SOIL CONNECTS

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

Issue 1 - December 2014

2015 International Year of Soils

this edition

Welcome to SOIL CONNECTS - 1

It is a pleasure to finally produce this inaugural edition of the newsletter covering the stories, issues, events from the members of Division 4. Just as importantly 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.

As we approach the International Year of Soil (IYS) 2015 there is a magnificent opportunity to put soil into the world's conversation about the future challenges we are facing. I am sure that this is a challenge that all members, not only of this division, but the IUSS will step up to and play their part.

I look forward to working as editor of this newsletter into the future and call on all of you who are reading it to make a contribution to future issues.

Damien Field
Editor, Soil Connects

Cover Photo - The first international Soil judging competition held in Jeju at the 20th World Congress of Soil Science. Photo provided by Stephen Cattle, The University of Sydney, Australia.

Soil Connects logo designed by;
David van der Linden

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

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 Commisison looks at soil as part of the ecosystem and how human activites 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 landuse 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 June 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,

Dear Colleagues and Friends,

It is with a great pleasure and a large satisfaction I announce the publication of this first issue of *Soil Connects*, the new Newsletter of the IUSS Division 4. It was an idea of Damien Field's (Chair, Commission 4.4) during the last World Soil Congress in Jeju, Korea. Damien has organized this 1st issue and will continue as Editor for Soil Connects. I thank him for having succeeded in the realization of this project.

I also want to welcome too Cristine Carole Muggler and Nilvania Aparecida de Mello, recently nominated as 1st and 2nd Division 4 vice chairs by the Organization Committee of the 21th World Soil Science Congress (Brazil). I am sure we will work well together. I would also like to take this opportunity to congratulate all the newly elected Commission Chairs and Vice Chairs of Division 4. I would also like to thank all of those who have contrbuted to the first edition of this newsletter.

At the last congress in Jeju I had the opportunity to meet with participants from various commissions and talk about the interactions and ideas for Division 4. I would like to thank you to all participants for the fruitful discussions. I think that everyone agreed on the proposition I put forward stating, 'we need to refocus the general activities of Division 4 to strengthen the link between soil science and the broader community and noted that there are elements that need to be included in the future, including the value of soil (economics), its interactions in ecosystem services, and management through environmental law. There is also the suggestion that a Working Group be formed to further proclaim the cultural dimensions of soils (art, literature, etc.)

On the last day congress I presented these ideas to the IUSS Executive Committee. The Executive approved these ideas and proposed we organize a symposium at the mid-term congress in Rio in 2016 illustrating the future role of Division 4 with stronger links with the human and social sciences. This will take some planning and sharing of ideas between all of us. As a start I recently had some discussion with a professor of Public Law at the University Jean Moulin - Lyon 3 (France) - Philippe BILLET - Director of the Environmental Law Institute, and working presently on environmental law for soils. I hope for the next years we will develop a good relationship with this colleague, and hope that he can make a contribution of his thoughts in the area in the next issue of Soil Connects.

For the 5th December World Soil Day (WSD) in France, the French association for soil science (AFES) organized a one day colloquium at the Chamber of Deputies on ecosystem services provided by soils to human societies. The assistance was mainly parliamentarians, representatives of different ministers, scientists and some farmers. On behalf of IUSS division 4, I gave a short and general talk on "Soils and Food security".

ARTICLES

For 2015 International Year of Soil, the IUSS president and Executive Committee asked each of the Divisions to present texts on the IUSS website during one trimester in 2015. The allotted time for Division 4 is from October to December 2015. I have just sent a short list of titles (included the articles of this issue) to the IUSS President to start this process but more is required of us, so please don't hesitate to propose a paper and send it to me and to Damien.

The best for you and family and
Happy New Year

Christian Feller

Towards the International Year of Soils: the challenge of bring people to care about the soil

Cristine Carole Muggler
Departamento de Solos, Universidade Federal de Viçosa, Brasil

As climatic conditions change and environmental problems grow, soil scientists and groups of soil users continue to speak out on the need to care for our soils. We know that soils are an integral part of the interactions between the atmosphere, hydrosphere, biosphere and lithosphere, and the functions that soil provide has a role in regulating and these interactions. Equally important is the role that this fragile layer of the earth's crust contribution to maintaining life. Those of us who know have given soil a special place and refer to it as a system by itself: the pedosphere.

Still, individuals and society in general do not realize that quality of life and our welfare are at risk when soils are not cared for. More often than not people are more likely to be concerned with issues around water, forests, and endangers species, and while admirable causes not realise the role of soil in supporting these issues and securing soil is one of the grand challenges facing humankind. One might argue that soils are taken for granted, or soils are not popular. This provides a challenge for us who know and work with soil, how are we to respond?

The International Year is a great opportunity to reach out and spread the word about soils. Not only the functions and essentiality of soils, but also its wonders: amazing biodiversity, incredible colours and unexpected beauty! To realize about soils is a first step to know more about them. With knowing comes enchantment, which is the basis of love and care. This is a chance to ask people to know about soil and to care. To engage present and future generations with soils is our ongoing task. For some years now, the Latin American Soil Science Congresses has set a aside a day for school children and teenagers to make public presentations and it is amazing to see how many are concerned about the threats to soil and choose to study them. At the last Congress in Cusco, Peru, Ronald Vargas, from FAO, was in charge of the initial presentation. He started to ask the children what is soil for them, and immediately a girl came loud and self-assured with the answer: Soil is Pachamama!! The mother Earth from the Inca civilization.

Of course this level of enthusiasm is still sporadic and there is much more to do to raise the soil's profile. Groups, actions, and initiatives are everywhere promoting the need to know and care for soil. This International Year now offers us the possibility of bring them together, making them visible and to potentiate activities, as well as upscale and downscale experiences. It is a challenge as well as an opportunity.

As soil lovers it is our year! Let's go for it!

