Recent applications of a land-use change model in support of sustainable urban development

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1. Introduction

Urban development is a complex dynamic process that is characterised by substantial spatiotemporal variation. Growth and decline coexist within neighbouring regions at short distances from each other. This makes steering urban expansion and intensification important policy issues in many regions, while preparing for decline and urban restructuring have become hot topics in others. At the same time, attention is shifting from government to governance and societal organisations and individual citizens become more important in decision-making processes. The outcome of these processes is uncertain and is likely to differ per region. This presentation explores the extent to which the operational, much applied Land Use Scanner model can support current planning issues in this highly dynamic environment. It starts by briefly introducing the model and then goes on to discuss recent applications related to sustainable urban development. Based on these applications potential improvements in the application of land-use models are suggested.

2. An operational land-use modeling framework

Land-use change models have become an established tool to help prepare and support spatial planning in the Netherlands and neighbouring countries. They can help formulate adequate spatial policies by simulating potential autonomous spatial developments or, perhaps more importantly, by showing the possible consequences of different policy alternatives. Policy makers can thus be confronted with a context of future conditions and an indication of the impact the spatially relevant policies they propose.

The Land Use Scanner we apply here has its roots in economic theory. It simulates the competition between urban, natural and agricultural types of land use and thus offers an integrated view on spatial development. It was developed in 1997 by a group of research institutes and has since been applied in many policy-related research projects in the Netherlands and abroad. The model is often applied to perform what-if type of applications that visualise potential spatial patterns associated with specific scenario conditions or policy interventions.

The demand and supply of land are balanced using three main components: 1) regional projections of land-use change (demand); 2) local definition of suitability; and 3) an algorithm that allocates land (cells) to those land-use types that have the highest suitability, taking into account the regional land-use claim. See Figure 1 for a visualization of the model's basic layout.

3. Planning-related applications

To be able to understand the applicability of the land-use model in the current societal and planning context, we briefly describe three recent applications that share the following characteristics. First, they deal with sustainability impacts of urban development like, for example, the loss of open space or the increased exposure of urban areas to flooding. Second they relate to contemporary planning issues, addressing questions as: what is the likely impact of decentralising the responsibility for spatial planning on future urbanisation patterns? to which extent is urban intensification possible to limit the ongoing expansion of urban areas? how will flood risk develop in the coming decades following socio-economic and climatic projections? Thirdly they reflect the three different types of applications

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generally found in planning related studies: what-if type of simulations, trend-based extrapolations and scenario studies.

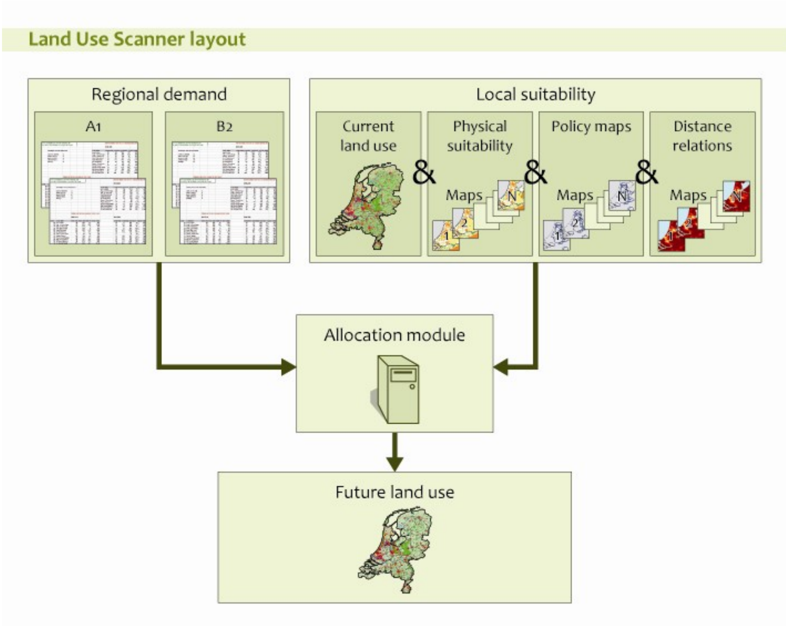

Figure 1. *The Land Use Scanner layout*

4. Discussion and recommendations

Model applications hitherto focussed on simulating future urban expansion patterns. This is for many regions a very real scenario and Land Use Scanner is a powerful instrument to explore the impacts of new urban development in terms of, for example, loss of open space and flood risk. In the near future other spatial policy challenges may become prominent. These may relate to steering urban intensification in regions of urban growth and urban restructuring in regions of population decline.

To allow the simulation of processes such as intensification and restructuring we are currently busy incorporating residential land-use density dynamics in Land Use Scanner. Including the underlying mechanisms into the model would at once improve the explanatory power of the model regarding these highly relevant policy issues, and enhance the detail of the relevant model output (i.e., local density). This would greatly enhance the potential for subsequent impacts assessment such as local flood risk assessments.

Furthermore, decision making in spatial planning is moving away from a straightforward, linear process towards a more incremental and iterative one. Traditional tools for evaluation and visualisation may not be fully suitable in this new context. They usually are slow in responding to new policy strategies and their output is often difficult to understand or even irrelevant for the various non-expert stakeholders that are involved in today's spatial development processes.

A possible way forward is to combine existing land-use models with new visually attractive user interfaces (such as touch tables). In doing so it may become possible to bring together the values and arguments of different actors in decision-making processes. A potentially useful tool for local-level decision making is offered by the Urban Strategy framework that visualizes impacts of spatial developments for different sustainability values related to people, planet and profit. Currently we are trying to combine this interactive local-level instrument with Land Use Scanner to visualise the coherence between various spatial development issues by linking their different spatial and temporal dimensions.