Food and Agriculture Organization of the United Nations

CONCEPT NOTE and AGENDA

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GLOBAL SYMPOSIUM ON

SOIL ORGANIC CARBON

UNLOCKING THE POTENTIAL OF MITIGATING AND ADAPTING TO A CHANGING CLIMATE

#GSOC17

itps INTERGOVERNMENTAL TECHNICAL PANEL ON SOILS

ipcc INTERGOVERNMENTAL PANEL ON climate change WHO UNEP

UNCCD SPI Science - Policy Interface

UNCCD United Nations Convention to Combat Desertification

World Meteorological Organization

GLOBAL SOIL PARTNERSHIP

CONCEPT NOTE

GLOBAL SYMPOSIUM ON

SOIL ORGANIC CARBON
(GSOC17)

Co-organized by FAO, GSP/ITPS, IPCC, UNCCD-SPI and WMO

21 – 23 MARCH 2017
FAO HQ, ROME, ITALY

www.fao.org/about/meetings/soil-organic-carbon-symposium

INTRODUCTION

In the presence of climate change, land degradation and biodiversity loss, soils have become one of the most vulnerable resources in the world.[1] Notwithstanding the enormous scientific progress made to date, protection and monitoring of soil resources at national and global levels still face complicated challenges impeding effective on-the-ground policy design and implementation that varies widely from region to region. There is still insufficient global support for the protection and sustainable management of the world's soil resources.

Soils host the largest terrestrial carbon pool [2] and play a crucial role in the global carbon balance by regulating dynamic bio-geochemical processes and the exchange of greenhouse gases (GHG) with the atmosphere.[3] Soil organic carbon (SOC) stocks amount to an estimated 1,500 ±230 GtC in the first meter of soil, nearly twice as much as atmospheric carbon (828 GtC as CO_2).[4] After the burning of fossil fuels, land use and land cover change (which includes agriculture) is the largest anthropogenic source of carbon into the atmosphere[5] and within agriculture, soils have been a global net source of GHGs.[6] These processes and emissions are strongly affected by land use, land use change, vegetation cover and soil management. SOC stocks in the upper soil layers (800 GtC in 0-40 cm)[7] are especially sensitive and responsive to such changes in land use and management, which provides an opportunity to influence the amount of CO_2 in the atmosphere. This can be achieved by maintaining existing soil carbon stocks (of particular importance in soils with high SOC content), or by soil carbon sequestration.

Soil organic matter (SOM) comprises a complex and continuous mixture of partially decomposed organic substances derived from plant litter, as well as faunal and microbial biomass.[8] As such, SOM plays a crucial role in many soil functions and ecosystem services such as buffering against climate change, supporting food production, regulating water availability, and more. Changes in the quality and/or quantity of SOM affects the capacity of soils to perform these ecosystem services and needs careful management. SOM is composed of roughly 58% carbon[9] which corresponds to SOC and is influenced by microbial activity, accessibility of organic residues to microbes, various site conditions and management practices. Managing SOC through sustainable agricultural and land use practices has become a widely acknowledged strategy to restore healthy soil properties to combat land degradation and desertification, and enhance the resilience of agro-ecosystems to environmental shocks.[10]

SOC pools differ, however, based on their biochemical stability (i.e. labile, recalcitrant and inert), decomposition rate (i.e. fast-active, slow-intermediate and very slow/passive/inert) and turnover time (i.e. short, long, very long).[11] When considering the effect of land management practices on SOC levels, therefore, the study of SOC stabilization (i.e. carbon associated with recalcitrant, very slow, passive and inert fractions) and destabilization (i.e. carbon associated with fast-active, and labile fractions) mechanisms are essential to determine the true effect on GHG emissions and SOC sequestration.[12]

1 FAO and ITPS. 2015. Status of the World's Soil Resources (SWSR) – Technical Summary. Food and Agriculture Organization of the United Nations and Intergovernmental Technical Panel on Soils, Rome, Italy

2 Scharlemann et al. 2014. Global soil carbon: understanding and managing the largest terrestrial carbon pool. http://www.tandfonline.com/doi/abs/10.4155/cmt.13.77

3 Lal. 2013. Soil carbon management and climate change. http://dx.doi.org/10.4155/cmt.13.31

4 Le Quéré, C., et al. 2016. Global Carbon Budget 2016. Earth Syst. Sci. Data, 8(2): 605-649.

5 IPCC. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge and New York (2014).

6 Lal. 2013. Soil carbon management and climate change. http://dx.doi.org/10.4155/cmt.13.31

7 Le Quéré, C., et al. 2016. Global Carbon Budget 2016. Earth Syst. Sci. Data, 8(2): 605-649.

8 Totsche, K.U., Rennert, T., Gerzabek, M.H., Kögel-Knabner, I., Smalla, K., Spiteller, M., Vogel, H.-J., 2010. Biogeochemical interfaces in soil: the interdisciplinary challenge for soil science. J. Plant Nutrit. Soil Sci. 173, 88–99

