Geophysical Research Abstracts
Vol. 15, EGU2013-12906, 2013
EGU General Assembly 2013

Lignocellulose biomass production potential from poplar short rotation plantations on marginal land in Germany and their impact on soil organic carbon stocks

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In this study we assess the potential of lignocellulose biomass production by short rotation plantations in Germany. To avoid conflicts with agricultural food production only marginal agricultural land was accounted, which is usually of low quality and productivity. The process-oriented biogeochemical model LandscapeDNDC was used in conjunction with the forest-growth model PSIM to simulate the yield of poplar grown in short-rotation plantations throw-out Germany. The model was validated on five sites with different climatic conditions in Central Europe. The study aims to assess the effects of biomass short rotation plantations on the soil organic carbon stocks in Germany by comparing the cultivation of the bioenergy crops against the former arable land use (taken from the NitroEurope database).

Using regional model input, with climatic drivers and soil properties being the most important, the biomass production potential of poplar plantations was simulated. To limit short-term climatic effects on the simulation outcome, we simulated biomass yields from short-rotation (6 year) Populus plantations for three time slices (1990–1995, 2000–2005, and 2010–2015) with climate data taken from the NitroEurope database and provided the simulated yield averages and standard deviations of these runs as well as the changes in soil organic carbon stocks compared to the former land use due to the land use change.

Considering 10% of the arable land with the lowest productivity, the model results in a biomass production of approximately 6.78 t DM / ha / year which is approx. 10.1 kilo t DM / year while the 10% of the arable land with the highest productivity result in 8.11 t DM / ha / year which is approx. 12.6 kilo t DM / year (averages over 3 simulation time slices).

We will present results of transient simulations of several rotations with various rotation lengths for biomass yields and changes in soil organic carbon stocks.