Geophysical Research Abstracts
Vol. 21, EGU2019-7421, 2019
EGU General Assembly 2019

Sustainable whole system: Miscanthus, Willow and Poplar bioenergy crops for carbon stabilisation and erosion control in agricultural systems

Dagmar Henner (1), Pete Smith (1), Christian Davies (2), Niall McNamara (3), and Juraj Balkovic (4)

(1) University of Aberdeen, Institute of Biological and Environmental Sciences, Aberdeen, United Kingdom (r01dnh14@abdn.ac.uk), (2) Shell, Houston, USA, (3) Centre for Ecology & Hydrology, Lancaster, UK, (4) IIASA International Institute for Applied Systems Analysis, Laxenburg, Austria

Bioenergy crops are an important source of renewable energy and are a possible mechanism to mitigate global climate warming by replacing energy with higher greenhouse gas emissions. There is, however, uncertainty about potential synergies and trade-offs of increased use of this energy form. This is even more enhanced by the non-predictable climate change currently going on. Energy crops like Miscanthus and Short Rotation Forestry (SRF) or Short Rotation Coppice (SRC) are becoming more and more important and increasingly visible. Integrated into a sustainable whole system of primary use (bioenergy) and secondary use (soil carbon stabilisation and erosion control) in agricultural areas, Miscanthus, Willow and Poplar can be used to mitigate climate change impacts without negative trade-offs. Therefore, policy-relevant scientific data as a basis for future policy decisions is needed. The goal of this project was the development of a sustainable whole system of Miscanthus, Willow and Poplar bioenergy crops in the European agricultural setting. Focus has been on biodiversity, water and air security, erosion control and soil security, GHG emissions and soil C changes compared with the most common agricultural crops (barley, corn maize, winter rapeseed, rice, winter rye, soybean, sunflower, winter wheat, sugar beet, potatoes). The technical distribution potential and likely yield of second-generation energy crops, such as Miscanthus, SRC with willow, and SRF with poplar, was modelled using SalixFOR, PopFOR and MiscanFOR. The results were coupled with EPIC model results about carbon changes and erosion risk, represented by different erosion modelling approaches (e.g. RUSLE, MUSLE, . . .). The sustainable whole system can work as a tool to identify areas where Miscanthus, Willow and Poplar bioenergy crops can be used to produce bioenergy without trade-offs for land use change or food security. When properly used, the above-named bioenergy crops can instead be seen as tools for carbon stabilisation and erosion control. Changes in topsoil SOC (0 – 30 cm) under Miscanthus can range from 0 to increases of up to 2000 kg/ha/y. Differences in erosion potential for agricultural crops compared with Miscanthus, Salix and Poplar will be highlighted. For Miscanthus, RUSLE predicts erosion between <0.5 to 20 t/ha/y in Europe. Further, we will show modelled yield maps for Miscanthus, Salix and Poplar in Austria and present constraint/opportunity maps for Europe based on the factors total economic value, technical potential, current land use, erosion and carbon changes, biodiversity and trade-offs and synergies. In this sustainable whole system Miscanthus, Salix and Poplar show their climate change mitigation and adaptation potential. The results can be used for policy-relevant decisions. The data can be used for developing land management practices and reducing impacts from climate change.