

Newsletter

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SmartSOIL (Sustainable farm Management Aimed at Reducing Threats to SOILs under climate change) is a research project in the European Commission Seventh Framework Programme. It aims to contribute to reversing the current degradation trend of European agricultural soils by improving soil carbon management in European arable and mixed farming systems covering intensive to low-input and organic farming systems. SmartSOIL will identify and develop options to increase C stocks and optimise C use (flows) whilst maintaining sustainable SOC stocks.

<http://smartsoil.eu/>

Recent SmartSOIL Publications and Reports

Typical farming systems and trends in crop and soil management in Europe (Deliverable 2.2)

This paper analyses and maps the typical European farming systems. The main objective is to identify a representative European farming systems with relevant crop and soil management at the EU-27 regional level NUTS 2. This information is then used in SmartSOIL to upscale and extrapolate the results of the mitigation actions in the case studies. The deliverable includes a complete dataset build on: a) the European public or research databases that contain statistical information about farming systems (EUROSTAT, SAPM and MITERRA) b) the European projects that have analysed agro-ecosystems previously (SEAMLESS, PICCMAT) and c) a literature review of previous studies on soil and crop management. In addition, this database was analysed and validated by means of surveys to experts in seven project partner countries (the Netherlands, Denmark, Italy, United Kingdom, Poland, Hungary and Spain). This task was undertaken in collaboration with the partner teams in the Case Studies. Finally, the validated dataset was then used to parameterise a simplified model that quantifies the variables used in the mapping. The full report (SmartSOIL Deliverable 2.2) is available at:

http://smartsoil.eu/fileadmin/www.smartsoil.eu/WP2/D2_2_Final.pdf

Soil and Soil Organic Carbon within an Ecosystem Service Approach Linking Biophysical and Economic Data (Deliverable 3.1)

Soil organic carbon is a vital component in the healthy functioning of soils needed to ensure the productivity of soil for agricultural production. At the same time soils contribute to human well-being through a wider range of ecosystem services including water quality, flood control, carbon sequestration, recreation and cultural heritage. Scotland's Rural College (SRUC), together with the Universities of Aberdeen and Copenhagen, have begun to explore the complex relationships between soil carbon,

ecosystem services and human well-being. The aim is to understand how the value of these benefits is determined by soil organic carbon, and also be able to assess whether and how soil management leads to the sustainable provision of these benefits.

The main output of the research is an overview table capturing the variety of ecosystem services derived from a lowland arable landscape. This illustrates the information needs for a better understanding and quantification of the links between 'what soil does and provides', and the consequent impacts on human well-being. As a key message, soil functions should be viewed as bundles of soil processes that are providing input into the delivery of valued final ecosystem services. The report also addresses soil stock and service flow concepts that motivate questions about the meaning of soil resilience and sustainability.

The full report (SmartSOIL Deliverable 3.1) is available at: http://smartsoil.eu/fileadmin/www.smartsoil.eu/WP3/D3_1_Final.pdf

Overview and assessment report of decision support tools and knowledge platforms (Deliverable 4.1)

The report provides overall recommendations for development of the SmartSOIL DST and toolbox, including the design, support, inputs, results, and maintenance:

- DSTs should not be too complex in terms of data or technological requirements because it could limit user uptake;
- Results must be useful and comprehensive – most farmers will lack motivation to calculate their soil carbon unless the benefits of soil carbon management are clearly indicated;
- In order to provide relevant and useful results, the data on which the tool is based must be kept up-to-date and the software should be maintained; irrelevant outputs or frequent errors could cause abandonment of the tool;

- In terms of soil carbon management, existing DSTs address this issue in small part only (e.g., carbon sequestration due to land use change), so there is an important gap that the SmartSOIL DST could potentially fill.

However, due to the limited nature of the SmartSOIL project, integrating the simple model basis for the DST into existing DSTs and platforms should be explored for long-term inclusion of soil carbon management in broader sustainable soil management decisions. The full report (SmartSOIL Deliverable 4.1) is available at: http://smartsoil.eu/fileadmin/www.smartsoil.eu/WP4/D4_1_Final.pdf

[Uptake of soil management practices and experiences with decisions support tools - Analysis of the consultation with the farming community \(Deliverable 5.1\)](#)

Based on interviews with policy makers and advisors in six case study regions and countries (Denmark; Hungary; Italy; Scotland; Poland; Spain), this research aimed to consult experts about two main issues:

1. the current promotion, implementation and barriers to uptake of soil management practices with particular emphasis on soil carbon management, and
2. their experience, and requirements, of DSTs, with particular emphasis on those supporting soil carbon management.

