



SOIL CONNECTS is the biannual newsletter of Division 4 in the International Union of Soil Sciences

Issue 7 - December 2017



this edition

Welcome to SOIL CONNECTS - 7

It is a pleasure to release the seventh issue of the newsletter covering the stories, issues, events from the members of Division 4. This newsletter will contribute to a suite of newsletters already produced within the IUSS and will give its members the opportunity to share their knowledge of soil with other members and the broader community.

We are all preparing for a great World Congress in Rio and we hope that some of the great stories shared will be included in future editions of this newsletter.

It continues to be my pleasure to edit this newsletter and I call on all of you who are reading it to make a contribution to future issues.

Damien Field
Editor, Soil Connects

Cover Photo - Sun and soil

Photo sourced <http://www.dreams.metroeve.com/soil/>

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David van der Linden



Newsletter design inspired by Profile, a newsletter produced for Soil Science Australia

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IUSS Division 4 & Newsletter Information

DIVISION 4

The Role of Soils in Sustaining Society and the Environment

This Division focuses on transfer and outreach of good soil knowledge to society, as well as, taking responsibility for lifting the profile of soil among the general community. It takes the scientific knowledge and information developed in the other three divisions of the IUSS and shares this through education, international conventions and informing public policy and debate. Sharing of this knowledge between scientists, economists, policy makers and the broader community means this division interacts well beyond the traditional bounds of the soil science disciplines.

Commission 4.1 - Soils and the Environment

This Commission looks at soil as part of the ecosystem and how human activities impact on the soil and environmental interactions.

Commission 4.2 - Soils, Food Security and Human Security

This Commission looks at the challenge of maintaining agricultural lands, providing enough safe and nutritious food, and the role of soils in a changing world affecting human health.

Commission 4.3 - Soils and Land Use Change

In the context of global sustainability, this Commission investigates how soil functions can be managed and controlled to mitigate the impact of climate change. It also considers the impact of land use change with increased urbanisation, and loss of productive and forested lands.

Commission 4.4 - Soil Education & Public Awareness

A well informed public is needed so that the importance of soil is understood. This Commission shares the developments in learning and teaching of soil science that support this aspiration, as well as, developing strategies that increase the connectedness of the public with soil.

Commission 4.5 - History, Philosophy, and Sociology of Soil Science

This Commission deals with the past; it links the study of what has happened in history and how soil can be used to help explain the past changes. This Commission investigates the relationship between human development and soil.

Newsletter Contributions

Soil Connects is published in December and July each year. Contributions are to be received the first day of the month preceding the publication and can be emailed to the current editor Damien Field - email: damien.field@sydney.edu.au



Division Chair's Report

Christian Feller (Chair Division 4)

Three windows to view soil

In Soil Connects N°3 (December 2015) and at the Soil Inter-congress 2016 in Rio de Janeiro I mused on some future soil challenges. Through this I proposed the idea that Division 4 could be organized around 3 soil concepts, corresponding to three kinds of perception of soil by society:

Window 1) Soil as a natural system – we view soil as providing numerous ecosystem services to society and it is largely focuses on soil as an entity and the environmental sciences;

Window 2) soil as a cultural issue – here we take into consideration myths and religions, history, art, etc and it involves humanities and social sciences;

Window 2) soil as an inherited value – where soil is inherited by the individual as well as by society. Soil needs to be protected both legally and recognized for its natural capital. It involves the law, economy, and those who 'care'.

We often accept that soil is 'visible' to a small section of society, and talk amongst ourselves that for a large part it is 'hidden'.

For the soil scientists, agronomists, farmers and those that live closely with soil and its environment soil is 'visible' and considered as an important compartment of the Earth (at the same level as air, water, vegetation, rocks, etc.) This could even be said for other sciences including archaeologists and geotechnical engineers.

But for a very large part of the general public, soil does not exist. When one talks about soil it can be assumed that many do not know what you are talking about. My personal experience is they will ask, "if you are a specialist for floor covering or, if you are a geologist". I would suggest that a large part of the population is not aware of our commonly accepted scientific concept of 'soil'. It is when you start to mention the "earth under our feet" that there is a moment where you can convey a meaning of 'soil', and this a way to form a connection that is more difficult when you tal of the scientific concepts of soil immediately. This is why I suggest that the soil is one of the hidden faces of the Earth.

Therefore, one of the most important objectives of Division 4 is to make 'visible', knowable, and connectible this hidden part of the Earth. To achieve these objectives Division 4 needs to enlarge its competences and this is why I have proposed the 3 windows.

continued page 11.

**Make a contribution to Division 4 symposium by
sending your abstracts via the 21th WCSS portal**

<https://www.21wcss.org/?secao=conteudo&id=46>

by the 20 Jan 2018.

21st WCSS Brazil Division 4 is playing its part

Division 4 has developed a comprehensive schedule of division and interdivisional symposium for all conference attendees to enjoy. The list of divisional symposium are on page 6 and of course on the WCSS website.

There are five interdivisional symposium with the first focusing on **4.1. Soils, Society and Culture: people's connections to soil**, providing the opportunity for dialogue and to build a shared understanding about how different people and groups perceive and relate to soil. This is supported by **4.2 Soil Education and public awareness**, which tackles the challenge of education and how different audiences are reached, as well as, understanding the public perception of soil.

In a changing world time should be taken to reflect on the philosophical and practical perspectives on how we conduct our work. Session **4.3. Paradigm change in soil science: utopia or reality?** is a forum for epistemological reflection on the state of the soil science profession in a changing world.

A significant change has been the '4 per mille' initiative, which has brought much attention to soil carbon sequestration, in order to improve soil fertility, adapt to climate change and reduce greenhouse gas emissions, targeting agricultural soils in particular. Session **4.4. Soil organic matter to secure food and water and the 4 per 1000 initiative** aims to discuss these different aspects.

Session **4.5. Soil governance and sustainable development goals: connections between land use policies, soil science and society** recognises that shift in focus of soil's role from agricultural to being a limited resource of the planet that needs to be secured to guarantee productive soil that also provides essential ecosystem services supporting human health.

We hope that these 5 interdivisional symposium will inspire much discussion and debate as we consider our role in securing the future of soil. More details can be found on page 25.