International year of soil

United Nations A/RES/68/232

General Assembly

Distr.: General
7 February 2014

Sixty-eighth session
Agenda item 25

Resolution adopted by the General Assembly on 20 December 2013

[*on the report of the Second Committee (A/68/444)*]

68/232. World Soil Day and International Year of Soils

The General Assembly,

Reaffirming General Assembly resolutions 53/199 of 15 December 1998 and 61/185 of 20 December 2006 on the proclamation of international years, and Economic and Social Council resolution 1980/67 of 25 July 1980 on international years and anniversaries, particularly paragraphs 1 to 10 of its annex on the agreed criteria for their proclamation, as well as paragraphs 13 and 14, stating that an international day or year should not be proclaimed before the basic arrangements for its organization and financing have been made,

Noting that soils constitute the foundation for agricultural development, essential ecosystem functions and food security and hence are key to sustaining life on Earth,

Recognizing that the sustainability of soils is key to addressing the pressures of a growing population and that recognition, advocacy and support for promoting sustainable management of soils can contribute to healthy soils and thus to a food-secure world and to stable and sustainably used ecosystems,

Recalling the Rio Declaration on Environment and Development,[1] Agenda 21,[2] the Programme for the Further Implementation of Agenda 21,[3] the Johannesburg Declaration on Sustainable Development,[4] the Plan of Implementation of the World Summit on Sustainable Development (Johannesburg Plan of Implementation)[5] and

[1] *Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3–14 June 1992*, vol. I, *Resolutions Adopted by the Conference* (United Nations publication, Sales No. E.93.I.8 and corrigendum), resolution 1, annex I.

[2] Ibid., annex II.

[3] Resolution S-19/2, annex.

[4] *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August–4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum), chap. I, resolution 1, annex.

[5] Ibid., resolution 2, annex.

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Visit http://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/68/232 for the complete declaration

Making connections through Global Soil Security

Alex McBratney and Damien Field
Department of Enviromental Sciences, The University of Sydney, Australia

The soil science community already knows the crucial role soil has in accumulating nutrients and water to secure our food, fibre, biofuel and freshwater now and into the future. The role of soil as a habitat for a large diversity of organisms and supporting environmental and human health is also firmly rooted in the soil scientist psyche. Over the last five decades food, water and energy security, along with the adaption to climate change, protecting biodiversity and human health are six global challenges that soil scientists need to be addressing. The challenge though for soil scientist is to ensure that their knowledge is not just limited to a discussion amongst themselves but also engages the broader community who are also tackling these existential challenges.

The realization that soil has an integral part to play in the global challenges has led to the concept of ***soil security***, which refers to the maintenance and improvement of the world's soil to produce food, fibre, freshwater, contribute to energy and climate sustainability, and help to maintain biodiversity and protect ecosystem goods and services.

At the 20th World Congress in JeJu, Korea this concept was introduced to the soil science community and recognised that soil security is framed by five dimensions. The dimensions of **capability** and **condition** focus on the biophysical evaluation of soil and asks the questions 'what can this soil do?' and 'what is the current state of the soil?'. When focusing on food production, land suitability is an effective means of evaluating how the current condition of the soil can support grain, livestock and horticulture production.

But by focusing only on food production have we missed a trick? To know the soil's full potential we need to recognise that it provides functions that support a range of ecosystem services, such as nature reserves, water catchment, urban development and cultural significance, and when these are evaluated it is possible to describe what the soil is truely capable of. In fact experts claim that ecosystem services contribute $33 trillion annually to the global economy, and combining soil capability with cost, infrastructure, and human desires the opportunities are now fully explored. Capability provides a basis to quantify the soil resource across space and time which can be mapped, planned, modelled and forecast.

While everyone's problem, but not the central concern of the soil scientist, are the socioeconomic challenges when soil is not secure. Soil security frames this by placing a value on the soil, a need to know how people are connected with soil, and these

along with the biophysical attributes, will contribute to good policy to secure the soil against further degradation. This is covered by the dimensions of **capitial**, **connectivity**, and **codification**.

Both ecosystem services and green economies accept placing a value on soil viewing it as a stock from which goods are produced. This approach recognises that the multi-functional nature of soil enabling both its productivity and ecosystem services to be valued, in other words, letting us compare apples and oranges. Such an approach was demonstrated at the World Congress by Anna van Paddenburg from the Global Green Growth Institute in Jakarta. Talking to 'Investing in Green Growth Investing in Soil Security', Anna described how a change in focus to include valuing natural resources results in synergies that support both agricultural production and maintain the surrounding ecosystem to support wildlife and water quality.

To support famers' connectivity with soil means having access to good soil knowledge. In the future, Johan Bouma from Wageningen University in the Netherlands talked at the congress of the need for *knowledge brokers* who have both current soil science knowledge and the social intelligence to see how this knowledge can be used to support the soil's capability and condition.

Connectivity though demands that society more generally is reconnected to the soil as a means to increase its value and security. To nurture the wider public's connection Robert Hill stated that success is often achieved when a clear message is developed focusing on a single indicator for change. Although single indicators are not endorsed by soil science generally, the recent focus of society and its understanding of soil carbon would suggest that if a single indicator was needed, should be soil carbon?

Evidence suggests that national, let alone internationally agreed, policy around soil is sporadic with few countries, such as Korea, having well-developed integrated regulatory strategy. Having society connect with soil and providing accessible soil capability and condition data will improve the opportunity for policy development to secure soil. All of this can only be achieved when soil scientists, economists, social science and policy makers discuss and all contribute to the decision making about soil and this is what **soil security** is striving to achieve.

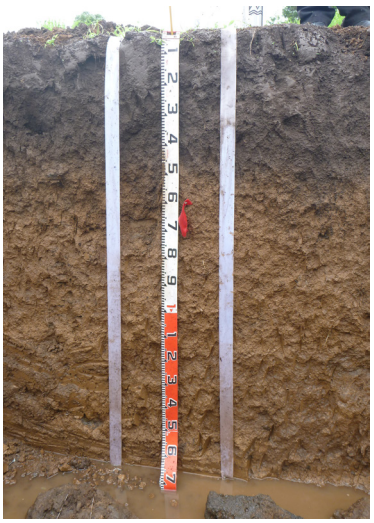
Therefore, there is a seventh global and existential challenge, that of soil security !