The research found no evidence of specific government policies for promoting soil carbon management practices in any of the case study countries; instead soil management advice and regulation is an integrated part of other cross-compliance, fertilizer management and agri-environmental scheme programmes. The extent to which farmers and advisors are aware of, and implement, soil carbon management practices varies considerably, both within and between, the case study countries, and is related to farm sector, farm size, level of profitability, and farmer factors. With respect to barriers to the promotion and uptake of soil management practices many farmers (and some advisors) are unconvinced of the economic benefits. The perception of scientific uncertainty limits the credibility of recommendations and advisors feel ill-equipped to provide reliable advice. Related to this, is the lack of real life examples and the difficulty of demonstrating the positive effects of soil management practices and economic benefits over a long time scale. Farmers lack of technical knowledge or familiarity with the practices compounds this, and commercial imperatives often override good practice. Incentives need to be financial, provided either as subsidies or by demonstrating the financial gains of implementation. Improving scientific clarity is thought to be critical. The full report (SmartSOIL Deliverable 5.1) is available at: <http://smartsoil.eu/activities/stakeholder-interaction/uptake-of-soil-management-practices-and-experiences-with-decisions-support-tools>

Scientific papers and articles

[Sources of Nitrogen for Winter Wheat in Organic Cropping Systems](#)

Petersen, S.O. et al., Aarhus University

Inputs of organic matter have a shorter-term direct and a longer-term indirect effect on the capacity of a soil to deliver plant-available N. During the initial decomposition phase, organic inputs increase microbial activity, which can be associated with net N mineralization or immobilization depending on the C/N ratio and other characteristics of the input. Subsequently, the N residing in residues of the initial decomposition phase adds to the main soil organic N pools, from where N is mineralized at a comparatively slow rate. The cumulative indirect effect of organic inputs thus reflects the duration of the specific management, while the direct effect depends on the quantity, as well as the quality, of recent inputs. To better synchronize soil N mineralization with crop demand, the relative importance of short- and long-term effects of organic inputs needs to be known in greater detail.

This study examined soil N stocks and pools of labile N in soil under winter wheat grown in three different organic cropping systems and one conventionally managed system without organic inputs as reference. Soil sampling took place in two successive years within the four experimental cropping systems at three (2007) and two (2008) sites with different soil types. We hypothesized that residue inputs from legumes and cover crops, and animal manure, would have similar long-term effects on N availability at all sites and that soil N availability and uptake by winter wheat would depend on the specific cropping system. It was found that inherent soil properties and past and current management all contributed to winter wheat N yields.

Published in Soil Science Society of America Journal 77, 155-165, 2013. [dx.doi.org/10.2136/sssaj2012.0147](https://doi.org/10.2136/sssaj2012.0147)

[Carbon dynamics and retention in soil after anaerobic digestion of dairy cattle feed and faeces](#)

Thomsen, I.K. et al., Aarhus University

Adequate inputs of organic matter to the soil are vital for maintaining the fertility of arable soil and for retaining atmospheric CO₂ in the soil organic matter pools. Arable land under intensive management tends to lose C and a systematic removal of manure and crop residues for energy purposes may enhance this negative trend. The return of the digested residues to arable land may alleviate prospected soil C losses, but the overall impact on soil C storage of using manure and crop residues for biogas production before land application remains unclear. The objective of this study was to compare the decomposition in soil of C added with primary plant biomass (feed) before and after being consumed by cattle, and before and after being subjected to anaerobic digestion for biogas production.

It was found that soil C sequestration is probably not influenced by the choice of energy utilization of the C held in the plant biomass. However, the exploitation of the easily decomposable C in the ruminants and/or in anaerobic biogas reactors most

likely affects the short-term soil fertility as the microbial activity is reduced when substrates are deprived of the most labile fractions before being applied to soil.

Published in *Soil Biology & Biochemistry* 58, 82-87, 2013 [dx.doi.org/10.1016/j.soilbio.2012.11.006](https://doi.org/10.1016/j.soilbio.2012.11.006)

Higher temperature sensitivity for stable than for labile soil organic carbon – evidence from incubations of long-term bare fallow soils.

Lefèvre, R. et al. (2013). *Global Change Biology* (accepted)

Shifts in $\delta^{13}\text{C}$ with loss of soil organic carbon in long-term bare fallow experiments

Menichetti, L., et al. (2013). *Oecologia* (submitted).

Managing soil organic carbon: a farm perspective

Julie Ingram, Jane Mills, Ana Freluh-Larsen, McKenna Davis, Paolo Merante, Sian Ringrose, Andras Molnar, Berta Sánchez, Bhim Bahadur Ghaley, Zbigniew Karaczun (2014) *Eurochoices* (accepted)

This paper presents a forum for preliminary advisors and policy makers about managing soil carbon. Key barriers to uptake of practices include: Production related decisions are taken in the short-term, but managing soil carbon needs a long-term approach perceived scientific uncertainty about the efficacy of practices; lack of real life 'best practice' examples to show farmers; difficulty in demonstrating the positive effects of soil carbon management practices and economic benefits over a long time scale; and advisors being unable to provide suitable advice due to inadequate information or training. Most farmers are unconvinced of the economic benefits of practices for managing soil carbon. Incentives are therefore needed, either as subsidies or as evidence of the cost effectiveness of practices.