9 Pribyl. 2010. A critical review of the conventional SOC to SOM conversion factor. http://dx.doi.org/10.1016/j.geoderma.2010.02.003

10 UNCCD-SPI. 2015. Pivotal Soil Carbon. Science-Policy Brief 01. http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/2015_PolicyBrief_SPI_ENG.pdf

11 Uta Stockmann, Mark A. Adams, John W. Crawford, Damien J. Field, Nilusha Henakaarchchi, Meaghan Jenkins, Budiman Minasny, Alex B. McBratney, Vivien de Remy de Courcelles, Kanika Singh, Ichsani Wheeler, Lynette Abbott, Denis A. Angers, Jeffrey Baldock, Michael Bird,Philip C. Brookes, Claire Chenu, Julie D. Jastrow, Rattan Lal, Johannes Lehmann, Anthony G. O'Donnell, William J. Parton, David Whitehead, Michael Zimmermann. 2013. The knowns, known unknowns and unknowns of sequestration of soil organic carbon. Agriculture, Ecosystems and Environment. 164, 80– 99.

12 Susan E. Trumbore and Claudia I. Czimczik. 2008. An Uncertain Future for Soil Carbon. Science. 10, 1126.

The 2015 Status of the World's Soil Resources report[13] highlights that more carbon resides in soil than in the atmosphere and all plant life combined. However, roughly 33% of the world's soils are degraded, which has led to large losses of SOC. Soils from various global agroecosystems (i.e. croplands, grazing lands, rangelands, peatlands, etc.) have lost 25–75% of their original SOC pool, depending on climate, soil type, and historic management.[14]

This amounts to 42 to 78 Gt of carbon, of which 18 - 28 Gt have been lost through desertification. These losses provide an opportunity: the recoverable carbon reserve capacity of the world's agricultural and degraded soils is estimated to be between 21 to 51 Gt of carbon. As such, SOC is included in the monitoring of SDG indicator 15.3.1, under which carbon stocks above and below ground is one of three sub-indicators to determine the proportion of land that is degraded over total land area. Addressing the increasing trends in soil and land degradation is a core challenge for sustainable development since degradation processes have adverse impacts on ecosystem services provided by soils, especially food security, water quality and availability, human health, and social and economic activities. Slowing or stopping soil degradation is a key factor in sustainable land management and mitigating desertification, land degradation and the impacts from drought.

The reversal of soil degradation through the build-up of SOM and the sustainable management of land and soils offers large potential to improve the performance of agriculture and forestry in climate change adaptation and mitigation as reported in the climate change assessments[15] and in national greenhouse gas inventories. This should be accompanied by action to reduce further soil carbon losses by addressing the drivers of degradation.

The role of soils and SOC in the climate system and in the context of climate change adaptation and mitigation has been widely recognized and validated in various studies, both experimentally and through modelling.[16] However, large-scale baseline and trend assessments are still inaccurate and many of the factors determining SOC quality and quantity in different parts of the world, as affected by climate change and measures to enhance SOC, are insufficiently investigated.[17]

Guidelines for the assessment of SOC and stock changes in the context of GHG emissions have been developed by the Intergovernmental Panel on Climate Change (IPCC).[18] However, reporting on the status and trends of SOC based on measurements is a challenging task which needs to be tackled through harmonized methodologies, the use of standardized sampling and modeling techniques, harnessing innovative solutions to data collection and sharing, and considering different field practices implemented by farmers at different scales. Initiatives aimed at improving information on the status of SOC can constitute a unique option to reinforce the current IPCC assessments and for reporting to the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Convention to Combat Desertification (UNCCD) and SDG 15.3.

The Global Soil Partnership (GSP) and members of the Food and Agriculture Organization (FAO) of the United Nations are currently working on the establishment of the Global Soil Information System as a tool for countries to regularly monitor the national soil condition. At the same time, in contribution to the sustainable development goal (SDG) indicator 15.3.1, the GSP is developing a Global Soil Organic Carbon (GSOC) map for finalization by December 2017. The GSOC map will be compiled from national SOC maps that are being developed by member countries according to agreed product specifications and which will be shared with the Global Soil Information System.

