

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

Dagmar Henner 20. April 2016

EGU - ERE1.8 - Energy and environmental system interactions - Policy and modelling



Second Generation Bioenergy Crops

- Mitigate climate change impacts
- Future large scale energy source
- Awarness of synergies and trade off's important
- Sustainable production and use
- Policy information and adaptation necessary



Ŧ

(cc

- Yield models developed for Miscanthus and Salix/Poplar
- MiscanFOR was parameterised and is used widely
- SalixFOR is currently being parameterised on a European scale
- Model parameters: soil, climate, management





- Economically viable from 15 t/ha/yr upwards
- Large areas in Eurasia have good to very good potential





Results created with the MiscanFor model using IPCC climate scenario A2 from the Special Report on Emissions Scenarios (SRES)



















Dry matter yield/water use Miscanthus





Dry matter yield / water use Miscanthus against Willow



- Initial parameterisation shows that SalixFOR is working
- Next step: use of field data to paramterise the model correctly
- First runs show that there is currently too much similarity with Miscanthus

Integration of Bioenergy Crops into Ecosystem and Critical Zone Services

• Earths permeable near surface layer

(i)

(cc

- Functioning critical for sustaining services, e.g., water, soil, atmosphere, food, biodiversity
- Combination provides useful instrument for evaluation of Ecosystem Services value and adaptation / regeneration capabilities with ultimate limiting factors included
- Reliability / Security Factor of recommendations enhanced by including Climate Change and Human Impact as well as changing Economic Climate and legislation

Ecosystem and Critical Zone Services

 \odot

() RV



Adapted from Critical Zone Services: Expanding Context, Constraints, and Currency beyond Ecosystem Services. Field J.P., Breshears D.D., Law D.J., Villegas J.C., López-Hoffman L., Brooks P.D., Chorover J., Barron-Gafford G.A., Gallery R.E., Litvak M.E., Lybrand R.A., McIntosh J.C., Meixner T., Niu G-Y., Papuga S.A., Pelletier J.D., Rasmussen C.R., and Troch P.A (2015): Vadose Zone Journal 14(1)

Matrix Integral Life Cycle Analysis of Sustainable Bioenergy Crop Use

00

(i)



Matrix Integral Life Cycle Analysis of Sustainable Bioenergy Crop Use shows the production chain for a sustainable and trade-off free use of Bioenergy Crops considering all relevant areas.



Exclusion Areas Miscanthus in Austria

Illustration of exclusion areas where Miscanthus cannot be grown





Next Steps

- Parameterisation of SalixFOR
- Modelling the impacts on a European Scale
- Combining Ecosystem Services value and impact with Critical Zone Services and Climate Change Scenarios
- Assessment of current Energy Systems and sustainable Integral Life Cycle Analysis
- Policy information and inclusion



Thank you for your attention.

I thank my supervisors Prof. Pete Smith, Dr. Christian Davies and Dr. Niall McNamara for their support, Dr. Astley Hasting for his cooperation on parameterising SalixFOR, Prof. Andrew Lovett from UEA for his support with value of Ecosystem Services and Prof. Dieter Murach and DI (FH) Rainer Schlepphorst from HNEE Eberswalde for their cooperation and data on willow.

Contact information: Dagmar Henner University of Aberdeen Email: dagmar.henner@abdn.ac.uk