



Effect of soil moisture on the carbon budget and water use efficiency of managed grassland

C. Ammann, A. Neftel and J. Fuhrer

Agroscope ART Research Station, Zürich, Switzerland (christof.ammann@art.admin.ch)

Agricultural ecosystems form a significant part of the European land cover. Management options like the conversion from arable land to permanent grassland and an optimized management intensity can facilitate carbon sequestration in agricultural soils. However, the soil carbon budget is also influenced by the regional climate conditions, which might change considerably in the future. Especially the soil moisture condition is critical for the productivity and the carbon cycling of temperate grassland. We have monitored the carbon cycle of a newly established managed grassland site on the Swiss Central Plateau since 2002. Continuous eddy covariance measurements and the quantification of carbon export and import by harvest and manure application allow for the assessment of the complete carbon budget. Over the entire 5-year period, the intensive management led to a significant carbon sequestration, while the extensive management caused a net carbon loss. The inter-annual variation of the carbon budget shows a clear anti-correlation with soil moisture content during summer, which was controlled mainly by precipitation. Carbon sequestration in the grassland soil was favoured in the wet years 2002, 2004, and 2006 (precipitation >300 mm between June and August) but not in the dry years 2003 and 2005 which showed comparatively low precipitation sums (<250 mm) for the summer season. In combination with high temperatures, low soil moisture had a stronger reduction effect on plant photosynthesis (GPP) than on soil respiration. The variation in the water use efficiency was mainly driven by GPP while the evapotranspiration showed only minor reaction to the varying precipitation and soil moisture. It was found, that even during the very dry period of the summer 2003 the grass roots were mostly able to take up enough water from deeper soil layers. In future climate conditions, more frequent warm and dry summers

may lead to continuing carbon loss from grassland ecosystems.