Working Groups Division 4, 21st WCSS Brazil

WG15. Cultural Patterns of Soil Understanding A: Anthropological, psychological, religious and spiritual perspectives on soils	1. Nikola PATZEL (DE) <patzel@bodenkommunikation.info>
WG16. Cultural Patterns of Soil Understanding B: Dialogues between traditional and scientific knowledge and perceptions of soils by different stakeholderS	1. Guilherme SOBRINHO (BR) <guilhermesobrinho@gmail.com>



21st WCSS Brazil

List of divisional symposia, Division 4

Commission	1. Convener (COUNTRY)
C4.1. Soils and the Environment	
C4.1.1. Soil ecosystem services	1. Fabiani Machado VEZZANI (BR) <vezzani@ufpr.br>
C4.1.2. Climate change and adaptation of soil functions	1. Masamichi TAKAHASHI (JA) <masamichi_takahashi@hotmail.com>
C4.1.3. Soil in the Anthropocene	1. Jock CHURCHMAN (AU) <jock.churchman@adelaide.edu.au>
C4.1.4. Soil as natural capital: Economic and legal dimensions of ecosystem services.	1. Brent CLOTHIER (NZ) <Brent.Clothier@plantandfood.co.nz>
C4.1.5. Carbon sequestration potential of soils	1. Claire CHENU (FR) <claire.chenu@inra.fr>

C4.2. Soils, food security, and human health	
C4.2.1. Soil and Human Health	1. Eric BREVIK (USA) <eric.brevik@dickinsonstate.edu>
C4.2.2. Soil quality and food security in the tropics	1. Cassio Hamilton ABREU (BR) <cahabreu@cena.usp.br>
C4.2.3. Soil quality to secure human and environmental health	1. Ganga HETTIARACHCHI (USA) <ganga@ksu.edu>

C4.3. Soils and land use change	
C4.3.1. Ecological soil management systems and soil quality	1. Pablo TITONELL (AR) <Tittonell.pablo@inta.gob.ar>
C4.3.2. Assessment and inventory of land use change under the SDG's perspective	1. Johan BOUMA (NL) Johan.Bouma@planet.nl

C4.4 - Soil education and public awareness	
C4.4.1. Soil science education in the 21st century	1. Damien FIELD (AU) <damien.field@sydney.edu.au>
C4.4.2. Soil education and public perception of soils	1. Cristine MUGGLER (BR) <cmuggler@ufv.br>
C4.4.3. Placement and accreditation of soil science in the workforce related to natural resources	1. David LINDBO (USA) <david.lindbo@wdc.usda.gov>

C4.5. History, philosophy, and sociology of soil science	
C4.5.1. Integration of historical, philosophical and sociological worldviews to secure and sustain soils in the future	1. Sabine GRUNWALD (USA) <sabgru@ufl.edu>
C4.5.2. Foreseeable breakthroughs in soil science	Alfred HARTEMINK (USA) <hartemink@wisc.edu>
C4.5.3. Field to Palette: Field to Palette: A Nexus Approach to Soil and Art	1. Alex TOLAND (DE) <a.r.toland@googlemail.com>

Open digital mapping for assessing carbon storage in tropical peatlands

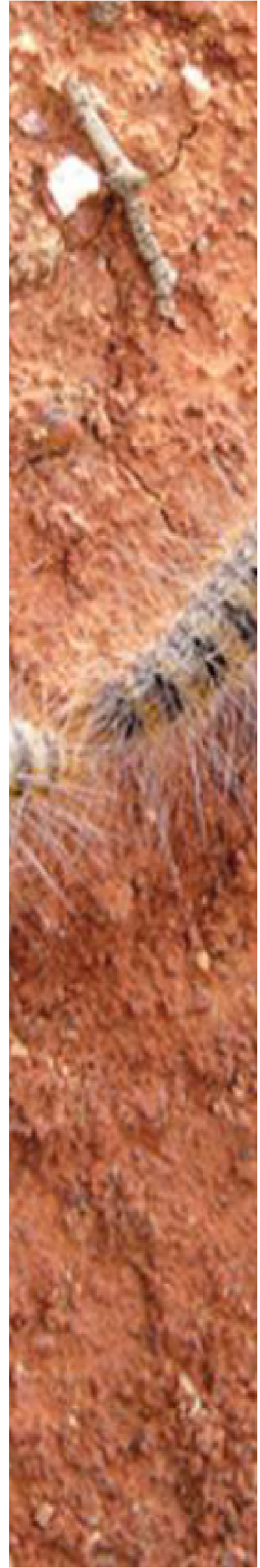
Rudiyanto
Visting Scholar

Researchers from Sydney, Australia, and Bogor, Indonesia demonstrate that tropical peatland can be mapped accurately and cost effectively using freely-available remote sensing data and open source software.

At COP23 in Bonn, the Global Peatlands Initiative and various organisations held events aiming to bring peatlands on the agenda at COP23. Peatlands have an important role in the global carbon cycle as it stores a huge amount of carbon. A small loss of peat from land clearance and mismanagement can contribute a large amount of CO₂ to the atmosphere. Indonesia has one of the largest peatlands in the tropics, with an estimate of 15 million hectares. Responding to the global issue of reducing CO₂ emissions, Indonesia has legislation on the protection and management of the peat ecosystem. The legislation outlined conservation areas, which depends on the thickness of peat; however, the main challenge is the lack of fine-scale, accurate maps of peat distribution and its thickness. The current peatland map in Indonesia is at a coarse scale with much uncertainty that it cannot be used to implement conservation and management regulations.



Peatland in Sumatra used for plantation.





ARTICLES

Traditional soil mapping techniques are too costly as they require many field observations, and the outputs can be too subjective. Many technologies for mapping peatlands have been tested in Indonesia, including flying sensors to detect peat from the above. However, many of the technologies are not cost-effective for large extent mapping. Researchers from the University of Sydney, Australia and Institut Pertanian Bogor in Indonesia proposed an open digital mapping methodology, making use of open data in an open-source environment, as a cost-effective and accurate method for mapping peat and its carbon stock for large areas in Indonesia. This is the first study which provided a detailed cost and blueprint for national peat mapping. The study was published in the upcoming issue of *Geoderma*, a global soil science journal.

