

Soil carbon assessment as part of a total carbon balance of a bio-energy culture with fast-growing poplar (POPFULL)

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The POPFULL research project aims at (i) providing a full accounting of the greenhouse gas balance, (ii) the quantification of energy efficiency and (iii) an analysis of the economic balance of a short-rotation coppice (SRC) culture with poplar and willow trees. The ultimate goal is to examine the potential of SRC cultures to reduce atmospheric CO₂-concentrations in Europe, through fossil fuel substitution, and to mitigate climate change. Within the scope of the project, this study focuses on the determination of productivity and making up the carbon balance of a large, multiclonal poplar plantation.

In April 2010, a short-rotation coppice plantation of 19 ha was established in Lochristi near Ghent, Belgium (51° 07' N; 03° 51' E) on a former agricultural site consisting of pasture and maize fields. Twelve poplar (*Populus*) and three willow (*Salix*) clones, belonging to different species and interspecific hybrids of various origins, were planted in replicated monoclonal blocks. The general idea is to make up the full carbon (C) balance of the SRC culture by quantifying all carbon pools and fluxes on a yearly basis. C-pools include all above- and belowground plant biomass (leaves, shoots, stump and roots) and soil carbon. Measured C-fluxes are photosynthesis, and both autotrophic and heterotrophic respiration of the ecosystem components. Measurements at leaf or plant level will be restricted to four representative clones and all data will be scaled up in place and time to determine the productivity and net carbon exchange of the total ecosystem on a yearly basis. The obtained production fluxes will be validated using flux measurement data of the entire ecosystem obtained by eddy-covariance techniques from a meteorological measurement tower in the plantation.

Assessment of initial soil carbon has been made just before establishment of the plantation, i.e. in March 2010. Soil samples were collected within the framework of a complete soil survey including former pasture and maize field soils. Both loose and bulk density soil samples were taken at 0-15, 15-30, 30-45, 45-60, 60-75, 75-90 cm below the soil surface, at 100 sample locations spatially distributed over the site. Carbon and nitrogen (N) contents were determined by dry combustion for all samples, which allowed to perform a study of the spatial variability of C and N contents and hence compare the two initial types of land use. Furthermore, differences in nutrient contents per 15 cm depth increment were examined and in combination with bulk density data, the total initial soil carbon pool was calculated. After the first rotation period of 2+2 years, an analogous soil survey will take place, allowing to determine the changes in carbon content of the soil.

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