



Simulating year-to-year variations in carbon stocks and fluxes in managed grasslands with PROGRASS, a process-based model of grass/clover interactions

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Recently, the dynamic plot-scale model PROGRASS was developed to simulate the seasonal and inter-annual dynamics of productive grass/clover mixtures in response to management and changes in the environmental conditions. PROGRASS explicitly deals with grass/clover competition for light, water and nutrients, and is therefore suitable for studying changes in sward composition and their implications for carbon stocks and fluxes. Here we examine the performance of PROGRASS in reproducing the variability of carbon fluxes observed in a long-term experiment conducted since 2001 at Oensingen, Switzerland (7°44'E, 47°17'N, 450 m a.s.l.), as a contribution to CarboEurope IP and NitroEurope IP. We show that the model adequately reproduces biomass growth and changes in the fraction of clover in response to fertilization over the observing period. It also provides a reasonable depiction of the effects of the summer drought of 2003 on carbon fluxes, both under intensive as well as extensive management. On the other hand, discrepancies between model simulations and measurements are found with respect to the inter-annual variability of net ecosystem exchange and carbon sequestration, in particular in the years following the 2003 summer drought. We therefore provide an attempt to understand these differences both from an experimental as well as a modelling perspective.