

Water balance and water-use efficiency of a poplar bio-energy plantation

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Here we present the framework and the first results related to the assessment of the water balance and water-use efficiency of a poplar SRC system dedicated to the production of bioenergy. The bio-energy plantation was established on 7-10 April 2010 on a former farmland in Flanders (Belgium) and consists of a 18.4-ha high density plantation of 12 different poplar (*Populus*) hybrids and species maintained over a 2 + 2 years rotation scheme. Measurements of water use and carbon uptake are being undertaken at different spatial (leaf, individual tree, ecosystem) and temporal (instantaneous, daily, seasonal) scales, using a combination of measurement techniques: leaf gas exchange measurements, use of stable isotopes, radial and height growth kinetics, sap flow monitoring, and eddy covariance. The data will (i) provide a comprehensive understanding of the physiological and the environmental controls that control water use and carbon uptake at each study scale, and (ii) quantify the water balance of the whole plantation. Information collected will also provide the necessary data set to update, calibrate and validate process-based models to simulate the potential of poplar SRC systems to mitigate CO₂ emissions in the not-too-distant future under conditions of global change.