World Soil Issues and sustainable development: an agenda for action

Abstracts

40 years

ISRIC – World Soil Information

Special Seminar

9th March 2006

Wageningen

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Program

8.30-8.45 Registration

8.45-9.00 Introduction by **Stein Bie**

9.00-9.45 **Pedro Sanchez,** Columbia Univ. USA
Achieving the Millennium Development Goals in Africa

9.45-10.30 **David Dent**, ISRIC Wageningen
Global soil issues: ISRIC in the world of soil information

10.30-11.00 Coffee

11.00-11.45 **Carlos Cerri**, CENA Brazil
Soil organic carbon stocks/sequestration and greenhouse gas emissions

11.45-12.30 **Tom Veldkamp,** Wageningen
Global land change and soil-landscape dynamics

12.30-14.00 Lunch

14.00-14.45 **Nuhu Hatibu,** ASARECA, Eastern and Central Africa
Quick-Win Solutions to Integrated Management of Soil- Health and Water by the Poor in Semi-Arid Areas of Africa

14.45-15.30 **Hans Hurni** CDE, Berne
Soils in the International Arena: Why do we do so little?

15.30-16.00 Tea

16.00-17.00 Plenary: An agenda for action. Chair **Don Sparks,** Univ. Delaware, USA

>17.00 Drinks in the World Soil Museum, and presentation of ISRIC Fellows

Achieving the Millennium Development Goals in Africa

Pedro Sanchez
The Earth Institute at Columbia University, 2-G Lamont Hall, P.O. Box 1000 Palisades, NY 10964-8000, USA E-mail sanchez@iri.columbia.edu

Abstract
The Millennium Development Goals (MDGs) are quantified targets to eradicating extreme poverty, established in 2000 with the UN Millennium Declaration. The goals are to eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality and empower women; reduce child mortality; improve maternal health; combat HIV/AIDS, malaria, and other diseases; ensure environmental sustainability; and to develop a global partnership for development.
Sub-Saharan Africa is far behind other regions of the world in achieving the MDGs. Unlike most of Asia, Latin America, and the Middle East, Africa is experiencing a decline in overall food production per capita. More than 70% of the absolutely poor and hungry people live in rural areas of the world, with farming as their main occupation and income source. But Africa's farmers generate the lowest food output per hectare of any major region in the world. The green revolution that tripled food production in developing countries in Asia, Latin America, and the Middle East—thus enabling them to improve government policies, markets and infrastructure—failed to benefit Africa. Without the increase in food production, little has improved in Africa's heavy burden of human disease, poor policies and governance, and lack of basic infrastructure for roads, water, and energy. Increasing the productivity of small-scale agriculture is therefore the first step in ending poverty in Africa.
Unhealthy soils and untamed water in Africa are the overarching obstacles to increasing agricultural productivity. I plan to discuss the central role of soils in kick starting the process and its links with policy.
Key words: Millennium Development Goals, MDGs, Hunger, Africa

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Global Soil Issues: ISRIC and the world of soil information

David Dent
ISRIC – World Soil Information, PO Box 353, 6700 AJ Wageningen, Netherlands, E-mail david.dent@wur.nl

Abstract
If we consider the global environmental outlook, there seem to be a few, inescapable scenarios:

- Continued human population growth, at least till 2050, and economic development – therefore continued, rapid land use change;
- Energy transition from fossil fuels to renewables;
- Climate change;
- Urbanisation.

These bring with them several soil-related issues and challenges:

- Food security: Food production and farm production in general needs to double by 2050;
- Nutrient and power addiction;
- Water requirements;
- Land degradation;
- Disturbance, even undermining of underpinning biophysical cycles.

For instance, how can we put back the soil organic carbon into the soils?
As for escape routes, there are known knowns – existing knowledge to be applied; known unknowns – knowledge gaps preventing effective solutions; and unknown unknowns.

Soil organic carbon stocks/sequestration and greenhouse gas emissions

Carlos C. Cerri[1]
(& Carlos E. P. Cerri[1], David Powlson[2], Niels H. Batjes[3], Martial Bernoux[4], Keith Paustian[5], Eleanor Milne[5], Charles W. Rice[6])
[1]*Centro de Energia Nuclear na Agricultura, Av. Centenario 303, CEP. 13400-970, Piracicaba, Brazil*
[2]*Rothamsted Research, Agriculture and Environment Division, Harpenden, AL52JQ, UK*
[3]*ISRIC – World Soil Information, PO Box 353, 6700 AJ Wageningen, The Netherlands*
[4]*Institut de Recherche pour le Développement, UR 179, BP 64501, 34394 Montpellier, France*
[5]*Natural Resource Ecology Laboratory, Colorado State University, Fort Collins, CO 80523-1499, USA*
[6]*Dept. of Agronomy, Kansas State University, Manhattan, Kansas, 66506-5501, USA*