13 FAO and ITPS. 2015. Status of the World's Soil Resources (SWSR) – Technical Summary. Food and Agriculture Organization of the United Nations and Intergovernmental Technical Panel on Soils, Rome, Italy

14 Lal, 2013. Soil carbon management and climate change. http://dx.doi.org/10.4155/cmt.13.31;

15 Smith et al. 2014. Chapter 11: Agriculture, Forestry and Other Land Use (AFOLU). In Climate Change 2014: Mitigation, Edenhofer et al (Eds). Cambridge University Press: Cambridge, UK, 2014.

16 Lal, 2013. Soil carbon management and climate change. http://dx.doi.org/10.4155/cmt.13.31;
Frelih-Larsen et al. 2014. Soil carbon management for climate change mitigation and adaptation: framing and integrating the issue in the evolving policy environment. http://ifsa.boku.ac.at/cms/fileadmin/Proceeding2014/WS_3_1_Frelih-Larsen.pdf
Scharlemann et al. 2014. Global soil carbon: understanding and managing the largest terrestrial carbon pool. http://www.tandfonline.com/doi/abs/10.4155/cmt.13.77;
UNCCD-SPI. 2015. Pivotal Soil Carbon. Science-Policy Brief 01. http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/2015_PolicyBrief_SPI_ENG.pdf

17 Scharlemann et al. 2014. Global soil carbon: understanding and managing the largest terrestrial carbon pool. http://www.tandfonline.com/doi/abs/10.4155/cmt.13.77

18 IPCC. 2006. IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Agriculture, Forestry and Other Land Use

These initiatives could provide valuable information to support the IPCC Sixth Assessment Report (AR6) and its products by contributing to the Methodology Report(s) to refine the 2006 IPCC Guidelines for National Greenhouse Gas Inventories as decided by the 44th Session of the IPCC (Decision IPCC/XLIV-L.3).[19]

During the 5th Working Session of the Intergovernmental Technical Panel on Soils (ITPS) of the Global Soil Partnership (GSP), the ITPS focused on establishing collaboration with the IPCC, UNCCD-SPI[20] and IPBES[21]. Within this context, the ITPS and the Acting Secretary of the IPCC discussed the importance of SOC in the climate change debate, with the Acting Secretary expressing the view that soils are currently only indirectly addressed in the IPCC assessment reports (ARs) and that it would desirable to incorporate the topic of SOC in the IPCC ARs, from AR6 onwards.[22] AR6 will be finalized in time for the first UNFCCC global stock take when countries will review progress towards their goal of keeping global warming below 2°C.

The ITPS and the Acting Secretary of the IPCC, supported by FAO, agreed to explore the option of a jointly organized Global Symposium on Soil Organic Carbon during the first quarter of 2017 as a common platform to discuss and elaborate the latest information on the role of soil and SOC in the climate change agenda. The UNCCD and its Science-Policy Interface (SPI) and the World Meteorological Organization (WMO) agreed to co-sponsor GSOC17 in light of the important contribution that maintaining and enhancing SOC can make to meeting the objectives of land degradation neutrality, reducing GHG emissions, and enhancing climate change adaptation.

19 IPCC. 2016. Sixth Assessment Report (AR6) Products. Outline of the Methodology Report(s) to refine the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. https://www.ipcc.ch/meetings/session44/l3_adopted_outline_methodology_report_guideline.pdf

20 UNCCD-SPI = Science-Policy Interface (SPI) of the United Nations Convention to Combat Desertification (UNCCD)

21 IPBES = Intergovernmental Platform on Biodiversity and Ecosystem Services

22 FAO, ITPS. 2016. Report of the Fifth Working Session of the Intergovernmental Technical Panel on Soils. http://www.fao.org/3/a-bl137e.pdf

AIM AND OBJECTIVES

The overall **aim** of the symposium is to review the **role of soils and SOC** in the **context of climate change** and sustainable development and build scientific evidence that could be **assessed in the regular IPCC Assessment Reports**, starting with the AR6 report and other reports to be produced during the 6th assessment cycle, as well as reporting to UNFCCC, UNCCD and on the SDGs.

Specifically, the symposium outcomes should provide crucial information that could contribute to:

- the refinement of methodologies for reporting on SOC as outlined in Volume 4 (Agriculture, Forestry and other Land Use) of the *Outline of the Methodology Report(s) to refine the 2006 IPCC Guidelines for National Greenhouse Gas Inventories* which was adopted by decision IPCC-XLIV/L.3 during the 44th Session of the IPCC;
- the Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security and Greenhouse Gas Fluxes in Terrestrial Ecosystems (SR2) agreed during the 43rd Session of the IPCC; and
- the Land Degradation Neutrality Target Setting Programme implemented by UNCCD.

