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 as many ecosystem services as possible at a Continental level including biodiversity, water, GHG emissions, soil, and cultural services. The distribution and production of second generation energy crops, such as Miscanthus, Short Rotation Coppice (SRC) and Short Rotation Forestry (SRF), is currently being modelled, 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 ecosystem services and biodiversity, and weighting of the importance of the individual ecosystem services. Energy crops will be modelled using low, medium and high climate change scenarios for the years between 2015 and 2050. We will present first 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. All this will be complemented by the presentation of a matrix including all the factors and ecosystem services influenced by land use change to bioenergy crop production under different climate change scenarios.