Abstract
Globally, soils store about 1500 Pg of carbon (C), which is three times the amount present in vegetation and twice the amount found in the atmosphere. Land use change, mainly for previous agricultural practices, has often decreased soil organic carbon (SOC) stocks due to enhanced mineralization of soil organic matter (mainly to CO_2). A significant fraction of the ~32% increase in atmospheric CO_2 over the last 150 years stems from the breakdown of SOM after forests and grasslands were cleared for farming. This process increases greenhouse gas (GHG) concentrations in the atmosphere, exacerbating global warming. Conversely, adoption of "best management practices", such as conservation tillage and crop residue retention, can partly reverse the process – they are aimed at increasing the input of organic matter to the soil and/or decreasing the rates at which SOM decomposes. This mechanism has been called "soil carbon sequestration". Some of the main issues – with focus on Tropical soils – that will be discussed in this seminar are: *Known knowns*, such as: Estimates of organic carbon storage in soil without human intervention; Land use (change) in the tropics is critical to the global C cycle; Measurements of management-induced changes in SOC in tropical soils are still limited; Soil geographical and analytical data, at national scale, are still not available in a uniform and standardized format for many countries; Many of the biophysical processes are known and these have been described in dynamic organic carbon models; Comparisons of SOC sequestration potential should consider changes in all GHG fluxes (CO_2, CH_4, N_2O,) as well as changes in full system carbon. The *Known unknowns* are*:* Present soil organic C stocks and changes therein, under different land uses; The amount of soil C remaining from native systems and the amount introduced by agricultural practices and resultant residues; Net GHG emission rates under different land uses and land use changes; Potential of soil C sequestration under present land uses; Dynamics of organo-mineral associations in relation to C cycling and sequestration in soils; mechanisms responsible for C stabilization and turnover in soil aggregates and of landscape effects on C sequestration. To what extent does black carbon contribute to C sequestration and is it possible to capitalize on it to achieve more? Interactions between organic and inorganic carbon (in arid regions). The *Unknown unknowns* are: Potential biotechnological improvements to enhance C sequestration (changes in plant biochemistry and belowground allocation by plants; How will global warming, through its effects on carbon inputs (quantity and quality) and soil C mineralization, affect soil C stocks (feedback); How will future "soil C sequestration/GHG emissions" impact on food security and livelihoods?

Global land change and soil landscape dynamics

Tom Veldkamp
Wageningen University, Department of Environmental Sciences, Laboratory of Soil Science and Geology, P.O. Box 37, 6700 AA Wageningen, The Netherlands
Tom.Veldkamp@wur.nl

Abstract
The Global land system is undergoing continuous change, predominantly due to human actions. Many impacts of these change occur at the local soil pedon and at the regional landscape scale. I will demonstrate how these two scales interact and that a dynamic modelling approach can bridge and quantify these interactions.
Spatial-temporal explicit modeling of landscape process dynamics such as water and soil redistribution within a landscape, gives insight in the impact of changing land systems. For several case studies it will be demonstrated how this type of research can determine and quantify the on- and off-site effects of land use systems within a landscape. Managing land use systems requires thus a combined on- and off-site approach in such a way that not only soil processes, but also the non-linear processes in the landscape are taken into account. In order to meet this aim of 'landscape farming', more studies integrating on- and off-site impacts of land use change for both short and long time-spans are required. The future of this integrated multi-scale landscape processes modeling will be explored. Such model simulations will allow assessments of possible on- and off-site effects as a result of possible planned or foreseen land use changes. Furthermore, they will allow the assessment of feedbacks into the land use, allowing scenarios of land use change causing land cover change. Such models could serve a multitude of stakeholders ranging from large-scale farmers to local and national policy makers.
Key words: Landscape, Agro-ecosystem, Scales, Erosion, Deposition, Modeling,

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Quick-win solutions to integrated management of soil-health and water by the poor in semi-arid areas of Africa

Nuhu Hatibu,
Associate Professor, Soil-Water Management Research Group, Sokoine University of Agriculture, Tanzania, and Regional Coordinator of the Soil and Water Management Research Network for East and Central Africa (SWMnet), P.O. Box 39063 – 00623, Gigiri, Nairobi, Kenya. n.hatibu@cgiar.org