Clay Dispersibility and Soil Friability—Testing the Soil Clay-to-Carbon Saturation Concept

P. Schjønning et al.. Published in *Vadose Zone Journal*, Vol. 11 No. 1, 2012, doi: 10.2136/vzj2011.0067

Soils and climate change

Pete Smith. Published in *Current Opinion in Environmental Sustainability*, 2012, 4:1–6, doi: 10.1016/j.cosust.2012.06.005

Scientific papers in preparation

- C-TOOL – A soil carbon model and its parameterisation
- Soil carbon content as affected by management and climate in Europe
- Analysis of factors controlling soil organic matter dynamics as affected by management practices: A model inter-comparison study.
- Crop yield as affected by long-term management and soil carbon flows and stocks
- Simulation of crop yield responses to varying soil properties and functions as affected by long-term carbon management
- Crop yield responses to input intensity under varying soil carbon stocks and flows
- A simplified model for assessing soil carbon management effects on soil carbon stocks and crop yield (J.R. Porter & J.E. Olesen)
- Crop yield and N utilization as influenced by C flux and stock components
- Ecosystem services as influenced by crop and soil management
- Towards mitigation of greenhouse gases by small changes in farming practices. Understanding local barriers in Spain. Mitigation and Adaptation Strategies for Global Change.
- Economic evaluation of strategies for mitigating greenhouse gases in potato production systems. ITEA-Información Técnica Económica Agraria.

SmartSOIL videoclips

SmartSOIL has the objective to disseminate best practices and innovative examples of farmers implementing specific soil practices to improve soil carbon management. A number of videoclips are available on SmartSOIL website, among others:

Soil Organic matter- Does it matter?

<http://smartsoil.eu/dissemination/>

Climate change already has influence on European agriculture

<http://smartsoil.eu/dissemination/>

SmartSOIL participation in events

Upcoming - 11th European IFSA Symposium, 1-4 April 2014 in Berlin, Germany

CCRI-University of Gloucestershire/Ecologic in partnership with Catch-C will host a workshop session: Farming systems facing global challenges: Capacities and strategies. Workshop theme Soil management: facilitating on-farm mitigation and adaptation
Details are here: http://project2.zalf.de/IFSA_2014/calls/call-for-abstracts/theme-3/workshop-3.1

Global Soil Week, Berlin, 27-31 October 2013

The conference brought together a wide array of international stakeholders from academia, civil society, business, and policy to discuss three major topics: 1) Understand soils in the nexus, 2) Manage the nexus, and 3) Create sustainable pathways to societal change.

Members of the SmartSOIL consortium (Ecologic Institute, Aarhus University, Alterra, CCRI-University of Gloucestershire), in collaboration with the European Commission DG Joint Research Center and the Institute for Advanced Sustainability Studies, hosted a session titled "Soil carbon management for sustaining agricultural productivity" under the first topic.

For more information see: <http://smartsoil.eu/news/news-item/artikel/the-smartsoil-project-was-well-represented-at-the-global-soil-week-in-berlin-27-31-oct-2013/>

Conference on Sustainable intensification: The pathway to low carbon farming? Edinburgh 25-27 Sept 2013

On behalf of the CCRI (Countryside and Community Research Institute, UK) and Ecologic team, Jane Mills presented a paper entitled: Soil management practices to deliver crop productivity and soil carbon storage: understanding socio-economic barriers to, and opportunities for, implementation

IX Spanish Agricultural Economics Congress (AEEA), Barcelona (Spain), September 2013.

For more information see: <http://www.creda.es/event/ix-congreso-nacional-economia-agraria/es>

II REMEDIA Workshop, Zaragoza (Spain), April 2013

Organized by the Spanish National Council for Scientific Research (CSIC), the workshop focused on mitigation of greenhouse gases emissions from agroforestry systems, and included 150 participants from 6 countries. The REMEDIA Network links ongoing research activities relating to mitigation in agroforestry systems. The network has an active blog and reaches over 300 scientists in Spain.

For more information see:

http://www.redremedia.org/events/index.php?option=com_content&task=view&id=212&Itemid=352

blog: <http://redremedia.wordpress.com/remedia-workshop-2013/>

SOIL CARBON SEQUESTRATION, for climate, food security and ecosystem services, Reykjavik (Iceland), May 2013

This conference highlighted the potential of SOC sequestration as a key option in mitigating climate change; identify tools and policies for enhancing SOC sequestration; and recommend means to bridge the gap between science, policy and action in restoring SOC for multiple benefits. A presentation was given on the Catch-C and SmartSOIL twin projects on Sustainable Soil Management in EU FP7.

For more information see: <http://scs2013.land.is/>

FAO/IAEA Int. Symposium on Managing Soils for Food Security and Climate Change Adaptation and Mitigation, Vienna (Austria), July 2012

This symposium was concerned with measures to manage soils that would achieve better crop yields under climate change while at the same time storing more carbon in the soils. A presentation was given of the carbon flux and stocks concept for understanding these interactions.

For more information see: <http://www-pub.iaea.org/iaea-meetings/>

EUROSOIL 2012, Bari (Italy), June 2012

At the 4th International Congress EUROSOIL 2012 Soil Science for the Benefit for the Mankind and Environment a presentation was given by the SmartSOIL partners on the soil carbon flux and stocks concept for improving the understanding and communication of benefits of improved soil carbon management.

For more information see: www.eurosoil2012.eu