Cross-Institute Programme for Sustainable Soil Function

SoilCIP

Newsletter for June 2010

A short newsletter again this month as I've been preoccupied with submitting the outline ISPG and National Capability proposals. We are proposing that much of the soils research will be in the 'Delivering Sustainable Systems' programme, but some will contribute to 'Designing seeds', '2020 Wheat' and 'Cropping Carbon', so the SoilCIP is fully committed to interdisciplinary science. Well done and thanks to all who contributed!

We have also submitted National Capability proposals for the long-term experiments, sample archive and eRA database (as one NC), the ECN (Rothamsted and NW sites) and, with Phil Murray leading the way, the Farm Platform. All proposals were submitted yesterday and we now await evaluation. This was expected to be in July but we are now told we will hear in early October so that we can write full proposals by Christmas. It will be a busy autumn and I will be hoping for a much wider involvement in the writing of the full proposals than was needed for the outline cases. I expect to be able to circulate the Cases for Support for all the proposed ISPGs shortly.

Related to this, I've been asked by RERAD to review the proposals for part of their new research programme, so that will help us to coordinate our research with SCRI and Macaulay. Has anyone else been contacted by RERAD?

Prizes

Congratulations to Dr Hua-Fen Li, a visiting scientist from China Agricultural University, who has been awarded the Bram Steiner Award by the Wageningen Alumni Network/Bram Steiner Foundation, for a paper based on her work at Rothamsted (Li H.F., McGrath S.P. and Zhao F.J. 2008. Selenium uptake, translocation and speciation in wheat supplied with selenate or selenite. New Phytologist 178: 92-102). The award recognises innovation, scientific quality and impact in plant nutrition research and comes with a €2500 prize.

I've been elected an Hon Fellow of the Royal Agricultural Society of England. Any more prizes/measures of esteem to report?

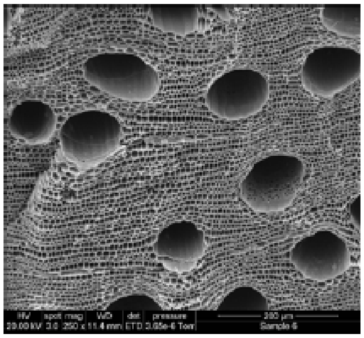
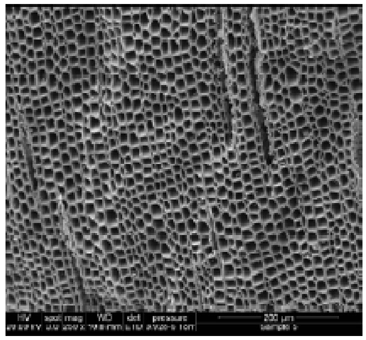
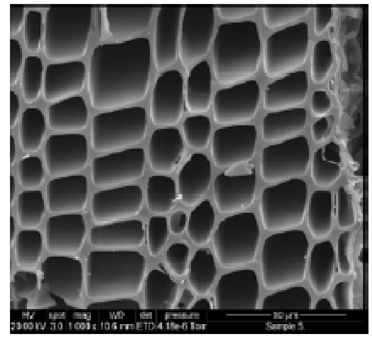
Biochar

The biochar review for Defra and Decc, that Roland and I were involved in writing with the UK Biochar Research Centre, is now available on Defra's website:
http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16168&FromSearch=Y&Publisher=1&SearchText=soil&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

As there is not much news this month, I've cut and pasted the article below in Biochar from the NZ Soil Science Society 'Soil News', just received from Trish Fraser.

Editorial - Associate Professor Marta Camps

Biochar and Soil Science

Despite its black and dusty appearance to the naked eye, at microscale, wood biochar reveals a complex and stunning structure, with thousands of regular-size hollows that make it resemble a honeycomb. From a soil science perspective, though, the view of this microstructure produces many additional thoughts. Soil physicians will tend to look at biochar as a tubular assembly, through which – if it is not too hydrophobic – water may flow and where it can be stored. The porous structure of biochar, on the other hand, is likely to provide microorganisms with a highly suitable habitat to colonise. A soil microbiologist will therefore envisage biochar pores as an environment to protect microbes from predation and desiccation, and as a source of some nutritional needs. In this sense it should be noted that, although the biochar stability makes it an unlikely major source of carbon and/or energy after any initial condensates have been decomposed, biochar surfaces are able to retain mineral nutrients and organic compounds suitable to fulfil microbial needs. The water content status of this porous structure will affect gas diffusion. This, in turn, will influence the nature and function of microbial communities inhabiting biochar pores, which may have implications for the fluxes of greenhouse gases, such as N_2O. Conversely, soil chemists will visualise the aromatic biochar as a highly condensed structure having some redox activity, in spite of its high stability. In fact, the electron-donating properties of aromatic areas with a high density of π-electrons explain the surface oxidation of charcoal particles with ageing, and the subsequent formation of O-containing functional groups responsible for the high surface reactivity of weathered biochar particles.