The soil judging juggernaut gathers momentum

Stephen Cattle
Department of Enviromental Sciences, The University of Sydney, Australia

Soil judgers in action at WCSS in JeJu, Korea.

The year of 2014 will prove to be a pivotal one in the history of soil judging. Although this field-based discipline of competitive soil description, classification and interpretation has a long and rich history in the USA (annual regional and national contests), its uptake in other countries has been poor. Prior to 2014, only Canada and Australia had hosted a single soil judging contest each. However, the 'soil judging landscape' changed significantly at the 20WCSS held in Jeju, Korea in June, when the inaugural International Soil Judging Contest was held in the three days leading up to the start of the Congress. Twelve teams of university soil science students from Australia, China, Hungary, Japan, Korea, Mexico, South Africa, Taiwan and USA competed, pitting their wits against the ash-derived soils of Jeju, and each other. Ultimately, the well-trained USA teams took first and second places in the overall classification (team-judged pit scores plus individually-judged pit scores), with Japan third. In the individual judging classification, the top three placegetters were Chien-Hui Syu from Taiwan, Tyler Witkowski from USA and Fei Yang from China. For all involved, this inaugural international contest was a great experience and built a lot of goodwill towards the discipline of soil judging.



Since June, the 2nd Australian Soil Judging Competition has been run at Melbourne in conjunction with the Australian National Soils Conference, and other countries/groups have commenced planning for soil judging contests in 2015 to help celebrate the International Year of Soils. In addition to the usual regional and national soil judging contests in the USA, an International Field Course and Soil Judging Contest is planned for Hungary in September, and a soil judging competition is also planned for Western Australia during 2015. These activities bode well for the future of soil judging, which has proven to be both a valuable educational mode, as well as a great way to engage a new generation of soil scientists.

Growing Food Crops on Urban Brownfields:
Best Management Practices to Reduce Potential Human Health Risk

Ganga Hettiarachchi
Kansas State University, Manhattan, USA

Growing of local crops, especially in urban areas is on the increase and many gardens are or will be located on land that may be impacted by previous use. These kinds of properties, i.e. vacant or abandoned properties with real or perceived contamination issues are called "brownfields". Not all brownfields sites will, of course, be suitable for growing food crops as the environmental conditions may not allow for this use. Growing food crops safely on mildly contaminated sites is possible for both the grower and consumer, if precautions are taken and best management practices are adhered to. Common urban soil contaminants include lead (Pb), arsenic (As), cadmium (Cd), zinc (Zn), and polycyclic aromatic hydrocarbons (PAHs) (Spittler, 1979; Chaney et al., 1984; Alloway, 2004; Brown, 2009; Roussel et al., 2010). Of these, Pb is by far the most dominant and wide-spread contaminant in urban environments. Soil remediation or managing risk posed by contaminants can be challenging as a result of poor soil quality and the presence of co-contaminants. Options such as raised-bed gardening or soil replacement can be physically and financially restrictive and there is a great need for sharing science-based knowledge on risk management associated with common urban soil contaminants.

Researchers at Kansas State University have been evaluating the uptake of heavy metals, metalloids and other contaminants by food crops grown on urban brownfields sites. The goal of this research is to enhance the capabilities of urban agriculture initiatives to produce food crops locally without concern about adverse health effects for the grower or the end consumer; to increase confidence in urban food production quality; to provide resources for producers, urban land managers, local and state government, and extension agents to implement proposed best management practices, and to contribute to the meaningful revitalization of brownfields sites in a sustainable manner. The research is made possible by a grant from the U.S. Environmental Protection Agency (USEPA).

Nationwide, seven test sites established thus far on brownfields sites slated for community gardens were evaluated by planting food crops over two consecutive growing seasons. Prior to adding a site to the project, historic site use of all sites was researched to narrow down potential contaminants. Soils were then tested for potential contaminants as well as for general soil properties. Soils at the various test sites exhibited lead concentrations from 100 mg/kg to 2,000 mg/kg, arsenic concentrations from 50 mg/kg to 130 mg/kg, and total PAH concentrations ranging up to 50 mg/kg. Three vegetable crop types with three very different growth and contaminant uptake patterns were planted over two growing seasons and soil and plant tissue samples were analyzed for contaminants associated with the respective sites. Effectiveness of selected site-specific soil amendments to reduce bioavailability of lead, arsenic and/or PAHs (polycyclic aromatic hydrocarbons) was evaluated.

Associated best management practices focusing on reduction of both direct (soil-human) and indirect (soil-plant-human) exposure to the gardeners and their children, and potential human health risks were established. Root crops were the only crops accumulated soil lead above the WHO/FAO maximum levels (MLs) with carrots taking up more lead than beets, radishes and sweet potatoes. In sandy soils with lead concentrations around 200 mg/kg to 250 mg/kg, lead concentrations in root crops exceeded the WHO/FAO MLs of 1-1.5mg/kg (dry weight basis). Arsenic uptake by all crop types was low in all vegetables indicating that food-chain transfer of arsenic may not be a problem for urban brownfields. PAH uptake by all crop types tested at our test site contaminated with PAHs was non-detect.

This picture shows growth difference in tomato plants growing in nonamended control plots and Tagro (a biosolids based soil product) plus dolomite amended plots, Tacoma, Washington test site (Defoe et al., 2014).