This open methodology combines field observations with factors that are known to influence peat depth distribution in space. These factors are represented by multi-source remotely sensed data derived from freely-available open data: digital elevation model from the Shuttle Radar Topography Mission, geographical information, radar (ALOS PALSAR and Sentinel 1 data) and optical images (Landsat TM). The method makes use of advanced machine learning models to predict peat depth every 30 m on the land surface. To make it transparent, accountable, and repeatable, all mapping procedures were scripted in the R open source and free software.

The authors successfully applied this approach in mapping peat thickness and carbon stock in the Bengkalis Island, Sumatra, covering an area of 50,000 ha. The authors further provided an estimate of the cost and time required for map production, i.e. 2 to 4 months with a cost between \$0.3 and \$0.5/ha for an area of 50,000 ha. Obviously, there is a tradeoff between cost and accuracy. And the cost will decrease significantly with increasing area.

Researchers from Sydney have developed digital soil mapping techniques and successfully applied them for nation-wide soil carbon mapping in various countries. Some researchers believe that the only solution for peat mapping is to fly Lidar, a laser instrument which provides elevation of the ground surface. This study demonstrates that we can map peat thickness accurately using freely-available data, the key is that we need to use multiple source of information not just elevation.

Due to the open nature of the method (open data, and open-source), the method is scalable to the whole country and can be done in parallel by many groups. With appropriate training, various groups in Indonesia can perform this mapping procedure in a standard, and objective way. The authors envisage if done in parallel (both field work and computer modelling), utilising existing observations and collecting new observations, a high-resolution peat map (estimate of peat thickness every 30 m) for Indonesia can be completed within 2 years.

To find out more see:

Rudiyanto, Budiman Minasny, Budi Indra Setiawan, Satyanto Krido Saptomo, Alex B. McBratney. Open digital mapping as a cost-effective method for mapping peat thickness and assessing the carbon stock of tropical peatlands. Geoderma. <https://doi.org/10.1016/j.geoderma.2017.10.018>

Climate Change revealed from historical soil temperature data

Budiman Minasny
The University of Sydney

Our research was instigated when we visited the Cowra Agricultural Research station in New South Wales, Australia, and Brian Murphy, a soil scientist there, showed us the soil temperature data from a depth of 1.8 m which was collected daily since 1942. The data show a gradual increase in soil temperature over time. So we looked further into this data and also analysed data from BOM stations in Gunnedah, Inverrel and Brigalow. They are all (ex-) agricultural research stations. Our study is published in the March 2018 issue of Geoderma.





ARTICLES

Historically, soil temperature data have been measured and recorded mainly for agricultural applications. Lambert (1779) in Germany and Forbes (1846) at Edinburgh in Scotland published time series of measurements of soil temperature at various depths. Many research stations around the world that recorded weather data also recorded soil temperature at one or more depths. In Australia, it is commonly measured daily at 09.00.

Cowra is located in New South Wales with a population about 10,000. The Cowra research station is about 3.2 km northeast from the centre of the town and about 1.1 km from the nearest housing development. Soil temperature data at Cowra was recorded daily at 09.00 at a depth of 1.8 m from 1942 to 2010, together with rainfall and maximum and minimum air temperature data. From 1972 temperatures at some shallower depths were also recorded.

We analysed the data and found significant average annual temperature rises in soil and air temperature data, with greater rises in the soil temperatures over this period. We also analysed soil and air temperature data recorded from 1970 at Gunnedah, Inverell, and Brigalow in eastern Australia.

To standardise for soil temperature measurements taken at various depths, we proposed a model that estimated the rise of the ground surface temperature accounting for the attenuation and delay of the surface temperature signal with depth. We estimated the rise of the soil surface temperature Cowra from about 1970 as 0.06 K per year. We found the rate of rise of the average of the daily maximum and minimum air temperatures to be 0.022 K per year. For Gunnedah, Inverell, and Brigalow, from 1970 the rates of rise of soil temperatures at 1 m and air temperatures were at around 0.02 K per year. These soil temperature data show a clear warming trend overall since about 1970.

These kind of data provided real information of soil temperature increase which will be useful to study its impact on microbes and plants. Sadly the Cowra Meteorology station was stopped in 2010 because of funding cut, and the Brigalow research station in Qld was sold in 2013.

So what are implications of this study?

First, soil temperature has been increasing for the past 50 years, and the increase is gradual rather than sudden. Thus many of the heating soil experiments will create unnatural change and response in microbial and plant activities.

Second, over 40 years, there is an extra annual heat storage in soil about 1 to 3 MJ m⁻² yr⁻¹.

Third, over 40 years the soil temperature rises of 2.44 K at Cowra and 0.8 K at Gunnedah, Inverell, and Brigalow will cause increases in the reaction rates for the greenhouse gases carbon dioxide and nitrous oxide of 18% and 6%, respectively.



Brian Murphy showed the thermometer which measured the warming earth.

continued from page 4

For the first window, to explain soil as a natural compartment to society, the current Division 4 can benefit of the soil scientist's knowledge developed through IUSS Divisions 1 to 3 and from different Div4 commissions, especially the commission 4.4. dedicated to the education about soil.

For the second window – soil as a cultural compartment – a Division 4 working group (WG) “Cultural patterns of soil understanding” was created at the 2016 Inter-congress at Rio de Janeiro. This WG (chaired and co-chaired by Nikola Patzel and Eric Brevik) has begun to prepare a book on the soil-society relations taking into account the cultural understanding of soils.

