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Carbon sink activity and GHG budget of managed European grasslands

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In agriculture, a large proportion (89%) of greenhouse gas (GHG) emission saving potential may be achieved by means of soil C sequestration. Recent demonstrations of carbon sink activities of European ecosystemes, however, often questioned the existence of C storing grasslands, as though a net sink of C was observed, uncertainty surrounding this estimate was larger than the sink itself (Janssens et al., 2003, Schulze et al., 2009. Then again, some of these estimates were based on a small number of measurements, and on models. Not surprising, there is still, a paucity of studies demonstrating the existence of grassland systems, where C sequestration would exceed (in CO_2 equivalents) methane emissions from the enteric fermentation of ruminants and nitrous oxide emissions from managed soils.
Grasslands are heavily relied upon for food and forage production. A key component of the carbon sink activity in grasslands is thus the impact of changes in management practices or effects of past and recent management, such as intensification as well as climate (and -variation).
We analysed data (i.e. flux, ecological, management and soil organic carbon) from a network of European grassland flux observation sites (36). These sites covered different types and intensities of management, and offered the opportunity to understand grassland carbon cycling and trade-offs between C sinks and CH4 and N2O emissions. For some sites, the assessment of carbon sink activities were compared using two methods; repeated soil inventory and determination of the ecosystem C budget by continuous measurement of CO_2 exchange in combination with quantification of other C imports and exports (net C storage, NCS).
In general grassland, were a potential sink of C with 60$\pm$12 g C /m2.yr (median; min -456; max 645). Grazed sites had a higher NCS compared to cut sites (median 99 vs 67 g C /m2.yr), while permanent grassland sites tended to have a lower NCS compared to temporary sown grasslands (median 64 vs 125 g C /m2.yr). Including CH4 and N2O emission in the budget , revealed that for most sites, GHG emissions were compensated by NCS. The role of management impact,soil organic C and fluxes driven by interannual climate variation will be dicussed in the presentation.