A strong population growth, extended transportation networks and a lack of structured spatial planning have all caused strong urban sprawl in a large number of regions worldwide. Until recently, 6 ha of open space were transformed per day into non-natural land uses in Flanders, Belgium. Mapping and modelling of these land-use changes may support the government in tackling the problems related to urban sprawl and in controlling the urban sprawl phenomenon.

Cellular automata (CA) models allow to explicitly handle spatial interactions between different land-use categories. Recently, a more straightforward, activity-based CA model (ACA model) for urban dynamics was proposed, which directly models spatial changes in the values of different ‘activities’ (population and employment in several economic sectors). The complex spatial structure and the strong mixing of functions of Flanders can be better represented by this model than by a regular land-use change model.

The main goal of this research was to further enhance this ACA model and apply it to simulate the impact of alternative policy scenarios on the spatial development of a region, with Flanders as the key application. Several model improvements were accomplished: firstly, the model was extended with the option to calculate long distances along a transportation network using a variable grid approach. Next, changes were proposed to the model equations that determine the activity densities in the model.

To calibrate the model, input maps for the past were computed by combining maps of the present with data available from remote sensing. The resulting time series of population maps provides a good insight into the evolution of population in Flanders and Brussels after 1986. Next, a semi-automated methodology was developed to calibrate the model. Finally, different scenarios of future land use in Flanders until 2050 were examined. The white paper of the Spatial Policy Plan for Flanders proposes to limit future land take to places with good public transport accessibility and proximity to services. The effects of this land-take neutral scenario were compared with a business-as-usual scenario.