantifying the nutrient efficiency of ecosystems as a whole.

4.05 Forest Impacts on Soil and Slope Stability – Facts and Gaps.

Shallow landslides have been a constant threat in mountainous regions, predominantly on steep slopes. The predicted intensification of climate extremes such as heavy rainstorm events increase the probability of occurrence of this natural hazard.

Vegetation in general and, in particular forests, essentially contribute to slope stability. Together with micro-organisms, primarily associated mycorrhizal fungi, roots are the main actors in soil aggre-gation and armouring, which are key for a resistant soil matrix and pore structure and, consequently, for stabilising steep slopes. Furthermore, the plant cover intercepts rain, reduces its impact energy on the soil surface, and influences soil hydrology by transpiration, all with a view to prevent superficial soil failure, namely shallow landslides.

Although the protective effects of forests against shallow landslides is widely accepted, their sound and easily practicable quantification on a large scale is still in its infancy.

Consequently, we want to bring together scientists, practitioners, and stakeholders to present and discuss (i) cutting-edge research in the field of biological slope stabilisation, (ii) new approaches for its quantification, (iii) tops and flops in its practical application, and (iv) needs and wants from the perspective of both practitioners and scientists.

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

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.

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.

4.08 Soil biodiversity and ecosystem functioning: novel approaches for analysing large metabarcoding datasets.

DNA-based approaches such as metabarcoding becomes increasingly popular and represents a very powerful approach for soil biomonitoring and biodiversity assessment. However, the enormous amount of data generated and their great diversity and complexity make their treatment difficult by classical statistical approaches. It is therefore essential to use analytical tools that can handle such data. Machine learning-based methods can better handle such complex data structure and have a huge potential to explain patterns in ecological datasets, but their use in soil biodiversity and biomonitoring studies remains limited. The objective of the session is to evaluate the advantages and limitations of combining metabarcoding and machine learning or other methods for soil biomonitoring and biodiversity studies. This interdisciplinary session will enable a broad range of specialists to interact and work together. Such interactions are highly needed for improving current biomonitoring approaches. We welcome contributions both on novel approaches for analysing large metabarcoding datasets and on respective applications in biomonitoring projects

4.09 Soil biodiversity and ecosystem functioning: soil fauna and soil functions, recent advances.

Halting biodiversity loss in terrestrial ecosystems is one of the United Nations Sustainable Development Goals. Soil fauna diversity (e.g. earthworms, nematodes, arthropods) plays an important role for various soil functions, such as nutrient cycling, soil greenhouse gas flux regulation, soil structure maintenance, and ultimately healthy soil development. However, some soil dwelling animals can also have detrimental effects on crops and natural habitats, and are targeted by pest monitoring programmes. Despite its importance, soil fauna and its functional diversity is underrepresented in scientific research and education. Its monitoring is difficult and data are often biased towards few taxa, have limited spatial and temporal coverage, and the quantitative importance of soil fauna diversity for soil functions and soil health remains largely unknown. This limits our capabilities for the design and implementation of effective biodiversity conservation measures and of land-use practices for sustainable management and restoration of soil health. The goal of this session is to provide a platform a) for the identification of important limitations and advancements in soil fauna diversity research with respect to soil functions, b) to breach gaps between soil fauna research and the needs for practitioners in agriculture, forestry, and nature conservation for soil health maintenance and restoration, and c) for presenting new ideas to involve the general public in soil fauna diversity research, e.g. through data collections, to raise more awareness for the importance of soils. The session should be of interest to soil scientists, agricultural and forest practitioners, and nature conservationists.

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

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.

4.11 Soils and ecosystems in a changing chemical climate.

We have seen in the last decades a drastic change in the chemical climate, away from a S- and N-dominated emission regime to nearly pure N-dominated emissions. Additionally, in the case of the N-emission, the focus has changed from a dominance of oxidized nitrogen to a dominance of reduced nitrogen. Changes in emissions induce changes in immissions and consequently in soils and ecosystems. This leads to an alteration of the retention behaviour of soils and consequently to changes in the leaching of elements from soils to the ground water. Because N and S are essential macro nutrients also the growth and the nutrition of plants are affected. Especially long time series of measurements (emissions, immissions, soil properties, plant nutrition, seepage water chemistry, ...) can document the above mentioned effects and we thus welcome particularly related contributions. In addition, we look for studies dealing with the consequences for ecosystem management, in particular forestry.