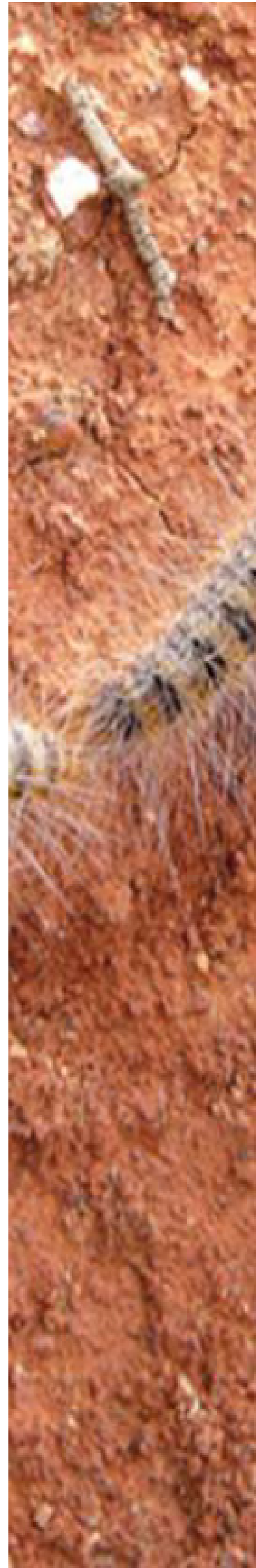
For the third window, the current division 4 has not yet competences for the legal and economy aspects of soil as a natural capital. It is the reason why the Division 4 dedicated to this thematic a symposium (C4.1.4) for the 21st World Congress of Soil Science (Rio 2018):

“Soil as natural capital: Economic and legal dimensions of ecosystem services”.

It is hoped that this symposium will be the basis for a new Div4 WG or a new Div4 commission in the future.

In conclusion, for everyone in Division 4, one of the main question is:
How make the hidden soil visible and connectible?

Christian Feller



Some words from Guy Roth Director of Northern Agriculture Narrabri, Australia

On Australia's first National Agriculture Day we celebrate Australian farmers producing food for the world.

Research and technology have allowed Australian grain growers to be among the most efficient, innovative, productive and sustainable food growers in the world. In Narrabri, in the heart of the North West NSW grain belt, The University of Sydney's Institute of Agriculture's Plant Breeding Institute undertakes key research and puts the innovations into the practice on its own research farm and with local farmers.

"We wanted to do something to contribute to the National Agriculture Day to help the community understand some of the technology used to produce food." said Associate Professor Guy Roth, Director of Northern Agriculture, The University Sydney Narrabri.

"It is a very busy time of the year for us. Various teams have been harvesting around 40,000 plots of unique types of wheat, chickpeas, faba beans and other crops. We also have 1000 hectares of wheat, canola and chickpeas in our larger farming systems research paddocks. Harvest takes our team about a month's work, seven days a week and we have about one week to go."

"I was talking with our cropping supervisor Kieran Shephard and we came up with the idea of cutting the word FOOD into the wheat which we were about to harvest. After all, agriculture is all about food production. The word food is only four letters, and maybe we could manage that with our larger state of the art 12 meter wide header.

"We devised a plan. Kieran put the metrics into the header's high tech navigation system and harvested the letters."

The University of Sydney is proud of its long association with the world's most innovative grain farmers. In the 1950's a group of grain growers banded together to buy a farm at Narrabri for research and they invited the university to lead a research effort on this farm.

"This partnership with the Wheat Research Foundation and Grains Research and Development Corporation has been highly successful, delivering key new, high quality, high yielding, and disease resistant wheat varieties.

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Food cut into the crop by programming the header's guidance system with the GPS details.



Yield monitoring of the crop harvested in making the word food

View from the header



Some facts on the letters FOOD

The paddock where it is located is on “Llara”, The University of Sydney’s newest research farm at Narrabri. This paddock is 280 hectares and is on track to produce 840 tonnes of durum wheat. That could be around 1 million packets of pasta.

The dimensions of the word FOOD is 216 meters long and the letters 60 meters high.

The harvester (“header”) had a 12 meter front on it, which is the letter width. The header is a state of the art machine equipped with GPS navigation for precision harvesting.

It can also produce yield maps that show the variability across the paddock, which in future years enable continuous improvement. The header can harvest about 8-12 ha an hour or 50 tonnes of wheat an hour.

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“This is a crop of durum wheat. Durum wheat is used to make pasta and compared to bread wheat has more protein and excellent cooking qualities. One of the special features of this specific variety being harvested is its brighter yellow colour which has market appeal for many consumers. People like a naturally yellow pasta as opposed to a white pasta. For growers, it has a better grain quality and bigger seed size.

“We use a lot of innovative technology and farm practices; crop rotations, soil maps from electromagnetic sensors, soil fertility tests, climatically adapted varieties, minimum tillage and stubble retention for soil health, a professional agronomist, yield maps, UAV or drone images, and GPS guidance systems on the machinery so that we have a controlled traffic system.

“The University recently expanded activities to allow larger scale trials and to answer other farming systems research questions. Future work will continue to increase wheat yield and grain quality and its climatic adaptation especially to heat and drought, water use efficiency. Increasing the area planted to grain legumes like chickpeas and faba beans is another key research focus. In the future we want to amplify agriculture’s productivity, food provenance, resilience, and harness digital technologies and connectivity for the benefit of consumers, producers, agribusiness and the environment.”

“Food comes from farms via supermarkets. Whether it is a loaf of bread or a fresh cherry; plant genetics, the soil, water, environment, and a lot of technology and management combine to produce the best produce in the world. Hopefully, the photograph with the help of local photographer Josh Smith helps remind people of the linkage between farms, the environment and all the skill and technology that enables them to enjoy great food.”

Education Sessions at 2017 SSSA in Tampa, Florida

Eric Brevik
Dickinson State University, USA

The SSSA Soil Education and Outreach Division had an excellent set of sessions at the 2017 Soil Science Society of America meetings. They began on Monday, October 23 with the session “Soils 101: From the Pulpit to the Pit”. Nine presentations covered a variety of ideas to improve student learning in soil science courses. This was followed by a “Soil Education and Outreach General Oral” session with another 10 sessions that covered surveys on student learning, perception, and attitudes, novel ways to use technology in teaching, and integrating soil information into park nature trails. Later in the afternoon the symposium “Agronomy and Technology: Collaborations for Solving Our Workplace Pipeline Problem” was held with four presentations and a discussion period. At about the same time a session with four presentations on “Impactful Images, Articles and Books in Soil and Agronomic Science”, cosponsored by S205.1 – History, Philosophy, and Sociology of Soil Science committee, was held. The day ended with a general session containing 13 poster presentations.

