GHG balance of a fast growing bioenergy system

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The ecosystem scale research project we just started in Belgium (POPFULL) will provide a full accounting of the greenhouse gas balance of a 18 ha short rotation coppice (SRC) plantation of fast-growing poplar and willow. The ultimate goal is to examine the potential of SRC cultures to reduce atmospheric CO_2 concentrations in Europe –through fossil fuel substitution – and to mitigate climate change.

As atmospheric CO_2 concentrations will inevitably increase further to values between 490 ppm (best case scenario) and 1260 ppm (worst case scenario) at the end of this century (IPCC, 2007), we are testing the potential of SRC plantations to sequester CO_2 from the atmosphere and also investigate the emission/uptake of the other most important greenhouse gases (H_2O, CH_4, N_2O) from the plantation and their environmental controls. We are measuring the different greenhouse gases exchange of this high-density SRC culture for four years using eddy covariance technique. This would represent the first project in which all these greenhouse gases are investigated at the same time at the ecosystem scale in a SRC coppice plantation.

The preliminary results from the first summer season 2010, showed that the greenhouse gas fluxes in the plantation are dominated by CO_2 and N_2O (CO_2 sink and a N_2O source). The CH_4 fluxes showed very low values, probably for the sandy soil usually dry on the surface. N_2O emissions increased in correspondence of precipitation events and soil flooding. Most interestingly we noticed that similar WFPS and water table could lead to very different N_2O emissions highlighting that the environmental controls on N_2O emission are still largely uncertain. The plantation is also a sink for O_3, probably uptake by vegetation.

Keywords: Climate change, Short rotation coppice, greenhouse gasses exchange.

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