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

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.

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).

4.14 Targeting land degradation neutrality!

Economic, political and social implications of SLM and land restoration in the context of desertification.

This session will address natural and technical options to sustainably manage and restore soil functions in drylands. According to the 2030 Agenda, the three dimensions of sustainable development are indivisible; hence, this session will include environmental, social and economic aspects of sustainable land management practices under the umbrella of Land Degradation Neutrality (LDN) and combat of Desertification.
This novel approach of LDN was defined by the Parties to the UN Convention to Combat Desertification as the way to preserve the amount and quality of land resources, to support ecosystem functions and services and enhance food security. For this session we particularly welcome contributions that report on exemplary studies that demonstrate how sharing knowledge (scientific and local knowledge), financial resources, land tenure and long-term involvement of communities supporting SLM practices are crucial to underpin sustainability.
New success stories could be identified and analyzed through indicators related to LDN indicators: land cover, land productivity, and carbon stocks. Therefore the session should be of interest to scientists, and policy and decision makers.

4.15 Targeting land degradation neutrality! Progress, challenges and opportunities in its operationalisation.

This session aims to provide insights into the mechanisms of operationalizing Land Degradation Neutrality (LDN) at national levels and the implications for reporting LDN at the global level. As a target of the Sustainable Development Goal 15 of life on land, various countries committed to achieving LDN, that is, maintaining or enhancing land-based natural capital by balancing its losses with gains. LDN will likely become a focus in national land use and land management policies and strategies. Yet questions remain on how each country will operationalize LDN and how reporting LDN at the global level will account for the differences within and between countries. Further, what metrics are suitable to operationalize LDN in the respective sub-national, national or regional contexts? What have been the experiences in the various target-setting processes of LDN, what are the emerging policy and practice issues, and how are they being addressed? We welcome any contributions reporting on experiences made so far and how LDN is being adapted to the realities of land management and governance in concrete contexts. This session should be of interest to both researchers and practitioners especially from the ministries of environment or agriculture that need to report on LDN and from international organizations.

4.16 Targeting land degradation neutrality! Regional impacts on soils by land abandonment.

In Europe many former agriculturally used areas have been abandoned, especially since the 1950's. Natural vegetation succession has developed on these lands since abandonment, influencing both degradation processes, hydrology and carbon storage. Sometimes also re-afforestation has been applied. However, the impact of land abandonment is strongly dependent on the local climatological and topographical conditions. In drylands abandonment normally leads to increased degradation prior to advanced vegetation development, which can locally take more than 50 years, whereas in humid areas vegetation cover will almost immediately develop. In this session we want to address the spatio-temporal effects of abandonment on degradation processes and status of these soils, and how this knowledge can contribute to reach land degradation neutrality and will affect soil carbon sequestration. Obviously, this is regionally very different, and we would like to invite contributions addressing these issues for this session, from any region in or outside Europe, to discuss the differences and implications for management and how this could contribute to the sustainable development goals.

4.17 Targeting land degradation neutrality! Sustainability and resilience of Mediterranean agroecosystems.

The Mediterranean climatic region, characterized by winter rain and summer drought, has given rise to a unique type of agriculture, intensive and highly specialized. Agriculture has, indeed, a very important socio-economic contribution all around the Mediterranean. Among the most important cash crops farming are grape and olive cultivation, which are both an intensive form of farming resulting in land degradation and biodiversity loss. In addition, soil erosion and runoff, loss of fertility, underground water contamination, are problems faced in this region. Thus, it is imperative to improve and/or restore soil functions in these degraded agroecosystems, as well as to adopt practices that promote their sustainability and resilience. The aim of this session is to focus on land degradation in the Mediterranean basin, due to agricultural practices, and to better understand its impact on soil functions and agroecosystem services (biodiversity; food provision; water flow regulation; water purification). In addition, we seek contributions that come up with natural and technical options to sustainably manage and restore soil functions making these agroecosystems resilient against disturbances such as climate changes. The session should be of interest to soil scientists and stake holders (farmers, managers, policy makers).

