Geophysical Research Abstracts
Vol. 17, EGU2015-15628, 2015
EGU General Assembly 2015

How can soil organic carbon stocks in agriculture be maintained or increased?

Axel Don (1) and Jens Leifeld (2)

(1) Thünen Institute of Climate-Smart Agriculture, Braunschweig, Germany, (2) Climate / Air Pollution Group, Agroscope, Zurich, Switzerland

CO_2 emissions from soils are 10 times higher than anthropogenic CO_2 emissions from fossil burning with around 60 Pg C a-1. At the same time around 60 Pg of carbon is added to the soils as litter from roots and leaves. Thus, the balance between both fluxes is supposed to be zero for the global earth system in steady state without human perturbations. However, the global carbon flux has been altered by humans since thousands of years by extracting biomass carbon as food, feed and fiber with global estimate of 40% of net primary productivity (NPP). This fraction is low in forests but agricultural systems, in particular croplands, are systems with a high net exported carbon fraction. Soils are mainly input driven systems. Agricultural soils depend on input to compensate directly for i) respiration losses, ii) extraction of carbon (and nitrogen) and depletion (e.g. via manure) or indirectly via enhances NPP (e.g. via fertilization management). In a literature review we examined the role of biomass extraction and carbon input via roots, crop residues and amendments (manure, slurry etc.) to agricultural soil′s carbon stocks. Recalcitrance of biomass carbon was found to be of minor importance for long-term carbon storage. Thus, also the impact of crop type on soil carbon dynamics seems mainly driven by the amount of crop residuals of different crop types. However, we found distinct differences in the efficiency of C input to refill depleted soil C stocks between above ground C input or below ground root litter C input, with root-C being more efficient due to slower turnover rates. We discuss the role of different measures to decrease soil carbon turnover (e.g. decreased tillage intensity) as compared to measures that increase C input (e.g. cover crops) in the light of global developments in agricultural management with ongoing specialization and segregation between catch crop production and dairy farms.