The specific objectives of the symposium are to:

1. Examine the current scientific and technical understanding of the role of soils and SOC in the climate system for carbon sequestration and climate adaptation;
2. Review the potential and limitations of SOC management to contribute to climate change mitigation and adaptation, addressing land degradation, and meeting the sustainable development goals;
3. Review current knowledge on land and soil management impacts on SOC (and SOC stabilization and destabilization mechanisms), including identification of practices that increase SOC;
4. Enable and strengthen the provision of knowledge on SOC measurement, modeling and management, and the interlinkages with land degradation and climate change to inform upcoming IPCC assessment reports and reports to initiatives addressing land degradation;

5. Identify knowledge gaps and explore opportunities for collaborative research;
6. Identify policy options for relevant soil and SOC priorities to encourage the adoption of practices that enhance SOC sequestration and stabilization under national climate change agendas.

EXPECTED OUTPUT

The **symposium output** will be a scientific document highlighting the role of soils and SOC management in meeting the climate change and sustainable development agendas that could be assessed by IPCC in its regular reports, starting with SR2, the refinement of the inventory guidelines, and AR6, as well as reporting to UNFCCC, UNCCD and the SDGs. The document will present an overview of the state-of-the-art in SOC monitoring and reporting, measures to maintain and enhance SOC, and recommendations for managing SOC in agroecosystems of special interest (carbon rich soils, grasslands and livestock production systems, and drylands). The ITPS, UNCCD-SPI and WMO will offer to present the workshop output to the IPCC for consideration by its AR6 Scoping Meeting scheduled for early May 2017.

SYMPOSIUM STRUCTURE

The Symposium will be a scientific meeting, held over three (3) days at FAO Headquarters in Rome, Italy from 21-23 March 2017 with **300-500 participants** representing all regions of the world.

The meeting will open with plenary addresses by representatives of the hosting organizations, presenting the policy context, relevance of SOC and outcomes sought from the symposium:

- IPCC Presentation: Key findings of the AR5 on agriculture, soil and SOC; expectations/needs for SR2, refinement of the inventory guidelines, and AR6;
- ITPS Presentation: Key aspects of soils and SOC to be considered in regular IPCC assessments;
- SPI presentation: Importance of soil and increasing SOC in achieving Land Degradation Neutrality (LDN).

Keynote presentations will be given by invited leading SOC experts in relation to the following main themes (the themes are further elaborated under Item 6):

- **Theme 1**: Measuring, mapping, monitoring and reporting SOC;
- **Theme 2**: Maintaining and/or increasing SOC stocks (fostering SOC sequestration) for climate change mitigation and adaptation, and Land Degradation Neutrality;
- **Theme 3**: Managing SOC in soils with a) high SOC-peatlands, permafrost, and black soils[23] b) grasslands, and livestock production systems and c) in dryland soils.

PARALLEL SESSIONS

will be held per the above three themes, to be organized by session conveners. The format of the parallel sessions will be determined by the conveners (in close collaboration with the organizing and scientific advisory committees) to ensure the themes are sufficiently presented and discussed to compile the main outcomes and key aspects that could be assessed by IPCC in its regular reports, starting with SR2 and AR6, the revision of the 2006 IPCC guidelines for national GHG inventories, and the implementation of LDN.

ABSTRACTS AND PAPERS

for key topics (as identified by the organizing and scientific advisory committees) will be invited to support the above themes and incorporate case studies from different countries. Guidelines for the preparation of abstracts and papers will be provided.

PARTICIPANTS

will include representatives from FAO member states, UNCCD country Parties, organizing institutions, relevant Panels, presenters whose abstracts are accepted and scientists and practitioners working in related fields.

23 Black soils, scientifically known as Mollisols (in the USDA Soil Taxonomy) and Chernozems/ Kastanozems/ Phaeozems (in the WRB classification system), comprise deep soils with very high soil organic carbon content (between 7 and 15%).

SYMPOSIUM COMMITTEES

The following Committees will be established:

ORGANIZING COMMITTEE:

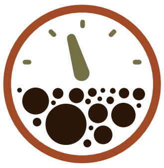
Comprised of representatives from each of the co-organizing bodies (FAO/GSP/ITPS, IPCC, UNCCD-SPI and WMO). It will oversee the overall organization of the Symposium, guide the formats of the parallel sessions, and oversee the finalization of the Symposium outcomes.

SCIENTIFIC COMMITTEE:

Comprised of representatives from the relevant panels, as well as additional leading experts in the four main themes. The Committee is responsible for evaluating submitted abstracts and papers, as well as ensuring the scientific quality of the parallel sessions and Symposium outcomes.

SYMPOSIUM THEMES AND KEY QUESTIONS TO BE ADDRESSED

Based on the listed objectives, the symposium will focus on three major themes to collate relevant information as elaborated below. In order to address the objectives, the main questions to be addressed during the symposium are listed under each theme.