4.18 Targeting land degradation neutrality!

The role of an enabling environment and soil organic carbon stock assessing and monitoring approaches.

Land degradation undermines the well-being of 3.2 billion people and costs about 10 per cent of the annual gross world product in loss of species and ecosystems services. Land degradation is defined by the United Nations Convention to Combat Desertification (UNCCD) as "the reduction or loss of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from a combination of pressures, including land use and management practices".

It is recognized in Sustainable Development Goal 15.3: “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 (LDN) is achieved if new degradation is balanced by reversal of degradation elsewhere in the same land type by restoration or rehabilitation. LDN relies on action at three entry-points in the response hierarchy: avoid – reduce – reverse. Attaining LDN requires i) addressing land governance and creating an enabling environment for LDN, ii) monitoring Soil Organic Carbon (SOC) stocks one of three indicators for LDN.
In this session we want to address science based-evidence:
• of the links between Sustainable Land Management (SLM) techniques and approaches and SOC,
• on best options (tools, models), adapted to available expertise, data, etc. for assessing the impact of SLM on SOC in achieving LDN,
• on the configuration of an effective enabling environment for LDN.
These topics will be introduced by UNCCD SPI and we would like to invite contributions from any stakeholder (inter alia, scientists, Civil Society Organizations (CSOs), practitioners) involved in LDN planning and implementation, early careers professional are welcomed. We particularly welcome contributions that report on case studies and experiences addressing one of more of these three topics. Examples from different regions would enrich the session.

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

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.

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.

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 Digital soil assessment – make soil function information available for sustainable soil use.

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 ressources 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.

4.23 Digital soil mapping for reaching land degradation neutrality by 2030.

Successfully achieving global Land Degradation Neutrality (LDN) by 2030 requires good governance. Governance bodies should be provided with reliable, functional and easy-to-interpret data, user-friendly tools and digital products to allow scientifically-based policy decisions of SDG measures, taking into account trade-offs and synergies between LDN and other key ecosystem services. Therefore, soil scientists should evaluate the suitability of the currently recommended set of sub-indicators for quantifying LDN, and propose pathways for reaching LDN. Soil properties data and digital soil mapping (DSM) are key to provide baseline information for LDN. Links with digital assessment of soil and their functions are fundamental, but also the assessment and propagation of their uncertainties.
This session is of interest for all soil scientists and policy makers who want to present and discuss DSM products and approaches for reaching LDN, from the local to global scale. The presented topics will enhance the discussion and evaluation of the current practices and identify pathways to improve the information provided to policy makers.

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

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.

Soil erosion is one of the major soil threats that can affect the ecosystem and human health by removing the top soil 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.

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 later requiring and interdisciplinary approach. Yet it is still difficult to quantify soil it 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.

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.

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.

Soil compaction due to vehicle traffic adversely affects soil functions and ecosystem services, and causes high ecological and economic costs to land owners, 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.

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.

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.

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. 137Cs, 239+240Pu, 210Pbex, 7Be), 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.

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.

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.

4.36 Soils as filters for clean water and the role of geospatial data and technologies in catchment/watershed and landscape planning and management.

This session should be of interest to soil scientists and soil managers and also any stakeholder (policymakers, agricultural practitioners, foresters, planners, environmental NGOs etc.) with an interest in geospatial data and it's use to imrove the sustainabiity of land use and land management, particularly in the context of catchment/watershed and landscape planning and management.
Objectives: 1. Frame the current understanding and the key challenges/opportunities that this area of soil science offers to the SDGs of Clean Water and Sanitation and Life on Land. 2. Highlight developments in geospatial data, technologies and GIS processing/modelling available to soil researchers, managers and other stakeholders. 3. Provide a synthesis of key conclusions of

the potential for this area of soil science to help achieve the SDGs for a range of stakeholders (soil scientists, practitioners, policymakers etc.)