The morning of Tuesday, October 24 continued with two sessions. The first had five presentations and was titled “Resources in Education and Outreach for Soils and Agronomy”. The second was on “Community Engagement and Public Participation in Environmental Research” with six presentations on soils and human health, citizen science, and soil health and security. The morning, and the meeting as far as soil education sessions was concerned, ended with the session “Information Delivery Tools to Enhance Agricultural Productivity and Profitability for Smallholder Farmers” with four presentations and a discussion session.

All told the Soil Education and Outreach Division sponsored or co-sponsored eight sessions with 55 presentations in 2017. The Division has steadily grown since it was formed as an SSSA Division in 2013, when it sponsored or co-sponsored three sessions, and looks forward to continued future growth. The Division thanks Dr. April Ulrey for her work over the past year as the Division chair and for her organization of the 2017 Education and Outreach agenda.





Food Security, Human Health and Societal Challenges were the Focus of Soil Chemistry SSSA in Tampa, Florida

Ganga Hettiarachchi

The SSSA Soil Chemistry Division had a great set of symposiums and sessions at the 2017 the American Society of Agronomy/Crop Science Society of America/ Soil Science Society of America Annual Meetings, “Managing global resources for a secure future”. This news item focusses on the two Soil Chemistry symposiums held on October 24, 2017, with four invited speakers in each.

First symposium, “Soil Chemistry, Food Security and Human Health” was organized by Kirk Scheckel and me, to highlight studies of soil chemical constituents, chemical properties, or chemical reactions for more efficient, sustainable, and/or nutrient-rich/contaminant-free food production and protection of soil, water, and human health. Gary Pierzynski at Kansas State University delivered the first talk “[Soil Chemistry, Food Security and Human Health: Overview](#)” to set the stage. This was followed by three talks focused on role of soil chemistry in food security and protection of human health. Those were: Mike McLaughlin from the University of Adelaide on “[Soil Chemistry, Food Security and Human Health: Manipulating Soil Nutrient Chemistry](#)”; Steve McGrath from Rothamsted Research on “[Micronutrients and the Link to Human Nutrition](#)”; and Jon Chorover from University of Arizona on “[Soil Chemical Transformations Affect Arsenic Bioaccessibility during Mine Tailings Phytostabilization](#).”

Second Symposium, “[Societal Challenges and Soil Chemistry](#)” was organized by Owen Duckworth, Matthew Polizotto and Aaron Thompson to highlight societal challenges through the lens of soil chemistry and discuss strategies for addressing water, climate, and energy related problems. Ronald G. Amundson from University of California-Berkeley began this session with his talk entitled “[Soil and 21st Century Societal Challenges](#).” This was followed by three other speakers, Thomas Borch at Colorado State University on “[Unconventional Oil and Gas Development: Implications for Soil and Water Quality](#)”; Scott Fendorf from Stanford University on “[Soil Processes As Solutions and Threats to Sustaining Groundwater Quality](#)”; and Markus Klebber from Oregon State university on “[Science, Language and Society: The Case of the “Humic Substances”](#).”

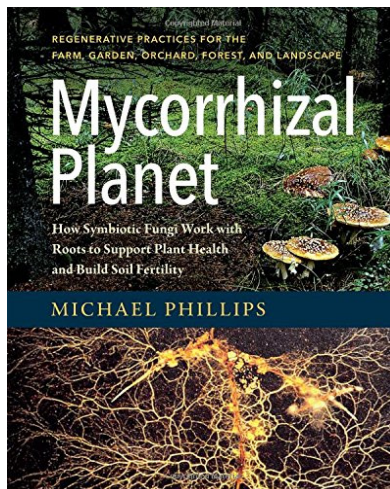
Immediately following the second oral symposium there was a Panel Discussion focused on Soil Chemistry and Grand Challenges of Food, Water, Energy and Climate. This was to engage the eight invited symposium speakers in a structured exploration of modern problems, research directions, and solutions related to soil chemistry. Great attendance and the active participation by attendees asking questions and making useful comments, made all these very lively and engaging. Both these oral symposiums were followed by poster sessions.



Image sourced from: <https://www.jerkeandsons.com/erosion-control>

Books

Publications



Publ. 2017, Chelsea Green
Michael Phillips

Summary

Mycorrhizal fungi have been waiting a long time for people to recognize just how important they are to the making of dynamic soils. These microscopic organisms partner with the root systems of approximately 95 percent of the plants on Earth, and they sequester carbon in much more meaningful ways than human “carbon offsets” will ever achieve. Pick up a handful of old-growth forest soil and you are holding 26 miles of threadlike fungal mycelia, if it could be stretched it out in a straight line. Most of these soil fungi are mycorrhizal, supporting plant health in elegant and sophisticated ways. The boost to green immune function in plants and community-wide networking turns out to be the true basis of ecosystem resiliency. A profound intelligence exists in the underground nutrient exchange between fungi and plant roots, which in turn determines the nutrient density of the foods we grow and eat.

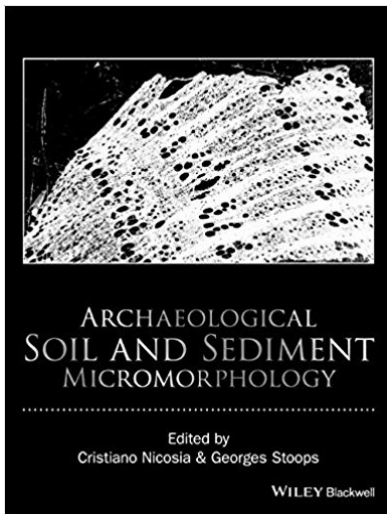
Exploring the science of symbiotic fungi in layman’s terms, holistic farmer Michael Phillips (author of *The Holistic Orchard* and *The Apple Grower*) sets the stage for practical applications across the landscape. The real impetus behind no-till farming, gardening with mulches, cover cropping, digging with broadforks, shallow cultivation, forest-edge orcharding, and everything related to permaculture is to help the plants and fungi to prosper . . . which means we prosper as well.

