

## Analyzing urban sprawl indicators under uncertainties

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### **Abstract:**

Urban sprawl causes the sealing of lands closest to the urban centers by transforming productive agricultural fields into impervious areas, with numerous economic, social and environmental impacts. Integrated monitoring is important to help urban policies and urban sprawl modelling, proposing urban sprawl indicators with combining spatial and social aspects of the phenomenon by spatial operators in GIS. For that, geographical information of sealing patches and territorial social data are used, but spatial uncertainties and their impact on the detection of indicator changes are usually ignored. The paper proposes (1) to evaluate uncertainties of indicator spatial and (2) to analyze the effect of upscaling on these uncertainties. The method used proposes to create impervious polygons according to their measured geometric and thematic uncertainties using a Monte Carlo simulation approach and to simulate social data according to census uncertainties. Impervious polygons are used in a closing operation, with different radius values, required to map morphological urban areas. The case study focused on three indicators (area, dispersion coefficient and population density) of the morphological urban areas for four administrative levels of administrative territorial units of Languedoc-Roussillon region, France. Results show that indicator uncertainties are generally higher for less densely populated areas than for the others at the finest territorial level, that the closing radius had a slightly influence on indicator uncertainties, and that uncertainties decreases with the upper territorial entities.

**Keywords:** Spatial indicators, Monte Carlo, urban polygon simulation, remote sensing, upscaling