4.37 Spatial and temporal changes in soil information: potential pathways for monitoring soils

Monitoring the change in soil through time across a landscape is fundamental to understanding past and future impacts of management on soil properties and functions. It is also crucial to assessing whether we are meeting Sustainable Development Goals, for example SDG15: Reaching Land Degradation Neutrality by 2030. However, given the cost of acquiring soil observations more research is needed in soil monitoring. The objectives of this session are to present state-of-the-art approaches for all aspects of soil monitoring. This includes both application and methodological research. Possible methodology topics could be monitoring designs, statistical approaches for space-time modelling, integration of process-based models into monitoring approaches, and the utilisation of space-time data cubes (e.g. remote sensing) for improving our predictions.
This session should be of interest to all soil scientists and policy makers, especially those interested in quantifying the trajectory of the change in soil through time to assess the sustainability of the way we manage our precious soil resources.

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.

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.

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.

4.40 Wind erosion problems and preventive measurements.

This session aims to bring together leading experts, scientists, practitioners and researchers in the field of soil erosion by wind. The session will provide an overview and discussion about physical, chemical and ecological issues of wind erosion, preventive measurements against wind erosion, and possible solutions using available technologies for the restoration, mitigation and restoration of degraded land. We will discuss the issues of soil degradation/desertification as a major economic, social and environmental problem as a concern of many countries in all regions of the world, to make the Sustainable Development Goal target of achieving land degradation neutrality by 2030 a national target for action.
During the session we will discuss adopting appropriate conservation practices such as GIS systems for condoling, monitoring all parameters to analyze the soils loss and land susceptibility to wind erosion. Intercropping, establishing water retention basins and building terraces can reduce soil erosion. However, these measures cannot be effective unless risk areas of soil erosion are identified. A quantitative and qualitative approach is therefore required to better identify such risk areas for improving land management. Developing and refining methods for sediment budgeting and tracking is important to identify areas where soil erosion and sediment production are most critical.
Session topics are: Implementation of the SDG priorities; GIS systems for monitoring soils erosion; Modern technologies and models for prevention, mitigation wind erosion negative impact; New global data products for soil erosion by wind; Soil nutrient and productivity losses during wind erosion; Capacity building and training programs for farmers and peasants to prevent soil erosion by wind; Wind-erodible fraction of agricultural lands and top soils.

SDG11 - SUSTAINABLE CITIES

5.01 Cultural heritage of urban and pre-urban soils: archeological approach

Archaeological deposits are oftentimes perceived differently, depending on the disciplinary background of the researcher. In classical archaeology, cultural deposits are an enclosing matrix of artefacts (i.e., material heritage). Hence, formation and transformation processes of the enclosing matrix are commonly not studied by archaeologists, which tend to exclude these aspects from the study site formation. However, geologists, geographers and pedologists who study archaeological deposits are more concentrated with the groundmass (‘matrix’) and stratigraphy, rather than the incorporated artefacts. In paleopedology and pedoarchaeoology, cultural layers are regarded as multicomponent polygenetic soil-sedimentary systems being a product of complex interaction between geogenic (geomorphic, sedimentary, syn-sedimentary pedogenic and diagenetic) processes and related anthropogenic processes. The idea of this session is to bring together specialists of different backgrounds (paleopedologists, archaeologists, paleogeographers etc.) to share their understanding, knowledge and experience regarding archaeological deposits, and to discuss ways of improving interdisciplinary cooperation. Geoarchaeological topics of either theoretical and/or applied methods, as well as new developments and ideas, are very much welcomed.

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

This session A 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.

5.03 Soil quality and quantity:
Innovative approaches of land use plannng and urban development for a sustainable use of soils
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
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; (ii) 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 Well-being for urban people: enhancing ecosystem services provided by urban soils for sustainable cities
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.