Building soil structure and fertility that lasts for ages results only once we comprehend the nondisturbance principle. As the author says, “What a grower understands, a grower will do.” *Mycorrhizal Planet* abounds with insights into “fungal consciousness” and offers practical, regenerative techniques that are pertinent to gardeners, landscapers, orchardists, foresters, and farmers. Michael’s fungal acumen will resonate with everyone who is fascinated with the unseen workings of nature and concerned about maintaining and restoring the health of our soils, our climate, and the quality of life on Earth for generations to come

Details found at:

<https://www.amazon.com/Mycorrhizal-Planet-Symbiotic-Support-Fertility/dp/160358658X>

Summary



Publ. 2017, Wiley-Blackwell
Cristiano Nicosia
Georges Stoops

Archaeological Soil and Sediment Micromorphology goes beyond a mere review of current literature and features the most up to date contributions from numerous scientists working in the field. The book represents a groundbreaking and comprehensive resource covering the plethora of applications of micromorphology in archaeology. Archaeological Soil and Sediment Micromorphology offers researchers, students and professionals a systematic tool for the interpretation of thin sections of archaeological contexts.

This important resource is also designed to help stimulate the use of micromorphology in archaeology outside Europe, where the technique is less frequently employed. Moreover, the authors hope to strengthen the proper application of soil micromorphology in archaeology, by illustrating its possibilities and referring in several cases to more specialized publications (for instance in the field of plant remains, pottery and phytoliths). Written for anyone interested in the topic, this important text offers:

- Contributions from most of the world's leading authorities on soil micromorphology
- A series of chapters on the major topics selected among the most recurrent in literature about archaeological soil micromorphology
- Systematic descriptions of all important micromorphological features
- Special analytical tools employed on thin sections, such as SEM/EDS, image analysis, fluorescence microscopy, mass spectrometry, among others
- Numerous cross-references
- 400 illustrated full-colour plates

The resource provides the most current and essential information for archaeologists, geoarchaeologists, soil scientists and sedimentologists. Comprehensive in scope, Archaeological Soil and Sediment Micromorphology offers professionals and students a much-needed tool for the interpretation of thin sections of archaeological contexts

Details found at:

<http://www.springer.com/us/book/9780412145216>



PUBLICATIONS

Journal - Feature Article

Songs of the Soil. How soil themes have been represented in popular songs

Capra G. F., Ganga A., & Allan F. Moore A. F. 2017. *Soil science and plant Nutrition*

The soil–culture relationship has been investigated from various points of view. Surprisingly, however, there is a marked absence of papers investigating the way such a fragile resource has been represented in popular song. Many lyrics disclose how such a resource is lived, perceived, represented, and objectified in everyday human life by ordinary people. This paper observes that many of the greatest songwriters and interpreters on the international scene, from all musical genres, have dealt with soil, often from innovative and audacious perspectives. From the prosaic metaphor of the life cycle or as a medium for crops, the soil resource has also been cast as a means of pain, sacrifice, or even redemption. Sometimes seen as a secret world, a helpless creature, treated with a visionary or yet psychedelic approach, the soil has been represented in myriad ways. During the 1970s, several protest songs, which had the ability to raise awareness and mobilize millions of people in favor of the environmentalists cause, were based on ideological positions closely connected to soil issues, such as soil sealing and erosion. These (soil) songs are now considered the first environmentalist songs in the history of music. As soil scientists, we have often serious problems in communicating soil issues for a global audience, and, consequently, the worldwide political agenda often shows a dramatic lack of interest in such concerns. It is perhaps surprising that popular songs have still not become more common methods for sharing, educating, and sensitizing ordinary people, students, and scholars from every field of study, about soil concerns. Without trying to claim it as some sort of panacea, popular song (as already understood by ecologists and climatologists) can represent a powerful means of increasing public visibility and awareness about soil resource.

Books (Popular)



Publ: 2016, Penguin
Xanthe White

Summary

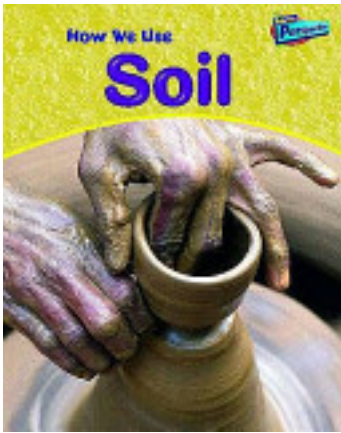
In *The Good Dirt*, landscape designer Xanthe White digs beneath the surface to reveal the secrets to successful gardening. As the title suggests, this book is all about the soil we find in our garden and more particularly how we can maximize its growing potential.

If you've ever wondered why some plants thrive in one location but struggle in your own backyard you'll be likely to find explanations in the soil below. Xanthe White examines the five main soil types found in New Zealand and offers advice on how to get the best from each one by working in harmony with nature.

Complete with ingredients guides for each soil type and ideas and design features to enhance its fertility, this is an essential companion for anyone looking to establish a new garden or improve their existing one

Details found at: <http://penguin.co.nz/books/the-good-dirt-9781775538547>

Books (Popular)



Publ: 2005, Raintree
Carol Bollard, Chrtis Oxland



Publ: 2015, Hachette, UK
Jamie Kornegay

Summary

Designed for young independent readers of between 6 and 8, Perspectives combines core non-fiction features with an emphasis on research skills with visual design. Using Materials focuses on the uses of a wide range of different materials, their applications, properties and why certain materials are selected for particular roles. Images help pupils to see these materials' uses, from the everyday to the unusual. The books explain where the materials come from and whether they are natural or man-made. They promote discussion regarding the sustainability of materials and the environmental impact.

Details found at:

https://books.google.com.au/books/about/How_We_Use_Soil.html?id=VuF3AAAACAAJ&redir_esc=y

Summary

It begins as a simple dream.

An idealistic environmental scientist moves his wife and young son off the grid, to a stretch of river bottom farmland in the Mississippi hills, hoping to position himself at the forefront of a revolution in agriculture.

Within a year, he is ruined.

When a corpse appears on his family's property, the farmer is convinced he's being set up. And so begins a journey into a maze of misperceptions and personal obsessions, as the farmer, his now-estranged wife, a predatory deputy, and a backwoods wanderer, all try to uphold a personal sense of honour.

