

A meta-analysis of agricultural land change in Europe to aid the design of an agent based land use model

Jasper van Vliet¹, Calum Brown², Dave Murray-Rust², Mark Rounsevell², Piet Rietveld³, Henri de Groot³, and Peter Verburg¹

¹ Institute for Environmental Studies and Amsterdam Global Change Institute, VU University Amsterdam, Amsterdam, the Netherlands

² School of Geosciences, University of Edinburgh

³ Department of Spatial Economics and Amsterdam Global Change Institute, VU University Amsterdam, Amsterdam, the Netherlands

Abstract

About half of the territory of the European Union is covered by agricultural land, and this agricultural land has changed considerably over the last decades, for example due to the abandonment of marginal lands and reforms in land ownership in post-socialist countries. Additionally, agricultural land change increasingly occurs in the intensity of use rather than in areas, for example by increased mechanization or by adopting organic farming practices. Land use models have been employed to understand past changes and to explore future changes. Since agricultural land changes are typically the results of human decisions, agent based modelling provides an appropriate platform for such studies. However, it is not directly apparent by what internal or external drivers the decisions of farmers are influenced. Consequently, it is not obvious what characteristics of the landscape, the farmer or the socioeconomic environment need to be represented in the model.

Drivers for agricultural land change, or farmers' decisions have been reported in many case studies, originating from disciplines as diverse as (rural) sociology, economics, physical geography and human geography. Consequently, these case studies have been investigated using a wide range of data sources and research methods singly or in combination. The aim of this study is to synthesize from this wealth of case study evidence the main drivers underlying agricultural land changes, with the ultimate goal to improve the design of an agent based land use models for Europe that is currently being developed within the VOLANTE FP7 project. This goal comprises the delineation of properties of farmers that need to be included in the design of agents to meaningfully explore land use trajectories in Europe as well as landscape properties and socio economic circumstances that are of influence.

The meta analysis considered cases that have been reported in peer-reviewed journal publications, and that investigate drivers for one of four possible types of agricultural land change: expansion, abandonment, intensification and extensification.

Drivers were analysed independently to find to what extent they are of influence for each type of land use change. Results show that farm or household economics play an important role: many changes are driven by an intention to increase profitability, or at least to avoid losses. However, social and cultural factors are also important and reduce the (economic) rationality of farmers considerably. This is increasingly true for hobby farmers or part-time farmers who combine agricultural activities with off-farm employment. These findings imply that agents should not be parameterized as economically rational agents, but that other social and cultural factors need to be considered in the design of agent based land use models.