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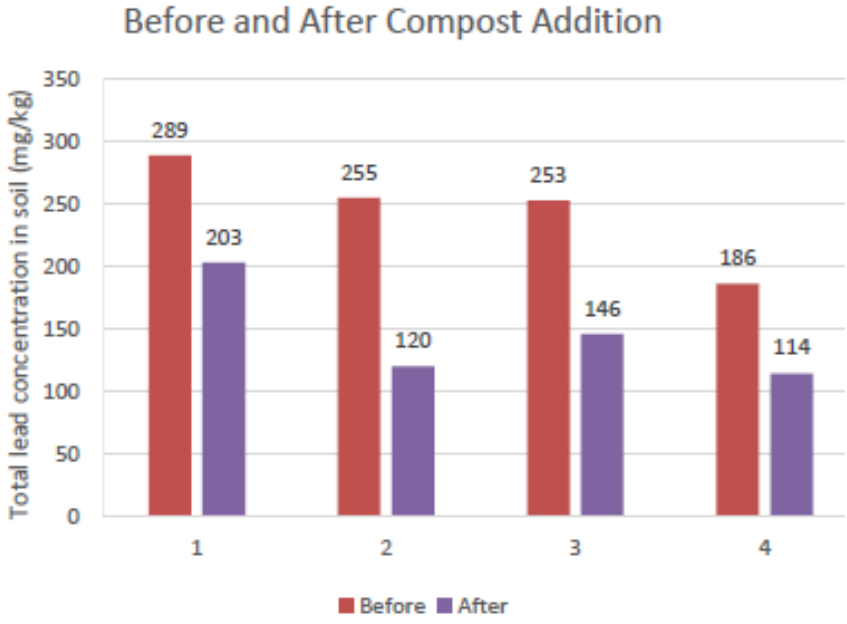
Overall findings indicate the following:
a) The potential exposure pathway of concern is direct exposure of humans to contaminated soils. The pathway from contaminated soil to plant to human is insignificant.
b) In general, concentrations of lead, arsenic and PAHs in vegetables harvested at test sites were low.

c) Contaminants were consistently diluted by the addition of compost.
d) Bioaccessible lead and arsenic in soils tested were low when measured using a physiologically based extraction method (modified from Ruby et al., 1996), mimicking GI tract dissolution processes.

When deciding to grow food crops on a mildly contaminated brownfields site, two options exist: growing in-situ (directly in the soil) or growing in raised beds filled with imported (tested) soils. If raised beds are selected as a best management practice, care should be taken that the garden paths, sideways and in between the beds are covered to prevent exposure to dust. If in-situ growing is selected, the soil very likely needs to be amended using compost and fertilizer because brownfields soils tend to be of poor quality. Generally, actions are taken to improve soil quality may also help to reduce the bioavailability of soil contaminants.

Examples are:

1) Compost addition will dilute overall contaminant concentrations, and mature/stable organic matter in the compost and the iron oxides present in some products such as composted Class A-biosolids will bind metals and organic contaminants in soils and thereby reduce their bioavailability.
2) In addition, compost addition helps maintain good soil nutrient status in soils. Maintaining good soil fertility and thereby increasing biomass production diluted lead concentrations in the vegetables.
3) The nutrient phosphorus, will transform lead into lead phosphate and reduce bioavailability.
4) Adjusting pH to around neutral (i.e. 6.5 to 7) will reduce the mobility of cationic metals such as lead and cadmium. For arsenic containing soils, the pH should not be adjusted to values over 6.5 to avoid enhanced arsenic mobility.
5) Soils may be impacted by more than one contaminant and a mixture of amendments (compost, phosphorus, and biosolids) would be beneficial.



Dilution effect on total contaminant concentration in soils upon compost addition at 28 kg m-2, Kansas City, Missouri test site (Attanayake et al., 2014).

References

Alloway, B. 2004. Contamination of soils in domestic gardens and allotments: A brief overview. Land Contam. Reclam. 12:179-187.
Attanayake, C.P., G.M. Hettiarachchi, A. Harms, D. Presley, S. Martin, and G.M. Pierzynski. 2014. Field Evaluations on Soil Plant Transfer of Lead from an Urban Garden Soil. J. Environ. Qual. Vol. 43: 475-487. doi:10.2134/jeq2013.07.0273
Chaney, R.L., Sterrett, S.B., Mielke, H.W., 1984. The potential for heavy metal expsoure from urban gardens and soils, In: Proceedings of the Symposium on Heavy Metals in Urban Gardens, Washington, D.C., Preer, J. R., Ed. University of the District of Columbia Extension Service: Washington, D.C., pp 37-84.
Defoe, P.P, G.M. Hettiarachchi, C. Benedict, and S. Martin. 2014. Safety of Gardening on Lead- and Arsenic-Contaminated Urban Brownfields. J. Environ. Qual. 43: 2064-2078. doi:10.2134/jeq2014.03.0099
FAO/WHO-CODEX. 1995. Codex general standard for contaminants and toxins in food and feed: Codex standard. Revised 1995, 2006, 2008, 2009, amended 2010. http://www.fao.org/fileadmin/user_upload/agns/pdf/CXS_193e.pdf (accessed 30 Nov. 2014).
Roussel, H., C. Waterlot, A. Pelfrêne, C. Pruvot, M. Mazzuca and F. Douay. 2010. Cd, Pb and Zn oral bioaccessibility of urban soils contaminated in the past by atmospheric emissions rom two lead and zinc smelters. Arch. Environ. Contam. Toxicol. 58:945-954.
Ruby, M. V., A. Davis, R. Schoof, S. Eberle, and C. M. Sellstone. 1996. Estimation of Bioavailability using a Physiologically Based Extraction Test. Environ. Sci. Technol. 30:422-430.
Spittler, T.M. and W.A. Feder. 1979. A study of soil contamination and plant lead uptake in Boston urban gardens. Communications in Soil Science & Plant Analysis 10:1195-1210.

Connecting people with soil

Ian Hollingsworth
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There may be another world called water, but living on earth we use soil to produce food to survive. Soil substrates support the ecosystems surrounding us that provide oxygen and filter water. Eons of time have generated soil pattern and biodiversity that imprint resilience to climate change on ecosystems and agriculture. However, reducing biodiversity and harvesting soil and water resources for agriculture to support growing populations and urbanisation have significant regional impacts that may increase food production but make it less sustainable at the same time.