THEME 1: MEASURING, MAPPING, MONITORING AND REPORTING SOC

National monitoring and reporting of SOC is becoming increasingly important in fulfillment of global Conventions and initiatives. For example, under the IPCC, national SOC stocks and stock changes are assessed annually in relation to GHG emissions according to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.[24] However, these Guidelines need to be updated[25] to provide a sound scientific basis for future international climate action, especially under the Paris Agreement[26] (which will come into effect in 2020). The IPCC will therefore produce a Methodology Report by 2019 as supplement (not full revision) to be used in conjunction with the 2006 IPCC Guidelines. This Report will 1) provide supplementary methodologies for GHG sources and sinks to fill information gaps and incorporate new technologies and information, 2) provide updated default values of emission factors and 3) provide additional or alternative up-to-date information and guidance as clarification of the existing Guidelines.[27] Under the Agriculture, Forestry and Other Land Use (AFOLU) section the Methodology Report will address the following issues in terms of changes in soil carbon stocks:[28]

- Update reference carbon stocks in soils;
- Develop new guidance for the Tier 2 methodology for mineral soils that requires less activity data than the current default method;
- Elaborate the Tier 3 methodologies with case study examples for soils.

With the development of the SDGs, SOC has the potential to be a globally relevant and feasible indicator to monitor trends of land and soil degradation since SOC stock is related to many fundamental soil functions, it serves as an important indicator of soil health and it is at the nexus of many soil-derived ecosystem services.[29] Under SDG 15.3.1 specifically, carbon stocks above and below ground is listed as sub-indicator to measure the spatial extent of degraded land as percentage of total land area.[30] As a step in developing a global product for SDG 15.3.1, the GSP/ITPS is developing a global soil

24 IPCC. 2016. Sixth Assessment Report (AR6) Products. Outline of the Methodology Report(s) to refine the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. https://www.ipcc.ch/meetings/session44/l3_adopted_outline_methodology_report_guideline.pdf

25 https://www.ipcc.ch/

26 United Nations. 2015. Paris Agreement. Available online at http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf

27 IPCC (2016). Report of IPCC Scoping Meeting for a Methodology Report(s) to refine the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Eds: Ngarize, S., Kranjc, A., Baasansuren, J., and Shermanau, P. Report of the IPCC Scoping Meeting, Pub. IGES, Japan.

28 IPCC. 2016. Sixth Assessment Report (AR6) Products. Outline of the Methodology Report(s) to refine the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

29 Lorenz, K. and Lal, R. 2016. Soil Organic Carbon – An Appropriate Indicator to Monitor Trends of Land and Soil Degradation within the SDG Framework? TEXTE 77/2016. Project No. 55337 Report No. 002413/ENG. Umweltbundesamt, Germany. Available at: http://www.umweltbundesamt.de/publikationen

30 http://www.unccd.int/Lists/SiteDocumentLibrary/Rio+20/LDN%202016/UNCCD%2015.3.1%20metadata%2004%20March%202016.pdf

organic carbon map which will be compiled from nationally produced SOC stock maps. This approach is implemented within the framework of the Global Soil Information System under the GSP using SOC stock calculations and reporting scales based on the 2006 IPCC Guidelines.[31] However, considering that SOC stock is an indirect parameter to measure land and soil degradation, several associated challenges would need to be addressed such as 1) the limited readily available datasets on SOC stock at national and regional levels, 2) the uncertainties associated with the suitability of existing data for monitoring SOC stock changes, and 3) insufficient quantitative evidence linking SOC stock changes to the various land and soil degradation drivers and processes.[32]

A further point of consideration within the context of SOC monitoring is the measuring, reporting and verification (MRV) which is aimed at tracking countries' progress in terms of climate change mitigation.[33] This includes all measures taken by states to collect data on emissions, mitigation actions and support. However, the MRV term is used very broadly and there is often no clear reference to the type of MRV needed, used or discussed. This often leads to confusion since the underlying nature of MRV-related activities differs according to their context and application. The main types of MRV related to SOC focuses on GHG emissions rather than SOC stocks per se. This begs the question whether specific MRV guidelines are necessary to assess SOC stocks and stock changes in relation to not only climate change, but also land degradation related reporting.

KEY QUESTIONS:

1. What are the latest and reliable reference values for soil carbon stocks, and stock change factors based on country- or region-specific data for the most important land uses to be updated in the 2006 IPCC Guidelines?
2. What are the recent developments in reliable methods and models to quantify SOC stocks and stock changes and how can these be best applied for SOC measurement and monitoring?
3. How can the uncertainties of SOC stock and stock change estimates be reduced?
4. Should specific MRV guidelines be developed to track SOC stocks and stock changes and if yes, what are the main methodological considerations?