A darkly comic debut novel by an independent bookseller, Soil traces one man's apocalypse to its epic showdown in the Mississippi mudflats

Details found at:

https://books.google.com.au/books/about/Soil.html?id=5B-V0BQAAQBAJ&redir_esc=y



New for Australia

National Agriculture day for OZ - Celebrating Australian food growers and researchers

On 21 November Australia will pause to celebrate the remarkable contribution of Australian agriculture. Every Australian has a stake in the success of this historic industry, and AgDay is your chance to get behind it. Did you know that each year the average Aussie farmer feeds 400 Australians, and 600 people around the globe?

You might think that farming is all about people in the bush wearing big hats, but it powers a much broader economic story. All told, agriculture employs more than 1.6 million Australians - in jobs like retail, logistics, technology and science.

There's much more to the story of Australian farming than meets the eye. See more at; <https://www.agday.org.au/> and read the next story to find out more

SEE THIS BLANK SPACE

Don't forget to send in your news, stories, pictures to be included in the next issue of Soil Connects

There is a spot waiting here



AUGUST 12-17, 2018 BRAZIL

Soil science:
beyond food and fuel

www.21wcsc.org



Soil Science: beyond food and fuel

Invitation

Dear Colleagues,

On behalf of the International Union of Soil Sciences (IUSS), the Latin American Soil Science Society (SLCS) and the Brazilian Soil Science Society (SBSCS), it is our pleasure to invite you to the 21st World Congress of Soil Science. The congress will be held in Rio de Janeiro, Brazil, August 12-17, 2018 and we hope that you will be able to join us for this global meeting.

As the most acclaimed meeting in the area of Soil Science, the WCSS will gather a large number of scientists and industries. It is expected the attendance of 7,500 participants, from more than 140 countries around the world. This will be an excellent learning experience, an opportunity for knowledge exchange toward technological advances, as well as a business opportunity for companies dealing in areas related to Soil Science.

The City of Rio de Janeiro is a cosmopolitan metropolis, known worldwide for its scenic beauty and natural resources, which provides a harmonious and agreeable environment for the inhabitants (“cariocas”) and visitors. Rio de Janeiro City’s main virtues are the kindness and hospitality with which all visitors are received. We invite you to enjoy the many attractions of Rio and find the reasons for the title – “Cidade Maravilhosa” (wonderful city).

Let us know how we may help you with the preparations for your participation in the 21WCSS, and we look forward to meet you in Rio de Janeiro, Brazil

Visit: <https://www.21wcsc.org/index.php>

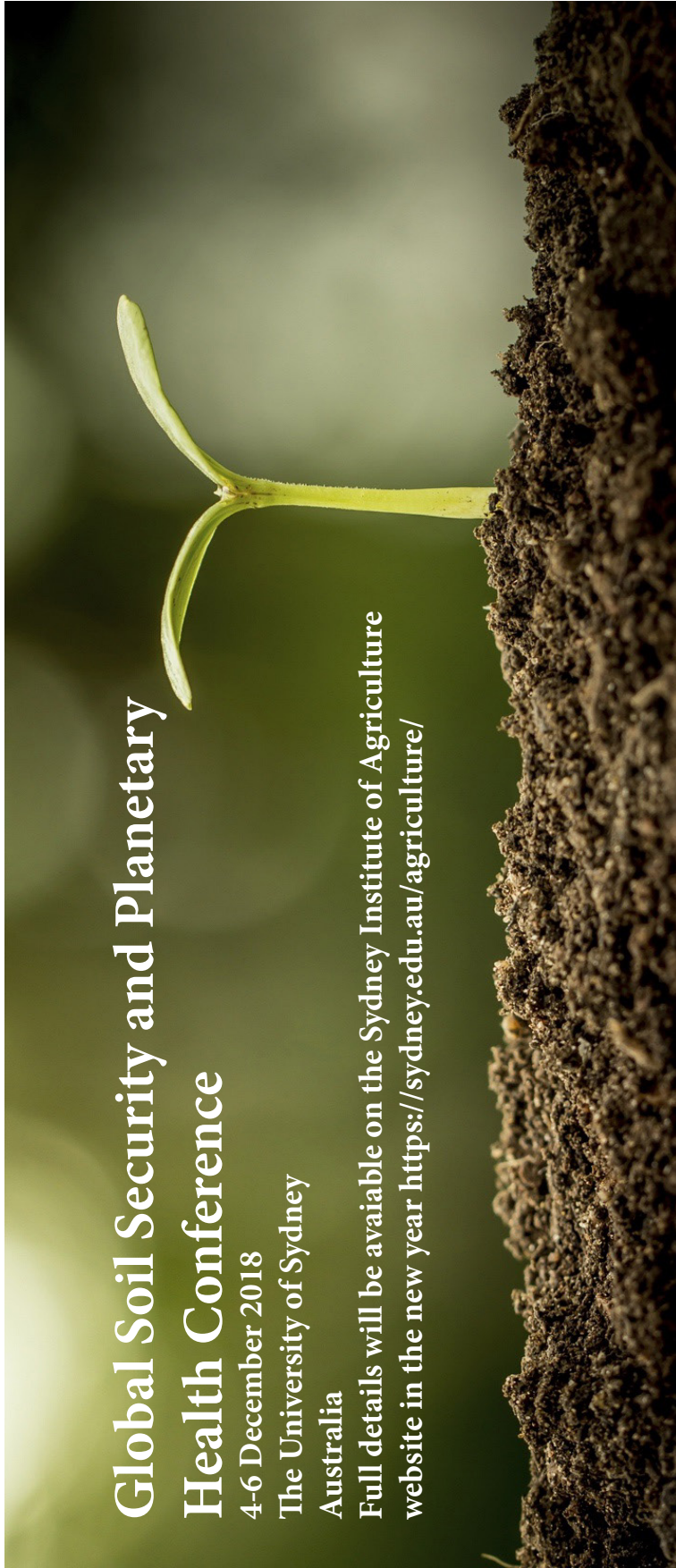




Send your Abstracts in by 10th Jan, 2018; 13:00 CET for:-

Soil science education, outreach and public engagement

This session welcomes all perspectives on teaching soil science from school level to continuing professional development in non-academic settings. Contributions are welcomed that move away from concepts and methods for teaching soil science within traditional disciplines (chemistry, biology, physics) to those that use soil systems approaches. Innovative methods from the field, classroom and laboratory are welcome from anyone working with soil science education across varied settings. We also welcome demonstrations of novel approaches for soil science outreach and public engagement that involve scientists and non-scientists. Examples that also measure the effectiveness of educational and outreach activities are especially welcome.