The risk that an agricultural system will fail translates directly to mortality and community annihilation in subsistence economies. Capital investment and the energy intensity in fossil fuels buffer unsustainable agricultural systems against failure to some extent in an industrial economy. We can run down biodiversity, deplete and contaminate water and soil resources locally until we run out of capital to purchase produce, or land, from somewhere else.

Current needs in developed economies to secure food supply motivates investment and development around the world. However, securing soil and water resources for agriculture could be at a tragic cost to cultural and ecological resources - particularly developing economies in the tropics with large populations to support. Clearing biodiverse forests, diverting rivers, draining wetlands displacing traditional economies and cultures to develop industrial agriculture in Africa, Asia, Australia and South America does not appear to be based on evidence that these developments will be sustainable.

A large proportion of the world's food is produced from smallholdings, urban gardens, forests, rangelands and aquaculture. Peasants probably have significantly more than half of the world's cropland and may be responsible for 70% of world food production. If we further disturb the global food production system with industrial agriculture we need to be aware of the sustainability implications and mitigate by design against catastrophic failure. Otherwise clearing native vegetation, supplanting small holder agriculture with industrial systems and urbanisation will remove the trace of millions of years of evolution and tens of thousands of years of cultural interaction with the environment and potentially reduce sustainable food production in a changing climate.

Moving communities from subsistence and small holder production to industrial, urbanised economies has pervaded development since the European industrial revolution. However, the impacts of these changes on securing soil to produce food and support sustainable landscapes may be reduced if communities can maintain connections to land. Perhaps urban planning to maintain the capacity to produce food, energy and fibre is as critical as transport and water supply services? Perhaps designing industrial agricultural developments to the scale and pattern of landscape ecology is worth exploring? Diversifying food production and soil management in the development process is likely to be a more reliable strategy over the long term than expanding agricultural monocultures that industrial agriculture currently relies on.

For instance there is interest in agricultural development across Northern Australia that politics and capital are keen to support. Concerns about the risks from extensive agricultural development to indigenous culture and ecological systems hasn't so far translated into investment in agricultural innovations that use endemic plants and recognise cultural connection to land. External interests are focussed on crops and plantations that are exotic, acquiring land and water resources and developing infrastructure.

There is far less interest in numerous "bush" foods, fibres and medicines that supported a subsistence economy and were integral to the most biodiverse woodland and wetland environments in Australia. Agricultural innovation based on the endemic species and cultural knowledge may add more value.

Compaction causes photos provided by Jay Jabro.

Soil compaction: causes, concerns, prevention and alleviation

Jay Jabro
Northern Plain Agricultural Research Laboratory, Montana, USA

Intensive farming, inappropriate soil management and heavier machinery have led to an increase in soil compaction in this decade prompting increased global concern regarding the impact of soil compaction on crop production and soil quality in mechanized agriculture. Soil compaction affects crop yields through alteration of soil physical, chemical and biological properties and processes. Worldwide, problems from compacted soil affect an estimated 68 million hectares from farm machinery traffic alone. Research showed that approximately 80% of soil compaction from wheel traffic occurs on the first pass of a tire.

Soil compaction due to field operations is an acknowledged problem worldwide. Soil compaction may occur during tillage, planting, spraying, and harvesting. We generally think of compaction being caused by wheel traffic, but it can also be caused by opener disks on planter units and some tillage tools will cause a “hard pan” just below the tilled depth.

Soil moisture content has a great impact on soil compaction. Dry soils would not compact nearly as much as a moist soil under the same applied load. Heavy axle loads of large equipment tend to drive compaction deeper than light loads.

Soil compaction is a factor in reducing crop yield. Roots cannot easily penetrate compacted soil and therefore even though there are nutrients and moisture in the soil, the plant cannot extract them. Compacted soils do not readily absorb water so they contribute to increased runoff on slopes and ponding in low areas. Runoff increases erosion and may carry fertilizers and pesticides into streams and rivers. Soil compaction can reduce crop yield up to 50% in some areas depending upon the depth of compaction and its severity.

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Deep rooted cover crops (e.g., rye grass, oilseed radish, safflower, turnip) that can penetrate hard soils may be used to create root channels that later decay and loosen the soil. Deep tillage is commonly used to alleviate soil compaction. Increasing soil organic matter and encouraging earthworm activities can also soften compacted soil.

Freeze-thaw cycles alleviate soil compaction and improve soil structure. Soil scientists at the Northern Plains Agricultural Research Lab (NPARL) in Sidney, MT, USA established a study in 2009 to evaluate the dynamic of freeze-thaw cycles on soil compaction in a clay loam soil.

The freezing and thawing cycle (FTC) significantly decreased the penetration resistance in compacted soils. The 0-10 cm depth showed the most change with a 73% reduction in penetration resistance. The 10-20 cm depth showed a reduction of 66%. The deepest depth (20-30 cm) showed the smallest reduction in penetration resistance but it was still reduced by 49% after the first winter. The soils in the plots that were not subjected to the FTCs did not show as large a reduction in penetration resistance. However, even in these plots we saw a reduction of 50% in the top layer, most likely from shrink-swell cycles caused by wetting and drying and from soil biological processes.

Our study did not directly measure differences in crop production between treatments. It is generally accepted that soils with a penetration resistance greater than 1.5 MPa (218 psi) are compacted, resulting in restricted root growth, limited water absorption and reduced nutrient uptake. The soils in our compacted treatment were close to 2.2 MPa (319 psi) at the start of the experiment and the FTCs reduced that to well under the threshold for compacted soils so we could reasonably expect yields to be better after the FTCs. An experienced farmer who normally expects favorable crop yields could surmise the futility of planting into obviously compacted soil. Yet after the FTCs, the planting bed was quite mellow with good seed-to-soil contact where roots could be expected to flourish.

