

Integrating utility-based land-use simulation and local cost-benefit analysis tools to support climate change adaptation and regional development strategies

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Agricultural land use patterns are continuously changing as a response to technological developments, changes in consumer preferences for agricultural products and competition with other land uses. Future changes can be expected as a result of policy reform (e.g. in subsidy schemes), climate change and socio-economic developments. Therefore, a good understanding of the factors steering agricultural land-use change is necessary. This is not only required to assess possible developments and impacts in the environment, economy and society, but also to support decision-making and the design of development strategies that are able to cope with future challenges.

Land-use models can be used as explorative tools to help understanding the causal links between factors, processes and patterns. We present an economic theory based land-use modelling framework aimed at explaining the causal link between economic decisions and resulting agricultural land-use patterns. The framework assumes that farmers pursue utility while considering alternative production options and making land-use decisions. Local utility is assumed to depend on a complex combination of different types of factors operating at multiple scales that together set the opportunities and constraints for different production options.

We demonstrate the ability of the framework to be implemented in a fully coherent and transparent multi-model approach, consistently coupling the simulation of local agricultural land-use patterns with the trends of key factors estimated by economic and agro-climate models, such as expected demand for agricultural commodities, crop market prices, cost of production factors and changes in crop yields/productivity. Furthermore, the local utility component of the framework can be used within an integrated assessment framework as a tool for spatially-explicit cost-benefit analysis for different purposes:

- analysing the impacts of climate change on the economic viability of current agricultural systems and the economic feasibility of adopting adaptation measures;
- evaluating investment decisions in the agricultural sector and assessing the sensitivity to variation in key production factors, e.g. investing on new (biofuel) crops;
- performing social cost-benefit analysis to explore the outcomes of changes in management practices and/or policy regimes, e.g. by monetising and internalising long-term externalities.

Examples are provided from different settings (in the Netherlands, Argentina and Australia) to illustrate how these tools can be used to informing policy-makers and stakeholders on possible socio-economic and environmental impacts resulting from climate change and/or policy reforms, and supporting decision-making to design robust strategies for regional development and climate change adaptation.