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# Editorial: Special theme issue “Mapping, monitoring and modelling of urban areas”

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# Editorial: Special theme issue “Mapping, monitoring and modelling of urban areas”

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1 Today 54% of the world’s population is living in urban areas, a number that is expected to rise to 66% by 2050 (United Nations, 2014). The increase in urban population over the last decades has led to a rapid growth of urban areas. This urban land consumption, if not managed well, puts strong pressure on open spaces and increases the demand for ecosystem services while endangering their supply (Elmqvist *et al.*, 2015; Burkhard *et al.*, 2012). Uncontrolled urban growth may also lead to higher costs for infrastructure investments and maintenance, reduced mobility of commuters, and a weakened sense of community (Putnam, 2000). Yet the pace at which urban areas expand in relation to urban population growth may be very different from one region to another. While in some regions in Europe urban land use is expanding faster than population growth, in other areas more compact forms of urban growth are observed with less adverse effects on the environment and on the supply of ecosystem services (EEA, 2006).

2 The way urban growth manifests itself is the result of a complex interplay of socio-economic and cultural factors, including national and regional traditions in planning. Understanding urban change processes, as they have taken place over the last decades, and how these processes are affecting both the human and natural environment is essential for developing sustainable urban management approaches meeting human needs, now and in the future, and safeguarding natural capital provided by ecosystems. The problem analysis, planning and monitoring phases of a sustainable urban management policy require reliable and sufficiently detailed information on the urban environment and its dynamics, as well as knowledge about the causes, chronology and effects of urban change processes.

3 Recent advances in urban remote sensing, mobile sensor technology, as well as new big data sources have created unprecedented opportunities for mapping and for monitoring of urban areas at finer spatial scales than ever before. At the same time new

approaches emerge for modelling of urban processes and improving our understanding of complex urban environments. This theme issue of Belgeo contributes to this exciting area of research and presents a collection of papers on mapping, monitoring and modelling of urban areas, both from a land-use as well as socio-economic perspective, at regional and intra-urban scales, relying on a diversity of data sources, and touching upon a variety of topics in urban research.

4 The first two papers focus on urban sprawl in Flanders. Vanderhaegen and Canters present a remote sensing-based approach for mapping sealed surface cover at the regional scale using time series of medium-resolution satellite data and apply their method to monitor the evolution in sealed surface cover in Flanders between 1976 and 2013. Their study indicates an overall increase in sealed surface cover over the entire period of 82%, with most growth being linked to an increase of residential areas. While over time the growth rate has been decreasing, in 2013 still 6.1 ha of open land in Flanders was transformed into built-up area on a daily basis. The highest growth in sealed surface cover is observed on the fringe of urban agglomerations and in strongly industrialized regions.

5 Verbeek and Tempels focus on the fragmentation of open space in Flanders and present two new methods to characterise fragmentation, one method measuring the density of fragmenting structures, and one method detecting open space fragments enclosed by ribbon development, which is shown to be useful for identifying open areas that are potentially under threat of being privatised. The paper argues that depending on the stakeholder’s perspective different interpretations of open space fragmentation may exist, requiring appropriate metrics for quantification. The two methods proposed are compared with two existing approaches for measuring fragmentation. Strengths and limitations of each method are discussed, mainly from the perspective of spatial planning and landscape conservation.

6 Verbeiren *et al.* present an Earth observation (EO) based approach to quantify the influence of canopy interception storage on the urban water balance for the Upper Woluwe catchment (Brussels), using NDVI data corresponding with maximum and minimum conditions in the yearly vegetation cycle. Seasonal variation in interception is simulated and used as input for spatially distributed modelling of the water balance in the catchment, using the WetSpa approach. Sensitivity analysis shows that EO based estimates of interception storage capacity are around 25% higher than the original look-up table based estimates used by default in the WetSpa model, resulting in an increase of 10% of the simulated interception. These results stress the importance of site- and time-specific information on canopy interception, as provided by EO-based modelling approaches.

7 The paper by *Guérois et al.* explores alternative ways for delineating Functional Urban Areas (FUA), based on isochrones modeling of road accessibility to the city centre, and applies the approach proposed to three large European cities (Paris, Barcelona and Berlin). The FUA obtained for these cities are compared with the classic approach for delineating FUA, based on commuter flows. Results of the modelling show that working with real travel times, taking traffic congestion into account, has a substantial impact on the delineation of urban areas, compared to the use of models based on theoretical travel speeds. The authors suggest a further exploration of the ideas put forward in their paper in order to develop new methods for urban area delineation, useful for

interurban comparison and applicable in cases where no data on commuter flows is available.

8 Veldhuizen and Pfeffer focus on the shortcomings of traditional choropleth mapping for intra-urban analysis and present an online tool for the region of Amsterdam for mapping spatial concentrations in demographic and socio-economic data. The mapping approach aggregates postcode areas with overrepresentation of a phenomenon with respect to average conditions both at the local scale as well as at the regional scale. The paper shows some examples of how spatio-temporal mapping of local and regional concentrations may be used as a diagnostic tool to improve our understanding of the dynamics of urban phenomena and how the tool may address the information needs of urban policy makers.

9 The study by Dai *et al.* presents a model for urban network simulation which, next to geographical factors incorporated in traditional urban network models, includes a topological factor making the formation of connections between cities sharing nearest neighbors more likely. The model is tested with empirical data on infrastructure networks connecting 25 major cities in the Yangtze River Delta, China. A comparison between simulated and observed infrastructure networks using four network similarity measures shows that topology plays a less important role in Internet-network formation than in land transportation networks. Although both rail and road networks seem to be influenced by topology, administrative boundaries prove to be more important in the shaping of the rail network, while road network formation is strongly influenced by distance decay effects.

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