THEME 2: MAINTAINING AND/OR INCREASING SOC STOCKS (FOSTERING SOC SEQUESTRATION) FOR CLIMATE CHANGE MITIGATION AND ADAPTATION, AND LAND DEGRADATION NEUTRALITY

Maintaining and increasing SOC stocks is critical not only to reduce GHG emissions and remove CO_2 from the atmosphere, but also to harness the benefits of increased SOC (and SOM) in the soil in terms of soil health and fertility and increasing its water holding capacity. Even though soils host the largest terrestrial carbon pool,[34] soil degradation, land use and land use change has resulted in soils having lost 25-75% of their original organic carbon pools.[35] Further SOC losses need to be prevented to maintain existing levels, especially in high-carbon soils, while the potential to restore SOC stocks to at least part of its former levels through carbon sequestration needs to be harnessed.

This session will bring together leading scientists and experts to discuss scientific evidence to determine the i) global potential to maintain and/or sequester SOC and the associated levels of uncertainty of achieving this potential, ii) upper limits to SOC sequestration potential (saturation levels), iii) SOC quality and long-term stability and the associated sustainability of SOC sequestration, iv) benefits of SOC sequestration for climate change adaptation and mitigation and for achieving LDN, and v) policy considerations to support or promote SOC sequestration.

31 GSP/ITPS. 2016. GSP Guidelines for sharing national data/information to compile a Global Soil Organic Carbon (GSOC) map. Available online at http://www.fao.org/3/a-bp164e.pdf

32 Lorenz, K. and Lal, R. 2016. Soil Organic Carbon – An Appropriate Indicator to Monitor Trends of Land and Soil Degradation within the SDG Framework? TEXTE 77/2016. Project No. 55337 Report No. 002413/ENG. Umweltbundesamt, Germany. Available at: http://www.umweltbundesamt.de/publikationen

33 UNFCCC, 2014. Handbook on Measurement, Reporting and Verification for developing countries, Bonn: s.n.

34 Scharlemann et al. 2014. Global soil carbon: understanding and managing the largest terrestrial carbon pool. http://www.tandfonline.com/doi/abs/10.4155/cmt.13.77

35 Lal, 2013. Soil carbon management and climate change. http://dx.doi.org/10.4155/cmt.13.31;

KEY QUESTIONS:

1. What is the global potential to achieve SOC sequestration across land uses and what is the level of uncertainty associated with achieving this?
2. What are the upper limits (potential saturation levels) to SOC sequestration potential?
3. What is the long-term stability of SOC and its components and what is the long-term sustainability of SOC sequestration?
4. Is there sufficient scientific evidence to establish whether SOC sequestration contributes to climate change adaptation, mitigation and achieving LDN?
5. How can policies support the adoption of practices that foster SOC sequestration and how can scientific evidence be packaged to inform such policies?

THEME 3:
MANAGING SOC IN SOILS A) WITH HIGH SOC - PEATLANDS, PERMAFROST, AND BLACK SOILS B) GRASSLANDS, AND LIVESTOCK PRODUCTION SYSTEMS AND C) IN DRYLAND SOILS.

A well-documented aspect of SOC management to maintain and/or increase SOC stocks is the site-specific nature of potential SOC stock changes as affected by, amongst others, climate, landscape, soil type, land use, land use change and soil management practices. This Theme will be addressed in three parallel sub-themes to discuss the context of maintaining and/or increasing SOC stocks under specific soil or land use conditions. Discussions will focus on scientific evidence in support of i) prioritizing soils to be conserved to maintain existing SOC stocks, ii) the potential to sequester SOC as a function of local soil and climate conditions, degradation status and land use (i.e. theoretical versus realistic SOC sequestration potential and the degradation threshold where SOC sequestration is no longer feasible), iii) potential derived ecosystem services and co-benefits of SOC sequestration, and iv) proven management practices that prevent SOC losses and foster long-term SOC sequestration.

a) Soils with high SOC – peatlands, permafrost and black soils

When considering the maintenance of existing SOC levels, soils with inherently high organic carbon content (such as peatlands, permafrost soils and so-called black soils which are broadly defined as *all soils containing a mollic horizon*[36]) are especially important in the context of climate change. This is mainly due to their potential as source of carbon emissions (especially CO_2 and CH_4) despite the fact that these soils do not cover a large portion of the global land area (of the global land surface, peatlands cover roughly 3%[37] and black soils an estimated 7% of the ice-free land surface[38]). Globally, peatlands alone are estimated to contain twice as much carbon as all the world's forests combined and four times as much as the atmosphere.