In addition to the methods mentioned above, limiting wheel traffic to a single path will subject a lesser portion of the field to compaction as will avoiding field operations on too wet soil.

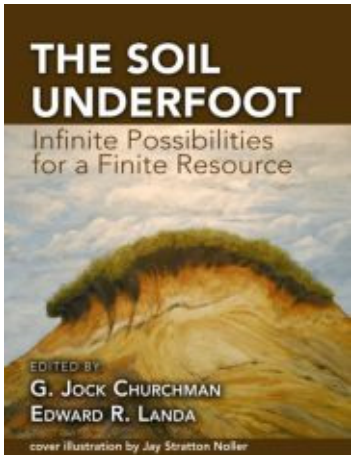
The development of proper farming practices (e.g., no-till, reduced tillage, crop rotations) that minimize soil compaction is essential for maintaining good soil structure and eliminating the need for multiple field operations.

For more information, please go to;

https://www.certifiedcropadviser.org/publications/sssaj/articles/78/3/737
https://www.soils.org/discover-soils/story/soil-compaction-and-freeze-thaw-cycles

Recent Publications

Books

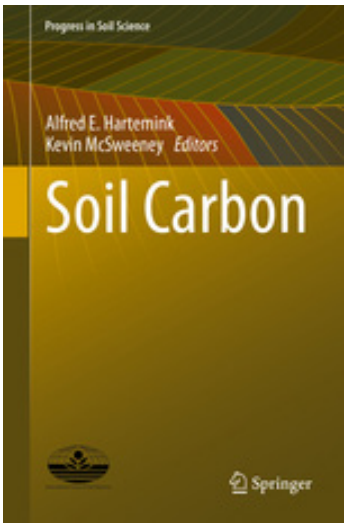


Publ: April 2014, CRC Press
Eds. J. Churchman & E. R. Landa

Summary

The largest part of the world's food comes from its soils, either directly from plants, or via animals fed on pastures and crops. Thus, it is necessary to maintain, and if possible, improve the quality—and hence good health—of soils, while enabling them to support the growing world population. The Soil Underfoot: Infinite Possibilities for a Finite Resource arms readers with historical wisdom from various populations around the globe, along with current ideas and approaches for the wise management of soils. It covers the value of soils and their myriad uses viewed within human and societal contexts in the past, present, and supposed futures.

Details found at:
http://www.crcpress.com/product/isbn/9781466571563



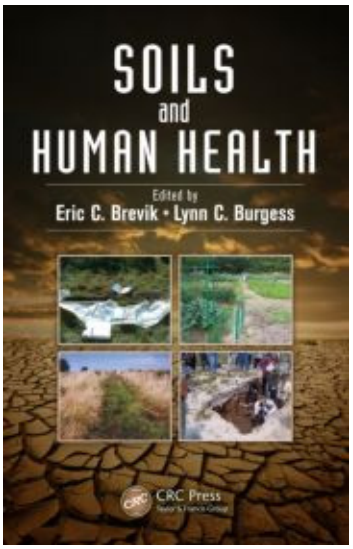
Publ: 2014, Springer
Eds. A. Hertemink &
K. McSweeney

Summary

Few topics cut across the soil science discipline wider than research on soil carbon. This book contains 48 chapters that focus on novel and exciting aspects of soil carbon research from all over the world. It includes review papers by global leaders in soil carbon research, and the book ends with a list and discussion of global soil carbon research priorities.

A wide variety of topics is included: soil carbon modelling, measurement, monitoring, microbial dynamics, soil carbon management, and 12 chapters focus on national or regional soil carbon stock assessments. The book provides up-to-date information for researchers interested in soil carbon in relation to climate change, and to researchers that are interested in soil carbon for the maintenance of soil quality and fertility.

Details found at:
http://www.springer.com/environment/soil+science/book/978-3-319-04083-7



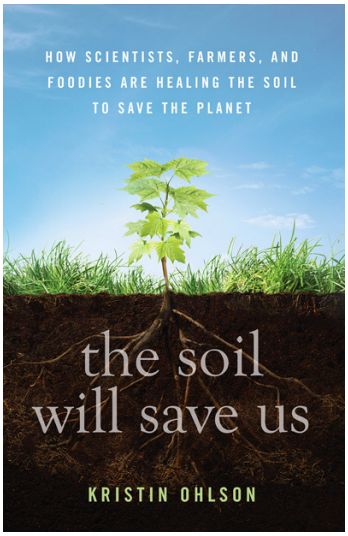
Publ: 2013, CRC Press
Eds. E. Brevik & L. Burgess

Summary

Despite the connections between soils and human health, there has not been a great amount of attention focused on this area when compared to many other fields of scientific and medical study. Soils and Human Health brings together authors from diverse fields with an interest in soils and human health, including soil science, geology, geography, biology, and anthropology to investigate this issue from a number of perspectives. The book includes a soil science primer chapter for readers from other fields, and discusses the ways the soil science community can contribute to improving our understanding of soils and human health.

Details found at:
http://www.crcpress.com/product/isbn/9781439844540

Books (Popular)