5.06 Science-policy interface: how to transfer soil science into laws and policies to safeguard urban soils functions?
In the context of urban expansion threatening fertile peri-urban soils we ask how to transfer the insights of soil science into effective policy decisions and legislation to protect and enhance soil functions, and ensure sustainable soil management, in pursuit of SDG 11

Sustainable Cities and Communities, SDG 13 Climate Action, and the Land Degradation Neutrality (LDN) objective in SDG 15? This will involve exploring answers to the following questions:

- What are the current limitations in the application of existing impact assessment regimes in relation to soils, and in the associated national and municipal decision-making processes? How can these limitations be addressed?
- How might the introduction of tradable land certificates work to achieve land degradation neutrality objectives? What assessment, evaluation and enforcement mechanisms are required?
- What are the science, policy, legislative and implementation challenges involved in payment for ecosystem services (PES) provided by soils, and how might PES relate to the urban and peri-urban setting?

The goals of the session are an exchange of international experience, best practice and research, and identification of possible practical outputs and future work.
Abstracts are invited from participants who wish to take part in a fishbowl session addressing one or more of the above questions.

5.07 Our common soil: towards a new project

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 “handson”, 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".

5.08 Market vs regulation: controversial lines for the implementation of SDG 11

Goals: Urban soils provide multiple functions. But how best to steer their use? Some call for regulation and a strong state while others argue for market mechanisms and believe in incentives. The session gives a platform to advocates and arguments providing insights on the approaches to implement SDG 11, asking the audience to vote for the convincing strategy.
Objectives: Are there convincing arguments favoring either regulation or market based strategies to implement SDG 11 or do we need both? Six advocates provide arguments on three topical soil related SDG 11 topics: 1) Land use [e.g. tradable planning permits vs. spatial planning regulation], 2) Mobility [e.g. subsidized public transport or city toll vs. use restrictions or bans for high emission cars], 3) Urban green ecosystem services (ESS) [e.g. public green spaces and rules for land owners vs. private provision of and access to green ESS]. A final slot brings perspectives together and addresses cross-cutting policy recommendations and research needs. Contributions: Abstracts are invited from individuals, who want to support a good debate by pointing out clear arguments in favour of either a more market or a more regulation based approach to implementing sustainable 1) Land, 2) Mobility and 3) Urban Green ESS in urban development – and then bring together all arguments in the roundtable setting.

5.09 Spatial planning, soil protection/regeneration: good practices

Soil policies main focus lies on the protection of soil, based on the principles of preservation of soil functions, prevention of soil degradation, mitigation of its effects, restoration of degraded soils and integration into other sectoral policies.
From a spatial development point of view, soil protection is as necessary as soil regeneration. In cities and urban environments there is a desperate need to protect valuable greenfields from land grabbing by building promoters and industries. Coupling of soil quality and specific land use is often not considered, although this could result in new opportunities. Of course, soil variability is very high in antropogenic urban areas. This implies good knowledge of soil quality in the area.
How can urban planners and soil scientists work together to protect valuable soil, land and greenfields in these urban areas under spatial pressures. Ambitious spatial planning will be needed to achieve these goals. The main driver to protect land and its soil quality is the policy and governance of the area at siege. Which governance models and specific cases are already present in Europe and how can we learn from each other?

SDG13 – CLIMATE ACTION

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

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 policy-makers and land users.

6.02 Biochar based fertilisers: interactions with plants and soils

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 fertlisers) increase the soil fertility. Indeed, changes in soil biology, physics and chemistry have been reported when biochar has been pre mixed 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 fertilitisers 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

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 (CO2) and nitrous oxide (N2O). 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 Co2-compensation for the benefit of peatland rewetting

The session is dealing with a Europe-wide relevant topic. In the context of climate change and under the Paris climate agreement, natural CO2 sinks, such as organic soils, are becoming increasingly important. It is therefore important to 1. exchange existing experiences and 2. build consensus on how to manage different practices.
The aim of an international dialogue is to enhance and promote CO2-compensation through peatland rewetting and raise the topic on political agendas.
The session is dealing with the following questions:

- CO2 Certificates of rewetted peatlands on the (voluntary) carbon market – different designs
- Mitigation potential of peatlands under agricultural production – a big and cheap (?) potential for the agricultural sector
- Methods of quantification of peat loss and peat growth
  (Tagungsthema 26.4. Berlin, Deutsche Gesellschaft für Moor- und Torfkunde)

6.05 Estimating the carbon sequestration potential of soils : scales and approaches

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 conveners: E Lugato JRC. A. Don Thunen institute

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

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.