At the same time, many of these soils have inherently high productivity and fertility, have high relevance for food security and are therefore often extensively farmed. Within this context these soils also have significance as potential SOC sinks through improved management practices in areas where historical SOC losses have occurred. There is still significant uncertainty about the carbon stocks and flows within high SOC soils however, since their extent, status and dynamics have not been estimated and mapped with sufficient accuracy.

b) Soils in grasslands and livestock production systems

Grassland soils are considered to have substantial potential to sequester carbon through improved grassland management practices or rehabilitating degraded grasslands. At the same time such practices often enhance productivity and tend to enhance the resilience of grasslands to climate variability. However, grassland carbon sequestration faces a number of challenges such as slower rates of

36 The International Network of Black Soils will be launched during GSOC17 under the auspices of the GSP to promote the conservation and ensure the long-term productivity of these soils through sustainable soil management.

37 Joosten, H., Tapio-Biström, M.-L., Tol, S. (2012): Peatlands - guidance for climate change mitigation by conservation, rehabilitation and sustainable use. Mitigation of climate change in agriculture Series 5. FAO and Wetlands International, Rome. 114 p.

38 Liu, X., Lee Burras, C., S. Kravchenko, Y., Duran, A., & Huffman, T. (2012). Overview of Mollisols in the world: distribution, land use and management. Canadian Journal of Soil Science.

sequestration compared to forestry and agricultural sequestration, difficulty in measuring changes in SOC stocks, costs of implementation are not well quantified and scientific information to inform policy analysis is less complete. At the same time, the opportunities to benefit from grassland practices that sequester carbon can be greater in grasslands since large populations of people depend directly on grasslands, but are often poor and vulnerable to climate variability and climate change. Implementing practices that increase grassland SOC stocks could thus lead to considerable mitigation, adaptation and development benefits.[39]

Livestock production systems occupies about two thirds of the world's agricultural land for the production of animal feed (grazed pastures, 80% and feed crops, 20%), with a quarter of the crop area being used to produce animal feed. With the global demand for livestock products expected to double by 2050, especially in developing countries, it is becoming increasingly important to improve forage-based systems that contribute to climate change adaptation and reduce carbon emissions associated with livestock production.[40]

c) Dryland soils – soil of arid, semi-arid and sub-humid areas

Drylands are characterized by generally low average rainfall (where rainfall is less than the potential moisture losses through evaporation and transpiration) and covers about 47% of the earth's land surface. Drylands are therefore often associated with a lack of water which severely constrains plant productivity and thus affects SOC accumulation in soils.[41] Nonetheless, dryland soils contain more than a quarter of the global organic carbon stores.[42]

Dryland soils are especially vulnerable to land degradation and desertification and associated SOC losses since SOC storage decreases with increasing temperature and decreasing soil water content. In fact, SOC pools are estimated to decrease exponentially with increases in temperature. As a result, dryland soils contain low SOC stocks and the factors that influence SOC sequestration such as climate, soil type, vegetation cover and management practices are especially important when developing SOC management strategies and practices for these soils.[43]

KEY QUESTIONS FOR EACH OF THE THREE SUB-THEMES:

1. Where are the priority areas for soil conservation to prevent SOC losses and what are the associated policy requirements to regulate their sustainable management?
2. What are the realistically achievable SOC stock changes and rates of change for specific soils and land uses?
3. What is the degradation threshold where soil restoration and SOC sequestration is no longer considered feasible?
4. What are the potential derived ecosystem services and co-benefits of SOC sequestration that would contribute to climate change adaptation and reducing land degradation?
5. What are the proven best management practices that prevent SOC losses and foster SOC sequestration?

39 Conant, RT (2010). Challenges and opportunities for carbon sequestration in grassland systems.
A technical report on grassland management and climate change mitigation. Prepared for the FAO.
Integrated Crop Management Vol. 9-2010.

40 Gaitán L., Läderach P., Graefe S., Rao I., and Van der Hoek R. 2016. Climate-Smart Livestock Systems: An Assessment of Carbon Stocks and GHG Emissions in Nicaragua. PLoS ONE 11(12): e0167949. doi:10.1371/journal.pone.0167949

41 Peeyush Sharma, Vikas Abrol, Shrdha Abrol and Ravinder Kumar (2012). Climate Change and Carbon Sequestration in Dryland Soils, Resource Management for Sustainable Agriculture, Dr. Vikas Abrol (Ed.), InTech, DOI: 10.5772/52103. Available from: http://www.intechopen.com/books/resource-management-for-sustainable-agriculture/climate-change-and-carbon-sequestration-in-dryland-soils