Global Soil Security and Planetary Health Conference

4-6 December 2018

The University of Sydney
Australia

Full details will be available on the Sydney Institute of Agriculture website in the new year <https://sydney.edu.au/agriculture/>





SPECIAL INSERT

Division 4, Interdivisional Symposium

4.1. Soils, Society and Culture: people's connections to soil.

The aim of this symposium is for dialogue and to build a shared understanding about how different peoples and groups perceive and relate to soil. The emphasis is on how people connect and why do they care about soils. Some contemporary societies seem to ignore or overpower the existential fact that soils sustain almost all terrestrial life. On the other hand, there are many cultural traditions, archaic as well as supported by world religions, philosophies and politics, considering soil to be of high intrinsic value as sustainer of life, or even to be sacred. The focus of this symposium lies on giving attention to elements that create cultural soil appreciation, as cultural and spiritual values, that can improve understanding and communication about soils.

Conveners: Nikola Patzel (patzel@bodenkommunikation.info) and Cristine Muggler (UFV/BR, cmuggler@ufv.br)

- a) The unrecognized face of the Earth. Christian Feller (IRD/FR, christian.feller@ird.fr).
- b) Soil Ethics – Soil Care, Beliefs and Values. Sabine Grunwald (University of Florida/US, sabgru@ufl.edu)
- c) Soil perception in non-western societies. Milinda Banerjee (LMU/DE and Presidency University/IN, milindabanerjee1@gmail.com)

4.2. Soil Education and public awareness.

The International Year of Soils brought soil to the center stage in many ways. The major goal of promoting dialogue among different soil-related groups and engaging everybody in a conversation about the vital role of soils was shared around the world. Subsequently, the Soil Decade was proclaimed by the IUSS Council and this has focused the IUSS contributions to soil education and communication. The challenges lie in how much has been achieved in public perception of soils, how diverse audiences are reached, sensitizing and touching individuals and peoples and how continuity and permanence of the spirit, actions and movement can be assured to increase soil awareness.

Conveners: Eric Brevik (US, eric.brevik@dickinsonstate.edu) and Fabiane Vezzani (UFPR/BR, vezzani@ufpr.br)

- a) Some challenges and accomplishments in soil science education: Teaching practices, principles, and beyond. Damien Field (University of Sidney/AU, damien.field@sydney.edu.au)
- b) Soil education in Latin America. Laura Berta Reyes Sanchez (UNAM/MX, lbrs@unam.mx and Cristine Muggler (UFV/BR, cmuggler@ufv.br)
- c) Which Public? Audiences of soil communication from an arts and humanities perspective. Alexandra Toland (DE, a.r.toland@googlemail.com)

4.3. Paradigm change in soil science: utopia or reality?

In this symposium dominant soil scientific paradigms are presented in the context of the history of soil science and the future challenges presented by environmental changes and the pressures of human flows. The session serves as an epistemological reflection on the state of the soil science profession in a changing world, providing philosophical as well as practical perspectives on how we conduct our work.

Concurrent and sometimes conflicting approaches to research, teaching, communicating and protecting soils are juxtaposed in the proposed presentations and a moderated discussion.

Conveners: Guilherme Sobrinho (Lapsiafro/UFRRJ/BR, guilhermesobrinho@gmail.com) and Alexandra Toland (DE, a.r.toland@googlemail.com)

- a) From soil properties to soil functions and beyond: paradigm change in soil science? Thomas Sauer (NLAE/USDA/US, Tom.Sauer@ars.usda.gov)
- b) A Soil Security concept to value ecosystem services. Cristine Morgan (Texas AM University/US, clsmorgan@tamu.edu)
- c) Cultural patterns of soil understanding. Nikola Patzel (patzel@bodenkommunikation.info)

4.4. Soil organic matter to secure food and water and the 4 per 1000 initiative

As soils are alive, the promotion of their functions go with the maintenance and enhancement of soil biodiversity. This means the increase of quantity and quality of soil organic matter to support and diversify the soil organisms. What are the technical practices to increase soil organic carbon stocks? What are the limits, the expected benefits and the potential drawbacks of implementing actions to increase soil organic carbon contents? What is the scientific knowledge urgently needed? The “4 per mille” initiative promotes soil organic carbon sequestration to improve soil fertility, adapt to climate change and reduce greenhouse gas emissions, targeting agricultural soils in particular. This session aims at bringing together scientists across many disciplines to discuss these different aspects.

Conveners: Beata Madari (EMBRAPA/BR, beata.madari@embrapa.br) and

- a) The ‘4 per 1000 initiative’. Claire Chenu (FR) (Claire.Chenu@grignon.inra.fr)
- b) ‘4 per mille’ a global perspective. Budiman Minasny (University of Sydney/AU, budiman.minasny@sydney.edu.au)
- c) Agroecology and tropical soils management beyond food security. Heitor Teixeira, UFV/WUR, BR, heitor.manciniteixeira@wur.nl)

4.5. Soil governance and sustainable development goals: connections between land use policies, soil science and society.

Globally, governance of the soil has been limited to an agricultural perspective due to increased food insecurity. However, there is a need to improve governance of the limited soil resources of the planet in order to guarantee healthy and productive soils for all essential ecosystem services. Additionally, the acceptance of the 17 Sustainable Development Goals (SDG's) by the United Nations General Assembly in September 2015 offers opportunities to analyze procedures and to derive common approaches for soil science, past and present land use changes and policies development.

Conveners: Gonçalo Farias (farias1949@gmail.com)

- a) SDG's as a prospect for the development of relations between soil science and society. Johann Bouma, WUR/NL
- b) Innovative soil governance in Latin America: La Ley de Tierras de Ecuador. Erika Zarate, Ministry of Agriculture, EC
- c) Soil as natural capital and the concept contribution to soil governance regulations, Brent Clothier/NZ



KEEP CONNECTING



WITH SOIL

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