



Impact of long-term agricultural management on landscape-scale SOC variability

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Land use is an important determinant for the soil organic carbon (SOC) stock and is often used as a key determinant in upscaling of SOC stocks. Because the response of SOC stocks on land use change is slow, also land use history is expected to be a potential determinant for regional level SOC stock inventories. So far, land use history is never used as a determinant for SOC stocks in upscaling, because of the limited quantitative knowledge of the effect of land use history on SOC stock and lack of land use history data.

We modelled the long-term effect of agricultural management on SOC stocks for a case study in the Netherlands. Carbon inputs in two historical land use systems (plaggen agriculture with high inputs, and heathland disturbed by plaggen harvesting, with low inputs) and two present-day land use systems (one with high inputs and one with low inputs) were quantified. With the RothC model, temporal dynamics of SOC stocks over 200 years under these land use systems were simulated, followed by 200 years of high-input modern agriculture. Data from a detailed soil mapping were used to evaluate the consequences of model results for landscape-scale SOC variability.

Model results show that the SOC stock in high-input land use was 1.5 times larger than in low-input land use after 200 years in both historical and present-day land use. Significant differences between the high-input and low-input systems only emerge after several decades. These differences are maintained over 150 years of high-input modern agriculture. Therefore, the traditional heathland farming that lasted from Medieval times to the 1850s has left an imprint on the landscape level SOC contents. High-input modern agriculture is only present since the 1950s and has not yet a dominant effect on SOC variability. We conclude that long-term land use history is a key determinant for SOC variability at landscape scale, both because of the imprint of historical land use systems and because of the spatial variability of historical land use. Including information on land use history will therefore lead to improved regional estimates of SOC stocks.