



Monitoring the Impact of Urban Growth Scenarios on No Net Land Take of Wallonia, Belgium Using a Cellular Automata Model

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The pressing demand for urbanised land due to the growing global population has led to increased land consumption, posing significant challenges to sustainable urban development. The European Union's No Net Land Take (NNLT) 2050 initiative aims to mitigate this issue by curbing urban expansion through urban densification or circular construction. Therefore, it is imperative to study the existing demand trajectory and their effects on the current development situation.

Wallonia, the southern region of Belgium, characterised by urban and peri-urban development, predominantly experience urban expansion. As a solution to that, government implemented various plans which focuses on revitalizing urban cores, addressing vacant buildings, and promoting the regeneration of central areas to prevent further urban sprawl. These ongoing urban pressures, makes it an ideal study area for conducting research on strategic planning.

In this study, we develop a Multinomial Logistic based Cellular Automata (MNL-CA) model calibrated using geophysical, accessibility, socioeconomic and spatial zoning data. Hereto, the model simulate futuristic urban growth until 2050 under two distinct scenarios:

- **Business-As-Usual** where urban growth continues following the historical demand trends within existing policies.
- **Growth-As-Usual** represents a scenario of latest observed built up demand trend along a constant rate .

The *BAU* scenario demonstrates a marked decline in urban expansion rates, stabilizing at 0 hectares per day by 2040. This trajectory reflects a shift toward densification and more spatially cohesive urban development. Meanwhile, the *GAU* scenario forecasts a sustained expansion rate of 2.51 hectares per day, resulting in a projected 49.20% increase in urban land by 2050. Together, these scenarios provide complementary insights: BAU serves as a valuable reference point for understanding controlled growth dynamics, while GAU offers a perspective for exploring the implications of constant expansion, thereby enhancing the robustness of future urban planning strategies.

While BAU offers a pathway aligned with policy goals, incorporating elements from GAU scenarios allows policymakers to "stress-test" urban strategies. This dual approach can enhance resilience

and flexibility in urban planning, enabling better accommodation of future growth challenges while adhering to sustainability principles.