6.07 Identifying processes and management practises for sustained usage of organic soils

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.

6.08 Machine learning to support soil and environmental policy making
Effects of climate change are becoming more severe and put a threat to agricultural productivity. To safeguard the production of sufficient food and to meet multiple SDG's, sustainable soil management is essential. Policy makers ask scientists and farmers to operationalize these ambitions and to deliver indicators for monitoring sustainable soil management. The last two decades, the amount of available soil and water data has grown extensively. Together with this growth, the interest in data driven machine learning algorithms has increased. We will focus on the application of machine learning within the field of soils science to support policy making. Presenters will first show how they applied machine learning in their own research to contribute to an SDG in direct link with policy making. After the presentations the audience can bring forward their own challenges and selected challenges will be discussed with the experts. This session should be of interest to soils scientist who want to incorporate the ever growing amount of data in their research and to those who want to get a grasp of the possibilities of current machine learning algorithms in the soil science-policy domain.

6.09 Managing soils functions to mitigate and adapt to climate change
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.

6.10 Mitigation of greenhouse gas emissions from organic soils
Globally, 10–20% of peatlands have been drained for agriculture or forestry, and these emit 6% of global CO2 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.

6.11 New frontiers in soil carbon storage: optimizing interactions between biotic and abiotic properties across scales
Increasing soil carbon storage is a promising hotly debated route for mitigating climate change by reducing CO2 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.

6.12 Permafrost soils in a warming world: inter-disciplinary approaches to better tackle impacts of high-latitude alterations
Climate change is modifying Arctic and subarctic regions at unprecedented rate. Permafrost is undergoing widespread degradation that strongly alters hydrological and biogeochemical cycles. Because what happens in the Arctic does not stay in the Arctic, there is a need to better understand how these modifications will further affect global cycles. 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. In this session, interdisciplinary approaches will be highlighted to better tackle the global impacts of high-latitudes critical zone alterations. This session aims at gathering scientists studying Arctic and subarctic critical zones. Contributions crossing soil sciences with a wide span of disciplines, ranging from hydrology, biogeochemistry, microbiology, or geomorphology, are welcome.

6.13 Permafrost soils under climate change – connecting soil functions and human activity
Soils in boreal and polar regions face tremendous alterations due to a fast-changing climate. The thawing of permafrost has strong effects on biogeochemical cycles possibly increasing trace gas emissions and inducing a positive feedback on global climate change. 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 fundamental soil functioning (biogeochemistry, microbiology, plant-soil interactions) to impacts of thermokarst erosion and new avenues in Arctic agriculture.
Let's come to together and share results, views and concepts to better connect the knowledge of soils and biogeochemical cycling at the poles and human activity.

6.14 Predicting som dynamics on larger scales. What are the greatest obstacles?
The demand on soil to adapt to and mitigate climate change is getting more into focus of stakeholders. Available SOC models differ in their representation of the carbon cycle in the soil. A so far less considered problem is the coupling with the Nitrogen cycle that may restrict further SOM increase due to water quality regulations. Urgent questions are: How good are our SOM predictions, how sound are our recommendations? Where are the biggest uncertainties, how can we handle them?
This will be discussed within four thematic blocks (with examples):
1. Calculation of Matter Input: C and N input from different plants / organic amendments. Transferability of crop growth parameters. Upscaling methods.
2. Structure of SOM models: Amount, Interconnection and Initialisation of SOM pools. Variability of turnover times.
3. Response on Environmental conditions: Reasonable temporal resolution. Parameter sensitivity.
4. site-specific target value of SOM content for productive soils: "one-time gain, all-time cost". pressure on N cycle.
The session should be of interest to all stakeholders, soil and agricultural scientists, who want to contribute to these discussions.