Abstract
While the majority of developing countries in Asia and Latin America have managed to move from severe food crises and famines of the 1960s to food sufficiency and surpluses, the situation in Sub-Saharan Africa (SSA) has become worse although the majority of its population are full-time food producers. Many international development experts have tended to romanticize the smallholder agriculture and rural life in SSA. However, we can not escape the fact that in the early 1960s the average yield of grains was nearly the same in all regions of the world at between 1 - 2 tons/ha, and while currently the average in the rest of the world is moving towards 4 tons/ha, SSA is stuck at less than 1 ton/ha. The main contrast seem to be the structure, in that agriculture in SSA is dominated by smallholder subsistence farmers, while that of other regions is dominated by medium to large farmers. The

productivity of smallholder farms remains at an average of 0.5 tons/ha while large scale ones even in SSA are able to attain up to 10 tons/ha of grain yields. Existing evidence shows that productivity of labor, water and land under smallholder rainfed farming in SSA is limited by three main factors, pests (especially weeds), shortage of soil nutrients (especially Phosphorous) and high variability in soil moisture. This paper presents and discusses technologies and practices which can be widely applied to overcome these three main constraints leading to trebling of productivity under smallholder farming. Then the paper analyzes why after many years of research and "perfection", these technologies and practices have not been adopted by the majority of smallholders in SSA. It is shown that there are two underlying factors. First, smallholder farmers are not adopting these systems due to poor ratio of benefit to costs brought about by inadequate development or complete lack of food trade to absorb at competitive prices the surplus produced by farmers in seasons of good rains. This prevents the poor smallholders in semi-arid areas from using good seasons to create wealth and build assets, which in turn limits their ability to cope with bad seasons, leading to frequent food shortages and famines. The second underlying factor is therefore the high variability of soil-moisture available for plant growth which tends to frequently nullify gains from investments in other productivity enhancing interventions. Therefore, management strategies of smallholders are driven by bad experiences during poor seasons and are thus designed to reduce risk by minimizing or avoiding investments in HYVs, improved seed, weed control or fertilizers. Consequently, although soil-moisture is often not the most limiting factor, reducing its variability in the semi-arid areas is the most important entry point in promoting adoption of other productivity enhancing interventions. It is perhaps for this reason that the *Green Revolution* in Asia first took root under irrigated conditions. Hence, quick-win solutions to the major obstacles faced by the poor in semi-arid areas of Africa are technologies and practices (such as precision tillage) that ensure adequate capture of rainwater where it falls coupled with husbandry practices (such as manure application) to keep the infiltrated water in the root zone followed by agronomic practices which ensures that the soil-moisture is transpired by crops and not lost to evaporation or weeds. Technologies and practices which reduce the occurrence and negative impacts of within-season dry spells should be at the top of the priorities for investments aimed at improving the productivity of smallholder agriculture in SSA. This must be supported by well functioning food trade including food-exchange mechanisms to ensure that farmers obtain adequate returns to financial capital and labor invested in these inputs.

Soils in the international arena: Why do we do so little

Hans Hurni
National Centre of Competence in Research, NCCR North-South, and Director, Centre for Development and Environment (CDE), Institute of Geography, University of Berne, Steigerhubelstrasse 3, 3008 Berne, Switzerland Email nccr-ns@cde.unibe.ch

Abstract
Land- and soil-related issues are a central factor of global sustainable development. Yet, there is little indication of effective international cooperation between scientists, policy makers and other stakeholders in relation to land degradation and sustainable land use and management. For example, soils have been largely missed out in the Millennium Ecosystem Assessment (MA) that was initiated by UN Secretary General Kofi Annan in 2001. The Framework Convention on Climate Change (FCCC) does not

adequately address soils as a potential sink for carbon sequestration. The Convention on Biological Diversity (CBD) is merely mentioning soil biodiversity as an important component of biodiversity. Only the Convention to Combat Desertification (CCD) covers land degradation as a major issue, at least in semi-arid lands, but the related operational programme of the Global Environment Facility (GEF) has few projects with explicit soil components. At the World Congress of Soil Science (WCSS) in 2002 in Bangkok, the IUSS General Assembly unanimously adopted a 9-point ‚World Soils Agenda', which included tasks for science, monitoring and research, for policy guidance, and for support of implementation. Apart from the few activities of the working group, however, no member association took the issue and followed it up at the national levels. Currently, IUSS is developing so-called 'IUSS Policy briefs', i.e. small leaflets attempting to relate soils to climate change, food production, human health, water, poverty alleviation, and land use planning. While this is a good initiative, will it have the long-needed impact? Why do we do so little? The presentation will try to look into the psychology of a soil scientist, but also at the various perceptions by international stakeholders and the public at large in relation to the soil resource. In conclusion, the need for establishing a new 'World Soils Council' will be argued, a body that becomes active in the international arena and takes the necessary initiatives.

Key words: sustainable land management, international agreements, stakeholders, soil perceptions, World Soils Agenda, IUSS Policy Brief, World Soils Council