MODELLING IMPACTS OF SECOND GENERATION BIOENERGY CROPS ON ECOSYSTEM SERVICES

COMBINING BIOGEOCHEMICAL MODELS (ECOSSE, DAYCENT) WITH BIOENERGY CROP MODELS (MISCANFOR, SALIXFOR) AND BIODIVERSITY (LEFT, ECOSSET) AND ECOSYSTEM ASSESSMENT AND VALUATION TOOLS (FRAMEWORKS, THREAT MATRIXES) TOWARDS AN UNDERSTANDING OF IMPLICATIONS, SYNERGIES, AND TRADE-OFFS UNDER CLIMATE CHANGE. OUTPUT WILL BE VISUALISED WITH ARCGIS AND GOOGLE EARTH ENGINE FOR A BETTER UNDERSTANDING WHERE BIOENERGY CROPS SHALL BE USED OR BETTER AVOIDED OVER THE NEXT DECADES TO MITIGATE IMPACT OF CLIMATE CHANGE.

Supporting Services
Services necessary for the production of all other ecosystem services
- Soil formation
- Nutrient cycling
- Primary production

Provisioning Services
- Products obtained from ecosystems
  - Food
  - Fresh water
  - Fuelwood
  - Fiber
  - Biochemicals
  - Genetic resources

Regulating Services
- Benefits obtained from regulation of ecosystem processes
  - Climate regulation
  - Disease regulation
  - Water regulation
  - Water purification
  - Pollination

Cultural Services
- Nonmaterial benefits obtained from ecosystems
  - Spiritual and religious
  - Recreation and ecotourism
  - Aesthetic
  - Inspirational
  - Educational
  - Sense of place
  - Cultural heritage

Source (left and right): Millennium Ecosystem Assessment

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Carbon mitigated by an increase in soil organic carbon from the plant residue input from a Miscanthus bioenergy plantation. This value is calculated from input from Miscanthus plant debris calculated by the MISCANFOR model and its decomposition along with the initial soil carbon using the cohort model. The mitigation is expressed in Mg. C ha⁻¹ yr⁻¹.


An example of combined results of modelled SOC and biodiversity threat shows that Miscanthus has a positive effect on SOC at Lincoln site (cross on left graph) where biodiversity threat is relatively low (see graph on right). The least areas with synergetic effect are found following land use change from woodland, the widest possible effect follows land use change from other arable use. It will be crucial to combine climate change with this scenario because precipitation can have an effect on this as shown.

Source: Ecosystem Land-Use Modelling & Soil C Flux Trial (ELUM). Review of the Effects of Bioenergy Crops on Ecosystem Service in the UK Context. Robert Holland, Donna Clarke and Gail Taylor (2013) Faculty of Natural & Environmental Sciences, University of Southampton, Southampton, SO17 1BJ

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MONTHLY N₂O FLUXES AT THE LINCUMSITES SITES - COMPARISON MODELLED AGAINST MEASURED SHOWS THAT MODEL DOES NOT YET EXACTLY FOLLOW HEAVY PRECIPITATION EVENT IN AUTUMN 2013

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