6.15 Pyrogenic organic matter in soils: stocks, degradation and transport processes
Fires convert a substantial fraction of the vegetation into pyrogenic organic matter. It is more resistant to environmental degradation than unburnt biomass and can act as a long-term carbon sink. Some remains for centuries to millennia in the environment, not statically but changing form and moving between terrestrial and aquatic pools. They are present in all compartments of the Earth: air, soils, sediments, rivers, and oceans. Despite its global importance, our understanding is still limited. Simple questions related to stocks, dynamics or age remain partially unknown. In particular, in soils, pyrogenic matter follows different dynamics than fresh organic inputs. for example, biological decomposition may be less predominant than for litter, while abiotic processes like lateral transportor solubilisation may be of major importance. This session aims at presenting our current knowledge about pyrogenic carbon stocks, degradation, stabilisation and transport in the soils. The session should be of interest to soil scientists interested in soil organic matter dynamics and policy makers interested in implementing global change solutions in soil management.

6.16 Soil archives to understand future changes of climate, landscapes, and the pedosphere
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 Soil biodiversity and carbon storage - how we can use soil biota to mitigate climate change
In this session we want to draw attention to the relationship between soil biodiversity and its capacity to store carbon in the context of mitigating climate change. Soils contain large proportion of global carbon pool. It is as the same time the most biologically diverse component of living organisms whose functional value includes nutrient and carbon cycling and soil structure modifications, and who influence soil fertility and for example water retention. Here we want to discuss studies and ideas that combine soil biodiversity to soil carbon pools as well as think of ideas how to modify/restore the soil biodiversity to optimize the carbon storage potential of each soil. ;We propose three conveners for this session, each with different background and expertise: Dr. S. Emilia Hannula (Netherlands Institute of Ecology, Wageningen, the Netherlands), Dr. doc. Jussi Heinonsalo (INAR Institute for Atmospheric and Earth System Research, University of Helsinki, Finland),Dr. Kyle Mason-Jones (Netherlands Institute of Ecology, Wageningen, the Netherlands)

6.18 Soil organisms: allies for enhancing sustainable use of soils and climate change adaptation
Soil organic matter (SOM) plays a crucial role in climate change mitigation and adaptation. The joint effort among soil ecologists, modellers and biogeochemists within COST Action ES1406 has pointed out the key role of soil fauna in carbon storage capacity, nutrient cycling and hydrology. The importance of soil organisms to ecosystem services is often overlooked, and must be taken into account in future land management strategies. Nature-based solutions are required to facilitate sustainable use and conservation of soils, including adaptation and resilience to climate change. Scientific synthesis of the current understanding of soil organisms-SOM interactions is needed, and guidelines for future experimentation and best regenerative practices to exploit soil multifunctionality have to be developed, tested and validated. Through an innovative multidisciplinary approach, region-specific land management practices should be proposed. The session would be of interest to soil scientists, policy makers and related end users in the domain of SOM management and climate change. A cost-effective sustainable land use and SOM restoration strategies are needed.

OVERARCHING TOPIC

O1 Let's bring soil science to classrooms – together we plan a school project on "soil means life"

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.

O2 Soil science skills for the future

This session aims at bringing together all stakeholders to share their views on what will be the expected skills of the future soil science professionals. Upstream contributors such as educators involved in initial or continuous education programs could present the anticipated evolutions of the student curricula they manage, whether they concern the training of researchers, engineers, managers, technicians, etc. Downstream contributors such as companies, NGOs, regional and local authorities could express the needs they identify according to excepted evolution of markets, legislations…Three reasons for selecting this session:-Get to know what could be the potential jobs of soil scientists in the future-Exchange with various stakeholders-Contribute to shape the future of soil science education!