TOWARDS AN INTEGRATED APPROACH FOR INCORPORATING SOCIO-ECONOMIC AND BIOPHYSICAL PROCESSES IN LOCAL SCALE LAND-USE MODELLING

Eric Koomen, Piet Rietveld, and Jasper Dekkers

Faculty of Economics and Business Administration, Department of Spatial Economics
VU University Amsterdam, the Netherlands
Fax: +31-20-5986004 / Email corresponding author: jdekkers@feweb.vu.nl

Abstract

Local land-use changes are driven by both socio-economic processes and biophysical processes that typically follow a different logic and happen at a different time scale (for example due to process-specific time lags). Economic processes are, to a large extent, explained by profit-maximizing behaviour and happen on a long time scale, whereas physical processes are generally well captured with spatially explicit simulation rules using short intervals. In fact, these different processes are generally simulated with different methods. Spatial interaction and discrete choice based approaches are generally used to simulate equilibrium conditions for economic processes, while rule-based and cellular automata based dynamic simulation is used to mimic physical processes. Application of the latter approach to economic processes may lead to sub-optimal results, and vice versa.

Both approaches usually have a different time resolution, each with its own advantages. Short time intervals (e.g. one year) capture the change and the state of dynamic variables that are relevant for modelling natural processes. A lower time resolution (e.g. ten-year steps) allows for a more appropriate specification of market behaviour, adjustment over time towards market equilibrium and optimization which is relevant for modelling different types of urbanisation and other human processes that involve a larger spatial environment as well.

We aim to develop an integrated approach that incorporates both socio-economic and biophysical processes at the local scale in land-use modelling. A crucial issue here is to come to a unified dynamic assessment framework for land suitability that incorporates the local potential for different types of use based on, for example, market preferences, land-use related adaptation measures and biophysical conditions that change over time. In addition, the approach should be able to express changes within short periods (preferably on a year-by-year basis) to accommodate biophysical and path-dependent processes.

The first innovative aspect in the proposed approach is the introduction of an economic rationale in overall suitability definition to allow for open competition between rural and urban land uses. The second innovation is the introduction of dynamics in the allocation of urban land uses (e.g. yearly time steps for specifying demand, calculating suitability and allocating land use).