Geophysical Research Abstracts
Vol. 15, EGU2013-4683, 2013
EGU General Assembly 2013

Estimating European soil organic carbon mitigation potential in a global integrated land use model

Stefan Frank (1), Hannes Böttcher (1), Uwe Schneider (2), Erwin Schmid (3), and Petr Havlík (1)

(1) IIASA, Austria (frank@iiasa.ac.at), (2) Hamburg University, Hamburg, Germany, (3) University of Natural Resources and Life Sciences, Vienna, Austria

Several studies have shown the dynamic interaction between soil organic carbon (SOC) sequestration rates, soil management decisions and SOC levels. Management practices such as reduced and no-tillage, improved residue management and crop rotations as well as the conversion of marginal cropland to native vegetation or conversion of cultivated land to permanent grassland offer the potential to increase SOC content. Even though dynamic interactions are widely acknowledged in literature, they have not been implemented in most existing land use decision models. A major obstacle is the high data and computing requirements for an explicit representation of alternative land use sequences since a model has to be able to track all different management decision paths. To our knowledge no study accounted so far for SOC dynamics explicitly in a global integrated land use model. To overcome these conceptual difficulties described above we apply an approach capable of accounting for SOC dynamics in GLOBIOM (Global Biosphere Management Model), a global recursive dynamic partial equilibrium bottom-up model integrating the agricultural, bioenergy and forestry sectors.
GLOBIOM represents all major land based sectors and therefore is able to account for direct and indirect effects of land use change as well as leakage effects (e.g. through trade) implicitly. Together with the detailed representation of technologies (e.g. tillage and fertilizer management systems), these characteristics make the model a highly valuable tool for assessing European SOC emissions and mitigation potential. Demand and international trade are represented in this version of the model at the level of 27 EU member states and 23 aggregated world regions outside Europe. Changes in the demand on the one side, and profitability of the different land based activities on the other side, are the major determinants of land use change in GLOBIOM. In this paper we estimate SOC emissions from cropland for the EU until 2050 explicitly considering SOC dynamics due to land use and land management in a global integrated land use model. Moreover, we calculate the EU SOC mitigation potential taking into account leakage effects outside Europe as well as related feed backs from other sectors. In sensitivity analysis, we disaggregate the SOC mitigation potential i.e. we quantify the impact of different management systems and crop rotations to identify most promising mitigation strategies.