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Carbon budget and cycling in a Danish willow short rotation coppice ecosystem– climate sensitivity and climate change mitigation potential

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The demand for carbon dioxide neutral carbohydrate production for energy purposes has raised the societal and scientific interest in new perennial biomass plantations. These plantations are fast growing and require low input in work, machinery and fertiliser. However little is known on the ecosystems that are being formed by growing such plantations. Especially short rotation coppices (SRC) form entirely new ecosystems in the temperate biome. It is easy to assume that SRC behave somehow in between forests and agricultural crops or grasslands, but there is almost no data on how these systems work, what their carbon budgets are, and how effective they sequester atmospheric carbon dioxide, especially in the soil. All these uncertainties make it difficult to evaluate, whether or not producing biomass with SRC is environmentally sustainable (Bikuña et al., 2017).
In 2010, a willow SRC was established on the DTU-Risø Campus (Roskilde, Zealand, Denmark, DK-RCW). Since 2012 CO_2, water and energy fluxes are being measured along with plant structural parameters and soil respiration. The results show that, on average, the SRC is very effective in absorbing atmospheric CO_2 and produces after initially lower values, ca. 20 t biomass per ha in three years. The carbon budgets fluctuate on average around 500 g C $m^{-2}yr^{-1}$ but can also reach more than 800 g C $m^{-2}yr^{-1}$, i.e. indicating a much higher net carbon uptake than accumulated in the yielded biomass.
We describe the here the first time results from 6 years' continuous flux measurements at this site in and evaluate their climatic sensitivity of the net carbon dioxide fluxes and the climate change mitigation potential of SRC cropping in Denmark.

Reference

Bikuña, K.S.d., Hauschild, M.Z., Pilegaard, K. and Ibrom, A., 2017. Environmental performance of gasified willow from different lands including land-use changes. GCB Bioenergy, 9: 756–769.