

Land use history explains soil carbon stocks

Through land use, people influence input and output of organic matter to the soil, which, after a long time, results in variability of soil organic carbon (SOC) stocks across the landscape.

Land use history is a dominant factor explaining the spatial distribution of the soil organic carbon stock. With data on land use history, insight in the spatial variability of SOC stocks was improved in several landscape-scale case studies and in the sand area of the Netherlands as a whole. These insights were used to improve understanding of the effects of future land use changes on SOC sequestration.

Case studies

Inventories of SOC stocks and assessments of SOC dynamics require

better understanding of SOC variability to decrease uncertainties. In this study, SOC variability was investigated in landscape-scale case studies. In forests, SOC stocks significantly differed between different tree species and between unmanaged and managed locations^[1]. In agricultural land, land use history explained much of the SOC variability, while the current land use had a small effect^[2,3]. This is a result of the slow response of SOC to land use changes: it takes many decades before land use significantly alters the SOC stock, while effects of past land use on SOC stocks are preserved for a long time.

Applications

Knowledge from the landscape-scale studies was used for upscaling SOC stocks to the Dutch sand area. Using readily available data on long-term land use, the error of the SOC map decreased by around 20% in almost two-third of the area (FIGURE) compared to the state-of-the-art Dutch SOC map. The results can improve the Dutch greenhouse gas inventory and stress the importance of long-term land use for explaining SOC variability. The impact of land use change on SOC sequestration was applied in a European-scale study to model future SOC sequestration under different scenarios^[4].



C.J.E. (NYNKE) SCHULP is a PhD student at the Land Dynamics Group of Wageningen University.

Her prime scientific interest is in studying the interface

between the biophysical landscape on one hand and human activities in past, present and future on the other hand. She is familiar with modelling land use changes and SOC dynamics and other ecosystem services, several statistical methods and research in soil science and historical geography.

+31 317 482004 / nynkeschulp@hetnet.nl

PROJECT: ME03 - Soil carbon dynamics and variability at the landscape scale: its relation to aspects of spatial distribution in national emission databases.

PARTNERS: Wageningen UR / University and Research Centre / Netherlands Environmental Assessment Agency (PBL) / Biometris / Plant Research International

REFERENCES

- Schulp, C.J.E., G.J. Nabuurs, P.H. Verburg, and R.W. De Waal, 2008. Effect of tree species on carbon stocks in forest floor and mineral soil and implications for soil carbon inventories. *Forest Ecology and Management*, 256: 482-490. <http://dx.doi.org/10.1016/j.foreco.2008.05.007>.
- Schulp, C.J.E. and P.H. Verburg, 2009. Effect of land use history and site factors on spatial variation of soil organic carbon across a physiographic region. *Agriculture, Ecosystems & Environment*, 133: 86-97. <http://dx.doi.org/10.1016/j.agee.2009.05.005>.
- Schulp, C.J.E. and A. Veldkamp, 2008. Long-term landscape – land use interactions as explaining factor for soil organic matter variability in agricultural landscapes. *Geoderma*, 146: 457-465. <http://dx.doi.org/10.1016/j.geoderma.2008.06.016>.
- Schulp, C.J.E., G.J. Nabuurs, and P.H. Verburg, 2008. Future carbon sequestration in Europe - Effects of land use change. *Agriculture, Ecosystems & Environment*, 127: 251-264. <http://dx.doi.org/10.1016/j.agee.2008.04.010>.

FIGURE
OC map of the Dutch sand area resulting from this study (a); areas where the state-of-the-art SOC map of the Dutch sand area can be improved (b).

