CO2 fluxes and carbon balance of an agricultural grassland in southern Finland

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Agriculture is globally a significant source of carbon emissions to the atmosphere. Main causes for these high emissions are conventional intensive management practices which include such as frequent ploughing, monocropping and high use of agrochemicals. These practices contribute to the loss of biodiversity and soil organic matter, as well as to the CO₂ emissions from land use. Recently, it has been recognised that agriculture functioning on the basis of regenerative practices is one of the most potential tools to mitigate climate change.

It is well known that topsoil layer and especially humus-rich soils can store more carbon than atmosphere and vegetation together. Therefore, increasing the amount of soil organic matter in the agroecosystems, by applying enhanced management practices such as reduced tillage, high biodiversity and cover cropping, agricultural soils would not only help to mitigate climate change but also to restore soil quality and fertility. To understand the carbon dynamics on different agricultural sites, factors affecting and comprising the carbon balance, and to verify soil carbon and ecosystem models, continuous long-term monitoring of the GHG fluxes is essential at such managed ecosystems. Here we present results from a new eddy covariance (EC) flux study site located in southern Finland.

Continuous CO₂ flux measurements using the EC method have been conducted at Qvidja farm on mineral (clay) soil forage grassland in Parainen, southern Finland (60.29550°N, 22.39281°E) since the spring 2018. Based on the flux and biomass data, the annual carbon balance was estimated to be negative, i.e. the site acted as an overall sink of carbon even in the dry and hot year 2018. However, the seasonal CO₂ fluxes were greatly dependent on weather conditions and management procedures. Results from 2019 show that the growing season accompanied with more mature and dense grass, a bit higher precipitation and lower temperatures, as well as higher cutting height was more favorable for carbon uptake in Qvidja as compared to year 2018.