42 UNCCD-SPI. 2015. Pivotal Soil Carbon. Science-Policy Brief 01. http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/2015_PolicyBrief_SPI_ENG.pdf

43 Peeyush Sharma, Vikas Abrol, Shrdha Abrol and Ravinder Kumar (2012). Climate Change and Carbon Sequestration in Dryland Soils, Resource Management for Sustainable Agriculture, Dr. Vikas Abrol (Ed.), InTech, DOI: 10.5772/52103. Available from: http://www.intechopen.com/books/resource-management-for-sustainable-agriculture/climate-change-and-carbon-sequestration-in-dryland-soils

AGENDA

<table>
<tr><th colspan="6">TUESDAY 21ST MARCH</th></tr>
<tr><td>08:30
10:00</td><td colspan="5">Registration</td></tr>
<tr><td>10:00
11:30</td><td colspan="5">OPENING OF THE SYMPOSIUM I Launch of the GSOC17 Video</td></tr>
<tr><td>11:30
11:45</td><td colspan="5">INTRODUCTION TO THE GSOC17 I Themes and work modalities</td></tr>
<tr><td>11:45
13:00</td><td colspan="5">PLENARY 1 I Setting the scientific scene for GSOC17</td></tr>
<tr><td>13:00
14:10</td><td colspan="5">SIDE EVENT I Launch of the International Network of Black Soils
LUNCH</td></tr>
<tr><td>14:10
16:00</td><td colspan="5">PLENARY 2 I Keynote presentations, setting the challenges of GSOC17 themes</td></tr>
<tr><td>16:00
16:20</td><td colspan="5">COFFEE BREAK</td></tr>
<tr><td rowspan="2">16:20
17:30</td><td rowspan="2">PARALLEL SESSION THEME 1
Monitoring, mapping, measuring, reporting and verification (MRV) of SOC</td><td rowspan="2">PARALLEL SESSION THEME 2
Maintaining and/ or increasing SOC stocks (fostering SOC sequestration) for climate change mitigation and adaptation and Land Degradation Neutrality</td><td colspan="3">PARALLEL SESSION THEME 3</td></tr>
<tr><td>SUB-THEME 3.1
Managing SOC in soils with high SOC - peatlands, permafrost, and black soils</td><td>SUB-THEME 3.2
Managing SOC in grasslands, and livestock production systems</td><td>SUB-THEME 3.3
Managing SOC in dryland soils</td></tr>
<tr><td>17:30
18:00</td><td>Theme discussion</td><td>Theme discussion</td><td colspan="3">Theme discussion</td></tr>
<tr><td>18:00
19:30</td><td colspan="5">COCKTAIL</td></tr>
</table>

WEDNESDAY 22ND MARCH

08:30 10:30	**PARALLEL SESSION THEME 1**	**PARALLEL SESSION THEME 2**	**PARALLEL SESSION THEME 3**		
			SUB-THEME 3.1	SUB-THEME 3.2	SUB-THEME 3.3
10:30 11:00	*COFFEE BREAK*				
11:00 13:00	**PARALLEL SESSION THEME 1**	**PARALLEL SESSION THEME 2**	**PARALLEL SESSION THEME 3**		
			SUB-THEME 3.1	SUB-THEME 3.2	SUB-THEME 3.3
13:00 14:15	**SIDE EVENT** | "World water day celebration: addressing water scarcity through sustainable soil management" *LUNCH*				
14:15 15:30	POSTER SESSION				
15:30 16:00	*COFFEE BREAK*				
16:00 17:15	Theme discussion	Theme discussion	Theme discussion		

THURSDAY 23RD MARCH

08:30 10:30	**WORK GROUPS** per Theme to develop Scientific, Policy and Advocacy messages for the outcome document.	**WORK GROUPS** per Theme to develop Scientific, Policy and Advocacy messages for the outcome document.	**WORK GROUPS** per Theme to develop Scientific, Policy and Advocacy messages for the outcome document.
10:30 11:00	*COFFEE BREAK*		
11:00 13:00	Continuation of work group	Continuation of work group	Continuation of work group
13:00 14:00	*LUNCH*		
14:00 14:50	**PLENARY 3** I Developing guidance for policy and decision makers (forward looking presentations)		
14:50 15:30	PRESENTATION by Chairs per Theme to provide a summary of the main session outcomes and key messages that would be reported in the Outcome report “Unlocking the importance of SOC”		
15:30 16:50	INTERACTIVE PANEL DISCUSSION		
16:50 17:10	CONCLUSIONS AND WAY FORWARD (beyond GSOC17)		
17:10 17:20	CLOSURE OF THE SYMPOSIUM		

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GLOBAL SYMPOSIUM ON SOIL ORGANIC CARBON
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