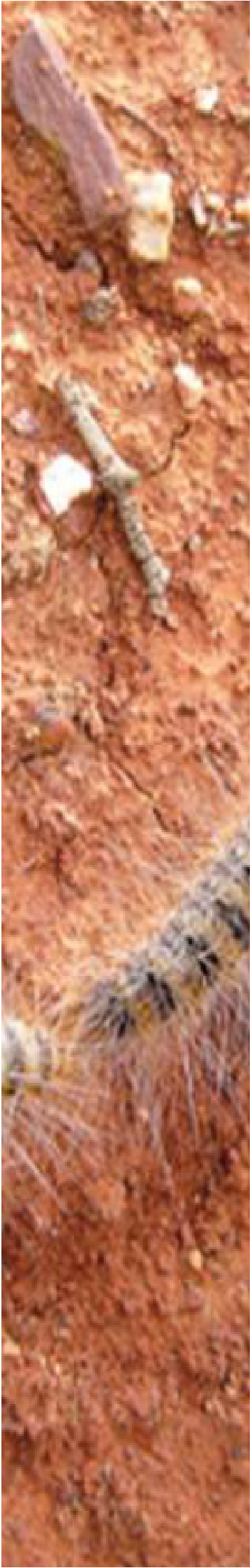
Publ: 2014, Rodale
Auth. K. Ohlsen

Summary

Thousands of years of poor farming and ranching practices—and, especially, modern industrial agriculture—have led to the loss of up to 80 percent of carbon from the world's soils. That carbon is now floating in the atmosphere, and even if we stopped using fossil fuels today, it would continue warming the planet. In The Soil Will Save Us, journalist and bestselling author Kristin Ohlson makes an elegantly argued, passionate case for "our great green hope"—a way in which we can not only heal the land but also turn atmospheric carbon into beneficial soil carbon—and potentially reverse global warming.

Ohlson's fascinating journey to understand the hidden dynamics of the natural world—brought to life through vivid storytelling and crisp, engaging analysis will inspire everyone to rethink the potential of the ground beneath their feet, as well as the landscapes around them, and to figure out how they can make a difference.

Details found at:
http://www.kristinohlson.com/books/soil-will-save-us



Books

The Soils of Poland: World Soils Book Series Bednarek, Renata Maria, Jankowski, Michał, Świtoniak, Marcin 2015 .
The Soils of Slovenia: World Soils Book Series Repe, Blaž 2015
The Soils of Germany: World Soils Book Series Scholten, Thomas, Fleck, Wolfgang, Fleige, Heiner 2015
The Soils of Antarctica: World Soils Book Series Bockheim, James (Ed.) 2014
The Soils of Iceland: World Soils Book Series Arnalds, Olafur 2015
The Soils of Bulgaria: World Soils Book Series Shishkov, Toma, Kolev, N. 2014

Journals

Bockheim, J.G., Gennadiyev, A.N., Hartemink, A.E., & Brevik, E.C. 2014. Soil Forming factors and Soil Taxonomy. *Geoderma*, (in-press).

Brevik, E.C., & Burgess, L.C. 2014. The influence of Soils on Human Health. *Nature Education*, (in-press).

Brevik, E.C., Sauer, T.J. 2014. The Past, Present and Future of Soils and Human Health Studies. *SOIL*, (in-press)

Brevik, E.C., Hartemink, A. E. 2013. Soil Maps of the United States of America. *Soil Science Society of America Journal*

Dominati, E., Mackay, A., Green, S., Patterson, M. 2014. A soil change-based methodology for the quantification and valuation of ecosystem services from agro-ecosystems: A case study of pastoral agriculture in New Zealand. *Ecological Economics*. 100, 119-129.

Hartemink, A.E., Balks, M.R., Chen, Z., Drohan, P., Field, D.J., Krasilnikov, P., Lowe, D. J., Rabenhorst, M., van Rees, K., Schad, P., Schipper, L.A., Sonneveld, M., Walter, C. 2014. The joy of teaching soil science. *Geoderma*. 217-218, 1-9.

Jabro, J.D., Stevens, W.B., Iversen, W.M., Evans, R.G., Allen R.G. 2014. Crop water productivity of sugarbeet as affected by tillage. *Agronomy Journal.* 106: 2280–2286.

Koch, A., McBratney, A., Adams, M., Field, D.J., Hill, R., Crawford, J., Minasny, B., Lal, R., Abbott, L., O'Donnell, A., Angers, D., Baldock, J., Barbier, E., Binkley, D., Parton, W., Wall, D.H., Bird, M., Bouma, J., Chenu, C., Flora, C.B., Goulding, K., Grunwald, S., Hempel, J., Jastrow, J., Lehmann, J., Lorenz, K., Morgan, C.L., Rice, C.W., Whitehead, D., Young, I., Zimmermann M. 2013. Soil Security. Solving the Global Soil Crisis. *Global Policy*. 4, 434-441.

McBratney, A.B., Field, D.J., Koch, A. 2014. The Dimensions of soil security. *Geoderma*, 213, 203 - 213.

Robinson, D.A., Jackson, B.M., Clothier, B.E., Dominati, E., Marchant, S.C., Copper, D.M., Bristow, K.L. 2014. Advances in soil ecosystem services: Concepts, models, and applications for earth system life support. *Vadose Zone Journal,* 12,

Stockmann, U., Adams, M.A., Crawford, J.W., Field, D.J., Henakaarchchi, N., Jenkins, M., Minasny, B., McBratney, A.B., Remy de Courcelles, V., Singh, K., Wheeler, I., Abbott, L., Angers, D.A., Baldock, J., Bird, M., Brookes, P.C., Chenu, C., Jastrow, J.D., Lal, R. Lehmann, J., O'Donnell, A. G., Parton, W., Whitehead, D., Zimmermann M., 2013. The known, known unknowns and unknowns of sequestration of soil organic carbon. *Agriculture, Ecosystems & Environment*. 164, 80-89.

Stockmann, U., Malone, B.P., McBratney, A.B., Minasny, B. 2015 Landscape-scale exploratory radiometric mapping using proximal soil sensing. *Geoderma,* 239, 115-129.

Wamelink, G.W., Frissel, J.Y., Krijnen, W.H., Verwoert, M.R., Goedhart, P.W. 2014. Can Plants Grow on Mars and the Moon: A Growth Experiment on Mars and Moon Soil Simulants. *PloS one,* 9,

Photo: Cristine Morgan, Texas A&M, Texas, USA.

2015
International
Year of Soils

The International year of soil (IYS) aims to be a platform for raising awareness of the importance of soils for food security and essential eco-system functions.

