Applying and improving planning support systems for sustainable urban development

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Land-use models have become an established tool to help prepare and support spatial planning. Typical examples concern the evaluation of policy alternatives and the exploration of future scenarios. This presentation describes three recent policy-related applications of an operational Dutch land-use model with a focus on sustainable urban development. Subsequently, it discusses ways to further improve land-use modelling in view of ongoing and expected changes in the societal and planning context of the Netherlands.

The first example shows that a land-use model can successfully be used to depict likely outcomes of policy changes in a Strategic Environmental Assessment report dedicated to the newly proposed national spatial strategy for the Netherlands. This what-if type of simulation typically relies strongly on expert judgement as it has to describe the impact of policies that have not yet been implemented and whose effects cannot be observed. These expert opinions can, to some extent, be tested in GIS-based analyses of the effectiveness of similar policies as described in other studies (Koomen et al., 2008). A recent, interview-based study by Van Kouwen (2012) into the potential future spatial developments in National Landscapes indicates that most parties involved do not expect sudden changes from the proposed changes in national spatial policy. These expectations, however, seem to be strongly linked to current political and economic conditions. When such conditions change, the current trend towards deregulation and decentralisation may lead to an increase in urban development in currently protected landscapes. Such threats to metropolitan open spaces have, for example, also been described by Van Rij (2009). Therefore, we strongly believe that the type of scenario-based simulations of potential impacts of policy changes described in this chapter offers a powerful approach to incorporate the notion of uncertainty in ex-ante policy evaluation.

The second example shows that current ambition levels are needed to prevent extensive loss of open space. Should urban development (in terms of intensification share and extensions' densities) follow past trends, large-scale urban extensions are likely to occur. This is especially true when future socio-economic conditions resemble the Global Economy scenario.

Finally, the third case study shows that the Land Use Scanner can be a valuable tool in the field of climate adaptation as well. By simulating future residential development at the highly detailed level of 1 hectare grid cells, it demonstrates that adaptation to flood risk emanating from future residential extension can be limited to highly localised strategies like spatial zoning. Cost can be minimised by focusing local adaptation strategies on the areas where risk is most concentrated. Prioritising the places where these concentrations occur in more than one scenario enhances the robustness of adaptation.

Our simulations can easily be expanded to explore other scenarios or strategies, and accommodate additional spatial restrictions or other types of development (e.g. agriculture, industry/commerce, recreation). Such simulations have been performed as part of other studies focusing on, for example, the environmental impacts of a new regional strategic vision (Koomen et al., 2011) or the potential for new biofuels in the country (Kuhlman et al., 2013).

The presented, recent Dutch land-use model applications focus 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 (Kuijpers-Linde, 2011). Intensification has the potential to preserve open space, keep down transportation costs, maximise urban economic productivity etc. Effective restructuring, in turn, could minimise the damaging effect shrink may have on the economic health of urban areas.

To allow the simulation of processes such as intensification and restructuring we are currently busy incorporate residential land-use density in Land Use Scanner. Ultimately, this requires a distinction between actors (residents), objects (residences) and land use (residential land) and the addition of information on each of these three layers in the model. Initial attempts to incorporate residential density have treated density change as exogenous model input, based on expert judgement and the extrapolation of past trends. This implies that, while all kinds of assumptions can be made regarding future dynamics on these issues, and numerous local indicators can be derived from the resulting output, the underlying phenomena remain outside the model, preventing them to be simulated in an integrated way that is most probably require. Making these phenomena endogenous model parameters by incorporating the underlying mechanisms into the Land Use Scanner 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 discussed in the third example that was presented.

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