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The German agricultural soil carbon inventory: conceptual framework and methodology

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Soil organic matter is a key parameter for soil quality, productivity and soil resilience to erosion and compaction. Agricultural soils tend to show depletion in soil organic carbon stocks due to cultivation. Intensive farming and almost complete biomass removal by harvest bring the input-output equilibrium of soil C out of alignment. Climate change increases the risk of soil organic matter losses by enhanced mineralisation so that the paradigm that soil organic carbon stocks are in equilibrium with their long-term use may not longer be valid.

The quantity of C stocks published in the literature varies greatly by author and climate region (Janzen 2004, Lal 2004). The data underlying these studies were collected within general soil surveys which often have not considered mall scale variability, land-use dependency as well as local influences of soil hydrology, exposition etc..

In Germany, there are two soil inventories for forest soils, but none for agricultural ones. To fill this gap and to provide a basis for reporting under the UN Framework Convention on Climate Change by national data, a nation-wide consistent, representative data set on present soil organic carbon stocks in the entire solum of agricultural soils a survey is being conducted between 2010 and 2013.

The project focuses on the following main objectives: (i) improvement of the national reporting on emissions under the UNFCCC, (ii) development of a consistent, nation-wide data set on current soil carbon stocks of agricultural soils, (iii) utilization of an adequate population for geo-statistical interpolation, (iv) using advanced modelling techniques under consideration of the theory of errors, and (v) provide the data basis to separate the influence of site and climate factors from land use history and land management.

We will present the conceptual framework and its implementation in the field. We will describe the analysis of representativeness at national level and for soil climate regions, how small-scale variability is addressed, the sampling design and quality assurance. In parallel to the field work detailed information about land use history and management of the sampling plots is collected by questionnaires. This will, for the first time, allow an in-depth analysis of natural versus anthropogenic controls of soil organic carbon stocks entirely based on national observations. The future prospect of climate change on soil organic carbon stocks can be modelled based on this project‘s data set, as well.

Janzen, H. H. (2004) Carbon cycling in earth systems - a soil science perspective. Agriculture Ecosystems & Environment, 104, 399-417.
Lal, R. (2004) Soil carbon sequestration impacts on global climate change and food security. Science, 304, 1623-1627.