Not all biochars have a regular microstructure. High-ash biochars (e.g., poultry litter, sewage sludge) are predominantly amorphous and heterogeneous, and have very intricate surfaces and internal properties. As soil mineralogists have illustrated, the mineral components of the ash fraction present within the carbon structure of biochar differ in the range of structural ordering. It is in this mineral fraction that most plant nutrients are encountered (e.g., P, K, Ca), although N is mostly found in the organic structure as heterocyclic N, and thus in a non-available form. Soil scientists who have specialised in soil fertility may therefore focus both on the role of biochar as a source of nutrients, in particular of high-ash biochars, and on the cation exchange properties that develop at their surfaces with ageing. The availability of some nutrients is highly pH-depended, and will be affected by the liming properties of high-ash biochars. Revealing the fate of the different elements present in both the inorganic and organic components of biochar is the aim of soil biogeochemical studies, with a crucial emphasis on the residence time of carbon in biochar. Finally, soil environmental chemists concentrate on the safety of biochar with regard to human and environmental health, with a main focus on the presence and availability of organic pollutants and heavy metals in biochar.

Specific studies are definitely needed on the effects of biochar on soils from the view points of different soil science disciplines, as these different approaches will produce the most important advances. However, our understanding of the effect of biochar on soils will remain poor and generally unable to be applied if the knowledge acquired is not integrated within a unified doctrine that considers the soil as a whole. Moreover, the design of adequate biochars for different soil and crop needs should be carried out through joint research with the biochar engineering discipline, which is also responsible for developing the technological and economical aspects of the production of biochar. The knowledge needed to determine the feasibility of the use of biochar as an amendment for New

Zealand soils should come not only from the integration of the different soil science disciplines, but also from interactions with other fields of knowledge. As soil scientists it is our responsibility, however, to understand the extraordinarily heterogeneous nature of soils, and how their internal organization, components and properties will vary in response to biochar addition. We can only act on soils, e.g., applying biochar to them, if we have a comprehensive understanding of their present and future characteristics, so that we can optimise this resource in a sustainable manner.

Click here for the on-line version of this Alert

International Union of Soil Sciences

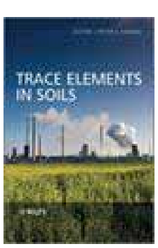
IUSS Alert 62 (June 2010)

Information for and from the global soil science community

New Publications

The Architecture and Biology of Soils : Life in Inner Space. Edited by K Ritz, Cranfield University, UK, I M Young, University of Abertay, Dundee, July 2010. Hardback, 400 Pages. 9781845935320UK £95.00, €135.00. Soil is a fundamental and critical, yet often overlooked, component of terrestrial ecosystems. It is an extremely complex environment, supporting levels of diversity far greater than any ecosystem above ground. This book explores how soil structure develops and the consequences this has for life underground. The effects of spatial arrangement, of soil's physical and biological components on their interaction and function are used to demonstrate their roles in ecosystem dynamics. Bringing together existing knowledge in the areas of soil biology and physics, this book explores the key characteristics of soil spatial architecture.

Soil Ecology and Management. By J K Whalen, McGill University, Canada, L Sampedro, Centro de Investigación Forestal de Lourizán Pontevedra, Galicia, Spain December 2009. Paperback, 304 Pages. 9781845935634. £37.50 €55.00. Soil Ecology and Management describes the organisms inhabiting the soil, their functions and interactions and the dimensions of human impact on the activity of soil organisms and soil ecological function. Chapters discuss basic soil characteristics and biogeochemical cycling, key soil flora and fauna as well as community-level dynamics (soil food webs). Unlike other soil biology and ecology textbooks, this text also conveys a better understanding of how human activities impact upon soil ecology in a section on ecosystem management and its effects on soil biota. The authors provide a unique perspective on the utility of soil organisms by exploring the biodiversity of soil food webs, how they are impacted by human activities and intervention and their management.



Trace Elements in Soils. Peter Hooda (Editor). ISBN: 978-1-4051-6037-7. Hardcover, 616 pages. April 2010, Wiley-Blackwell. £125.00, €143.80 Trace elements occur naturally in soils and some are essential nutrients for plant growth as well as human and animal health. However, at elevated levels, all trace elements become potentially toxic. Anthropogenic input of trace elements into the natural environment therefore poses a range of ecological and health problems. As a result of their persistence and potential toxicity, trace elements continue to receive widespread scientific and legislative attention. Trace Elements in Soils reviews the latest research in the field, providing a comprehensive overview of the chemistry, analysis, fate and regulation of trace elements in soils, as well as remediation strategies for contaminated soil. The book is divided into four sections: (i) Basic principles, processes, sampling and analytical aspects: presents an overview including general soil chemistry, soil sampling, analysis, fractionation and speciation. (ii) Long-term issues, impacts and predictive modelling: reviews major sources of metal inputs, the impact on soil ecology, trace element deficient soils and chemical speciation modelling. (iii) Bioavailability, risk assessment and remediation: discusses bioavailability, regulatory limits and cleanup technology for contaminated soils including phytoremediation and trace element immobilization. (iv) Characteristics and behaviour of individual elements.

www.iuss.org

Keith Goulding, 1st July 2010