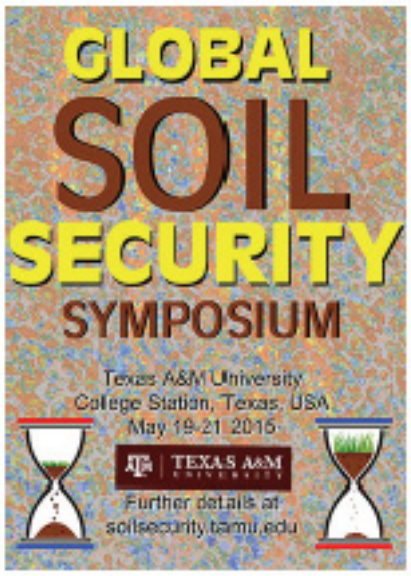
The objectives of the IYS are:

1) to create full awareness of civil society and decision makers about the fundamental roles of soils for human's life;
2) to achieve full recognition of the prominent contributions of soils to food security, climate change adaptation and mitigation, essential ecosystem services, poverty alleviation and sustainable development;
3) to promote effective policies and actions for the sustainable management and protection of soil resources;
4)to sensitize decision-makers about the need for robust investment in sustainable soil management activities aiming at healthy soils for different land users and population groups;
5)to catalyze initiatives in connection with the SDG process and Post-2015 agenda;
6) to advocate rapid enhancement of capacities and systems for soil information collection and monitoring at all levels (global, regional and national).

To keep up-to-date with what is happening globally visit:
http://www.fao.org/soils-2015/en/

Save the date!
3rd Global Soil Week
April 19 – 23, 2015
Berlin, Germany

The Global Soil Week aims at (i) establishing a transdisciplinary process for exchanging knowledge and experiences on land and soil issues, and (ii) raising public awareness on the importance of soils globally to influence land and soil policies for sustainable development.



Achieving soil security will need the invovlment of scientists, economists and social scientists, joing with politicians and the community to develop the right frameworks and responses to secure soil.

We are convening experts and innovative thinkers from a range of disciplines inclduing agricultural and resource economists, (rural) sociology, information technology, soil science, and agronomy to furhter develop the concept of soil security, and to work toward assessment and implementation strategies. The three day discuassion wi address the five dimensions of soil security.

Please visit https://globalsoilsecurity.tamu.edu/ for more detials.

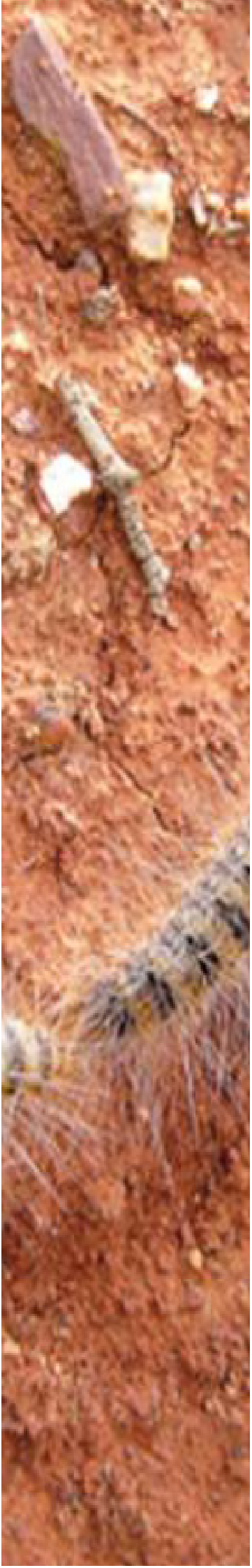
The European Geosciences Union (EGU) has established the Soil System Sciences (SSS) program group which will be formed again at the next general assembly to be held in Vienna, Austria from the 12th to the 17th April, 2015.
See: http://www.egu2015.eu/home.html

Digital Soil Morphometrics

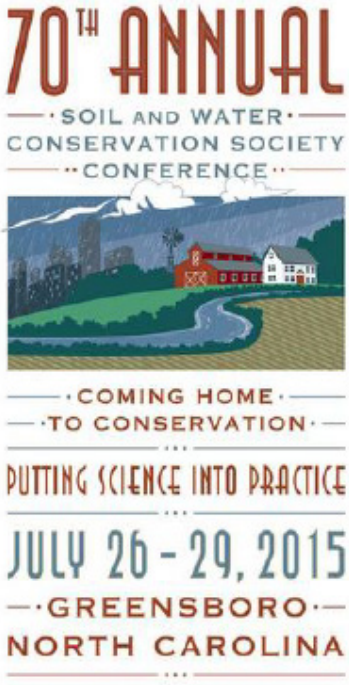
IUSS Working Group

The first workshop of the Digital Soil Morphometrics working group will be held from the 1st to 2nd June 2015, in University of Wisconsin,-Madison, USA.

Details at:
http://digitalsoilmorphometrics.org/inaugural-global-workshop-2015/



Please visit http://www.governancadosolo.gov.br/ for more detials



The 70th Annual Soil and Water Conservation Society (SWCS) Conference will provide a forum to celebrate past conservation accomplishments as well as share and promote science-based knowledge on critical, current issues facing soil, water, and environmental sustainability.

One way we are moving forward on current environmental challenges is by incorporating the former NIFA National Water Conference into the SWCS Annual Conference, which will increase collaborative opportunities for Land-Grant based scientists and educators engaged in water issues. SWCS welcomes this addition to our already diverse audience and the enhancement it will provide to all conference participants.

Please visit http://www.swcs.org/en/conferences/2015_annual_conference/for more detials.

COVER CROPS Iowa Conference
February 17-18, 2015
Sheraton Hotel
West Des Moines, IA

Together, the Soil and Water Conservation Society, Conservation Districts of Iowa, and the Midwest Cover Crops Council are hosting the Iowa Cover Crops Conference on February 17-18, 2015, in West Des Moines, IA. You will find the complete conference agenda, hotel reservation link, and additional information at www.swcs.org/15IACC.

Photo: Damien Field, The University of Sydney, Sydney, Australia

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