Geophysical Research Abstracts
Vol. 18, EGU2016-8654-1, 2016
EGU General Assembly 2016

Modelling impacts of second generation bioenergy production on Ecosystem Services in Europe

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Bioenergy crops are an important source of renewable energy and are a possible mechanism to mitigate global climate warming, by replacing fossil fuel energy with higher greenhouse gas emissions. There is, however, uncertainty about the impacts of the growth of bioenergy crops on ecosystem services. This uncertainty is further enhanced by the unpredictable climate change currently going on. The goal of this project is to develop a comprehensive model that covers high impact, policy relevant ecosystem services at a Continental scale including biodiversity and pollination, water and air security, erosion control and soil security, GHG emissions, soil C and cultural services like tourism value. The technical distribution potential and likely yield of second generation energy crops, such as Miscanthus, Short Rotation Coppice (SRC) with willow, poplar, eucalyptus and other broadleaf species and Short Rotation Forestry (SRF), is currently being modelled using ECOSSE, DayCent, SalixFor and MiscanFor, and ecosystem models will be used to examine the impacts of these crops on ecosystem services. The project builds on models of energy crop production, biodiversity, soil impacts, greenhouse gas emissions and other ecosystem services, and on work undertaken in the UK on the ETI-funded ELUM project (www.elum.ac.uk). In addition, methods like water footprint tools, tourism value maps and ecosystem valuation tools and models (e.g. InVest, TEEB database, GREET LCA Model, World Business Council for Sustainable Development corporate ecosystem valuation, Millennium Ecosystem Assessment and the Ecosystem Services Framework) will be utilised. Research will focus on optimisation of land use change feedbacks on above named ecosystem services, impact on food security, land management practices and impacts from climate change. We will present results for GHG emissions and soil organic carbon change after different land use change scenarios (e.g. arable to Miscanthus, forest to SRF), and with different climate warming scenarios. Further, we will show modelled yield maps for Miscanthus, Salix and Poplar in Europe and will present constraint/opportunity maps for Europe based on yield modelled and other factors e.g. total economic value, technical potential, current land use, trade off and synergies, and so on. All this will be complemented by the presentation of a matrix including the factors and ecosystem services influenced by land use change to bioenergy crop production under different climate change scenarios.