9. Simulation of future urban growth based on cellular automata models

The aim is to simulate the scenarios described in the last section using two different methods. One oof the model selected for the simulation of the urban growth is a cellular automata-based model. Such prospective models have evolved spectacularly over the last few years and their importance in such disciplines as territorial organisation and planning is today beyond all doubt.

In so far as they have to consider current processes and trends, these models are also important tools for the representation of future scenarios which raise issues about the sustainability of different types of growth, the impacts of sectorial policies, the effects of municipal or supra-municipal planning … in short, they are a laboratory for generating new discussion about planning and for assessing potential consequences of proposals made.

In the process, we have used the Idrisi Taiga GIS and the Macro Modeler tool. By way of key information, the following table shows the aptitude variables used in each area under study. The selection has been made from the results obtained in task 8 (the analysis of explanatory factors of urban growth).

The calibration of the two models was done by defining some initial calibration values with which to commence the trial-and-error process. Through the generation of diverse simulations, these values were modified to fit the different behaviour of urban occupation in each area under study and so that we could obtain simulations that fitted better the goals of each stage of simulation. Once the model was calibrated, ex post simulations were generated for the two areas under study. Figure 2 shows one of the simulations obtained for the Madrid urban regions en the ex post simulations for the period 1990-2000.

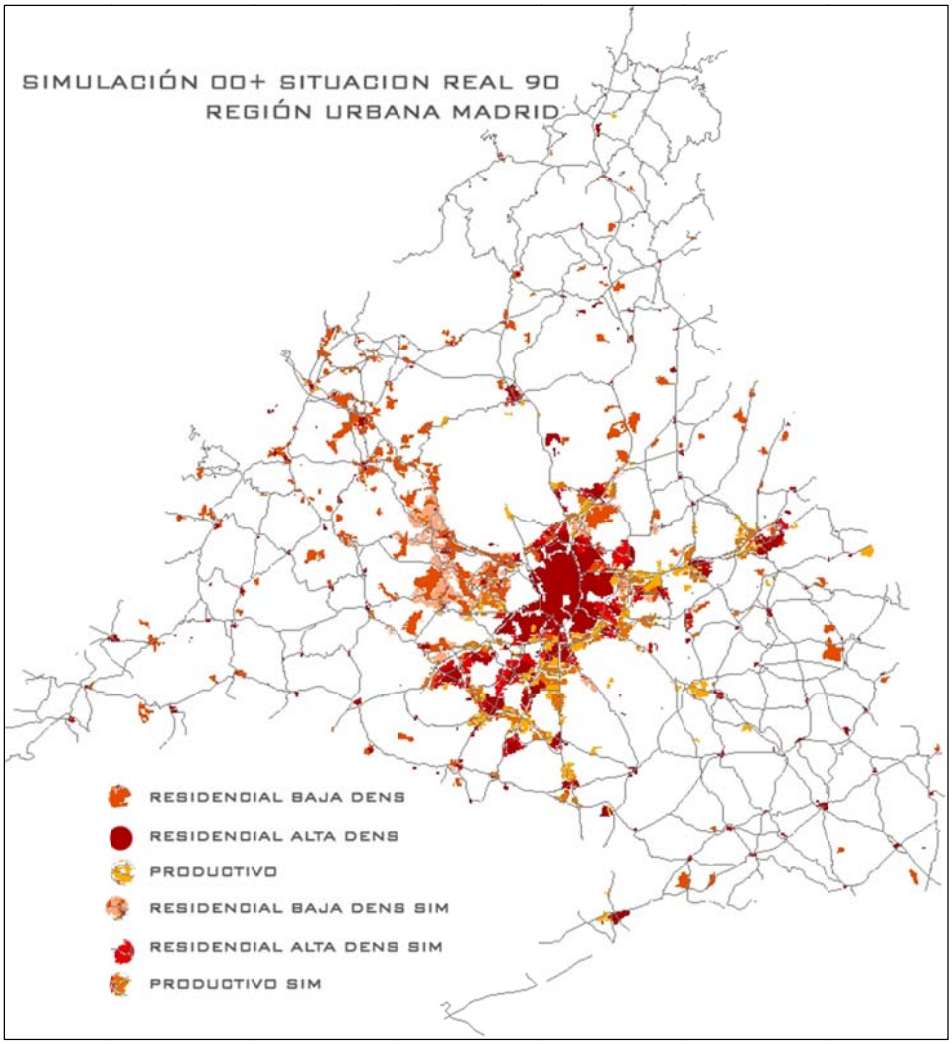

Figure 2. Post hoc simulation for the Madrid urban region

The verification of the results of the simulation is partially complete: results have been obtained for the Granada metropolitan area and are under way for the Madrid urban region. This verification has been carried out visually and using comparison tables in pairs. Results giving coincidence are not particularly high, but they are indicative of the model's capacity to represent growth trends in the area under study. This in itself is an important contribution, especially considering the absence of any such work in this connection for Spanish urban regions.

Finally, future simulations for urban growth are at the development stage, using the same techniques for the two areas of study. In regard of the demand scenarios described in section 8, different patterns of spatial behaviour for the uses to be simulated have been added, which reflect different patterns or forms of evolution in the metropolitan areas. Table 6 shows the spatial characteristics of the different scenarios to be simulated:

SPATIAL BEHAVIOUR		
Patterns		
BUSINESS AS USUAL SCENARIO	Industrial	*Nodal pattern*
	Commercial	*Nodal pattern*
	Low density residential	*Housing estate pattern*
	High density residential	*Aggregate pattern*
CRISIS SCENARIO	Industrial	*Nodal pattern*
	Commercial	*Aggregate pattern*
	Low density residential	*Aggregate pattern*
	High density residential	*Aggregate pattern*
INNOVATION AND SUSTAINABILITY SCENARIO	Industrial	*Linear pattern*
	Commercial	*Aggregate pattern*
	Low density residential	*Aggregate pattern*
	High density residential	*Aggregate pattern*

Table 6. Spatial behaviour of the scenarios after assigning patterns to land use

More information in:

Valenzuela, L.M; Aguilera, F; Soria, JA and Molero, E. (2008): Designing and assessing of development scenarios for metropolitan patterns. In Paegelow, M and Camacho, M (eds): "Modelling Environmental Dynamics." Springer-Verlag, Berlín. ISBN 978-3-540-68489-3.

Aguilera Benavente, F; Valenzuela Montes, L.M and Bosque Sendra, J (2011): Simulación de escenarios futuros en la aglomeración urbana de granada a través de modelos basados en autómatas celulares. Forthcoming in Boletín de la AGE.