

EVALUATING URBAN SPRAWL THROUGH DIVERSIFIED ENTROPY INDICATORS IN URBAN SYSTEMS. APPLICATION TO THE LISBON METROPOLITAN AREA

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Summary: Urban areas are multidimensional systems comprising individuals, communities, enterprises, and infrastructures coexisting in the same geographical area where many types and degrees of interaction can occur. The unchecked expansion of those areas, a relevant feature of urban sprawl, is a common and growing phenomenon in different urban systems (e.g., metropolitan areas). Urban Sprawl, due to its social, environmental, transportation, and economic impacts, is a major concern for planning policies.

Modeling urban sprawl is generally considered a challenging task, as several techniques could be used to develop measurements and model different aspects of sprawl. Moreover, sprawl metrics could comprise wider scopes, as well as unidimensional measurements or a combination of multiple dimensions (e.g., density, accessibility, diversity). Some of these dimensions include several metrics such as urban densities (e.g., population, jobs), entropy, spatial geometry indexes, or street network accessibility. Measures of diversity (e.g., entropy indicators) provide a means to evaluate the “mix” of open and urban space throughout an urban or metropolitan area. So, they are regularly used to measure urban sprawl, to reveal land-cover patterns (e.g., dispersed vs. compact), and to describe the structure and behavior of different systems.

This paper measures the evolution of urban sprawl in the Lisbon Metropolitan Area for the period 1991-2021 using Shannon’s entropy indicator based on data for population density at the level of civil parishes. We use spatial panel data models to explain the variation in these entropy indicators as a function of transport infrastructure, both road and rail-based; accessibility indicators; commuting costs; geographical indicators; socioeconomic variables; and land use policy variables. The main outcomes will allow us to discuss, the evolution of sprawl within the metropolitan area of Lisbon in the last 3 decades, and even more importantly, the main drivers of the observed sprawl evolution.