



Review

Do spatial patterns of urbanization and land consumption reflect different socioeconomic contexts in Europe?

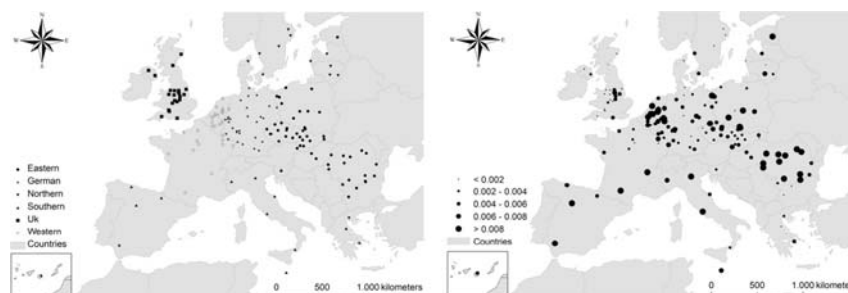
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HIGHLIGHTS

- We identified regional and place-specific factors shaping land consumption in 155 European cities.
- Eastern cities experienced the highest rate of land consumption in Europe (2006–2012).
- Cities in Germany and Austria experienced intermediate levels of land consumption.
- Northern European and United Kingdom cities had the lowest level of land consumption.
- Effective strategies of urban containment should consider the socioeconomic context at the local scale.

GRAPHICAL ABSTRACT

The spatial distribution of the 155 metropolitan regions in 6 European macro-regions (left) and the relative proportion of non-urban land converted to built-up area per year (right).



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ABSTRACT

Land-use changes and urban sprawl have transformed European cities, with a direct impact on both metropolitan structures and socioeconomic functions. However, these processes tend to be relatively different across countries, being influenced by place-specific factors associated to socioeconomic, historical, political and cultural factors that influence decisions on the use of land. Considering 155 metropolitan areas in 6 European macro-regions, the present study investigates spatial patterns of land consumption profiling cities according to a large set of territorial variables, with the final objective to identify relevant socioeconomic dimensions characteristic of recent processes of urban growth. Investigating the socioeconomic background underlying land-use changes in metropolitan regions allows identification of place-specific factors improving the design of effective strategies containing land consumption in different European urban typologies. An exhaustive analysis of land-use changes at regional and local spatial scales contributes to find alternative policies for land-use efficiency and long-term environmental sustainability.

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1. Introduction

Metropolitan regions worldwide have experienced territorial, demographic and socioeconomic transformations in recent decades (Turok, 2004; Couch et al., 2007; Schneider and Woodcock, 2008). Urbanization can be defined as one of the most important factors of landscape change in wealthy countries (Antrop, 2004), resulting in mixed compact and dispersed expansion waves (Bruegmann, 2005; Faludi, 2006; Solon, 2009). Compact urbanization was typically associated with settlement concentration and medium-high levels of population density; dispersed urbanization was commonly detected when people are inclined to move towards suburban areas, determining a progressive decline of inner cities' population (Zitti et al., 2015).

Considering Europe as the most developed and urbanized continent at the global scale, urbanization-driven land-use changes have caused a progressive decrease of cropland and a moderate expansion of forests and pastures, possibly due to enforced regimes of natural land protection (Paulsen, 2014; Haase et al., 2016; Salvati et al., 2016a). At the same time, urban sprawl became a pervasive phenomenon with relevant implications for both European metropolitan structures and socioeconomic functions (Bruegmann, 2005; Couch et al., 2005; Salvati and Gargiulo Morelli, 2014). However, urban sprawl and land-use changes were relatively different in each country, being influenced by place-specific factors associated to geographical, demographic and socioeconomic conditions and the related historical, political and cultural background (Arribas-Bel et al., 2011; Oueslati et al., 2015; Salvati and Carlucci, 2016). For example, residential sprawl patterns and processes in most British or French cities appear quite dissimilar from the ones typical of semi-dense, unregulated urbanization models in southern Europe or highly regulated, compact models of eastern European cities (Haughton, 1999; Couch and Karecha, 2006; Hewitt and Escobar, 2011).

Earlier studies have demonstrated that urban containment and sustainable land management policies may benefit from a comparative investigation about socioeconomic forces that shape land-use change and soil-use efficiency across metropolitan contexts (Faludi, 2006). Urban sprawl in Europe has been investigated in different socioeconomic contexts (Phelps and Parsons, 2003; Kasanko et al., 2006; Poelmans and Van Rompaey, 2009), but relatively few studies have addressed spatial heterogeneity in sprawl patterns and processes across countries and/or macro-regions (Oueslati et al., 2015). Such issue is particularly thought-provoking from a normative viewpoint, informing the design of effective policies oriented to (i) urban containment and (ii) soil conservation (Baing, 2010). In this way, a comprehensive investigation of multiple impacts of urban sprawl on socio-ecological local systems supports decision-making processes and may benefit from a multivariate

approach based on a diachronic analysis of socioeconomic and environmental indicators (Burton, 2002; Hasse and Lathrop, 2003; Salvati, 2016).

Assessment of dispersed urban expansion among European countries was based on methodologies identifying land-use changes at various spatial and temporal scales (Cheshire, 1995; Lambin and Meyfroidt, 2010; Hoymann, 2011; La Rosa and Privitera, 2013). A comparable analysis of factors underlying dispersed urban expansion based on standardized data collections is essential for understanding patterns and processes of land-use change with implications for a better comprehension of spatial variability in patterns and processes of urban sprawl in Europe (Cohen and Nijkamp, 2002; Schneider and Woodcock, 2008; Salvati and Carlucci, 2015). Quantitative information dealing with land-use change in metropolitan Europe was mainly based on statistical data with relatively low comparability across countries, except for the Corine Land Cover initiative, which has produced multi-temporal land-use maps at 1: 100,000 scales (European Environment Agency, 2006). The European Environment Agency (EEA) recently launched the Urban Atlas (UA) project, which promotes a pan-European land-use assessment that provides comparable, high-resolution maps for Large Urban Zones (LUZ). This geo-database is filling a gap in the data about landscape structure and land-use in a large sample of metropolitan regions in Europe. European LUZs were considered the elementary spatial unit in the present work. This choice is motivated with the fact that earlier studies have successfully explored sprawl patterns and processes at the LUZ level (e.g. Salvati et al., 2016b). Such spatial unit usually includes suburbs and a considerable part of neighboring rural areas where sprawl have manifested in the last two-three decades (Oueslati et al., 2015; Pili et al., 2017; Zambon et al., 2017).

Land-use datasets and thematic indicators are crucial to explore landscape change drivers (Salvati et al., 2016a). For instance, socioeconomic, political and cultural factors influence land-use decisions, especially when focusing on definite peri-urban landscape structures (Pinto-Correia and Kristensen, 2013; Hennig et al., 2015). Social indicators can be related to any given local context influencing metropolitan structures and organization (Moos and Mendez, 2015). Under the hypothesis that the progressive shift to capitalism and market economies has widened population and income disparities in metropolitan regions, demographic and economic indicators (e.g. assessing population concentration and income distribution) have been especially considered when investigating social forces underlying landscape changes (Paulsen, 2014; Hennig et al., 2015; Zitti et al., 2015).

Since population density and per-capita disposable income are positively correlated in urban contexts (Oueslati et al., 2015), the highest values for both these variables were traditionally expected in larger

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