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Towards an indicator of urban centrality? Exploring changes in present and resident population (1991–2011) in Greece

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ABSTRACT

This study compares the spatial distribution of resident and present population at the municipal scale in Greece (1991–2011) with the aim to infer recent trends in urban expansion. The ratio of present to resident population is proposed as a proxy of urban centrality indicating variations in urban hierarchy over time. Results of the analysis outline relevant changes in the spatial distribution of present and resident population along the urban–rural gradient. Apart from the metropolitan areas of Athens and Salonika (which concentrate nearly half of Greek population), the density of present and resident population varied largely across time and space. Urban regions showed higher values in the ratio of resident to present population than rural regions. The indicator proposed in this study contributes to defining more precisely urban and rural areas and may integrate decision support systems for diachronic analysis of urbanization patterns and processes.

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1. Introduction

With urbanization becoming a global phenomenon, urban population increased all over the world creating huge pressure on the environment (Champion and Hugo, 2004; Pacione, 2005; Couch et al., 2007). While reaching a peak in the growth of urban population between the early 1970s and the late 1980s, European countries – similarly to what was observed in the United States, Canada and Australia – experienced a process of demographic redistribution on a regional scale in the most recent decades (Angel et al., 2011). This process is particularly interesting in southern Europe because of the slow transition from compact morphologies to more polycentric and spatially balanced settlements (Kasanko et al., 2006; Kabisch and Haase, 2011; Salvati, 2014a). In some cases, however, Mediterranean cities expanded in a dispersed mode, determining land consumption, habitat fragmentation and biodiversity loss (Salvati et al., 2013). These patterns may have negative consequences on society and economic systems on a local scale, impacting urban sustainability (van Criekingen, 2010).

Suburbanization shaped urban systems promoting population growth and expansion around satellite cities and sub-centre towns, creating a sort of 'urban continuum' (Hahs and McDonnell, 2006). Population and activities redistribution over larger metropolitan regions altered the density gap discriminating urban from rural areas and shaping the hierarchy of large- and medium-size cities (Aplerovich, 1983). The redistribution of population along the urban gradient has been studied using different indicators, analysis' techniques and spatial scales of investigation (Haase et al., 2010; Kroll and Kabisch, 2012; Larondelle and Haase, 2013). The relation between population dynamics and sprawl was also deeply investigated and indicators assessing urban dispersion trends have been proposed (e.g. Altieri et al., 2014). Sprawl determines multiple impacts on soil, water, air and biotic components - often more relevant than those caused by the radio-centric expansion of head cities (Salvati, 2014b). At the same time, the classification in urban and rural areas, which is at the base of different policies in the economic, social and environmental fields, is becoming a challenging task in both geography, regional studies and environmental science (Craig, 1987).

Theoretical and empirical approaches to the classification of elementary (e.g. administrative) spatial units into urban or rural categories have been proposed based on several variables, criteria and methodologies (Hall et al., 2006; Dahly and Adair, 2007; Inostroza, 2014; Qureshi et al., 2014). Demographic indicators are

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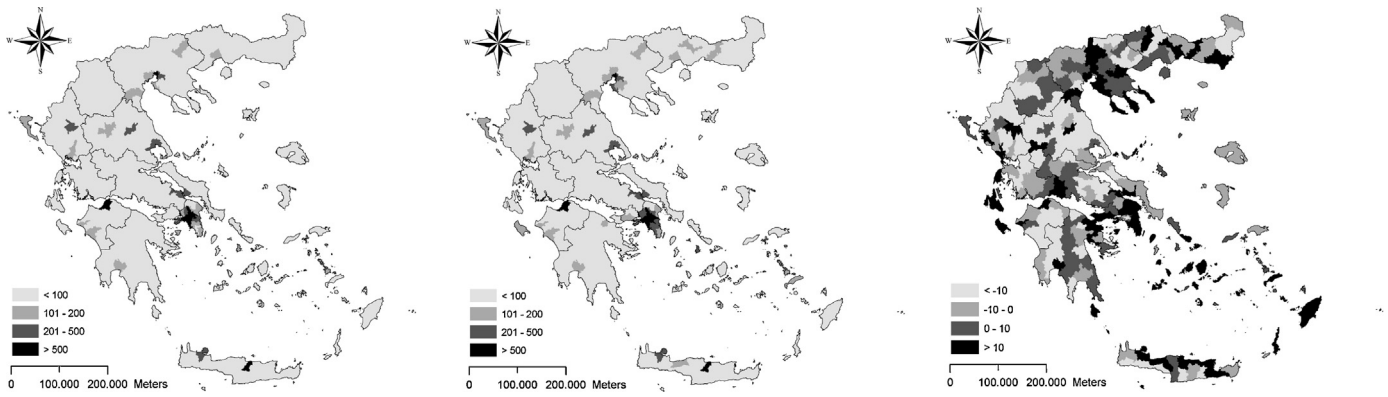

Fig. 1. A map of the study area illustrating population density at the municipal scale in 1991 (left) and 2011 (middle) and annual population growth rate 1991–2011 (right).

the most widely used in the analysis of urban-rural gradients estimating human pressure at the local scale better than other variables (Salvati, 2014a). However, the consolidation of 'urban continuums' driven by suburbanization limits the practical applicability of traditional approaches posing new challenges in the analysis of urbanization patterns and processes (van Criekingen, 2010; Salvati et al., 2013; Qureshi et al., 2014).

The correct identification of urban areas and the classification of rural areas is also a straightforward exercise in official statistics which involves the use of several variables together derived from data sources such as the national censuses of population, buildings and agriculture (European Environment Agency, 2010). The Statistical Office of the European Community (EUROSTAT), many national statistical services across Europe and international organisms, such as OECD and FAO, have proposed harmonized frameworks based on single- or multiple-indicator criteria (e.g. Salvati, 2014a). A multiple-indicator system is usually considered a more reliable tool compared with approaches based on individual indicators. However, the restricted availability of spatially-detailed, reliable and updatable indicators discriminating into urban and rural areas is a relevant constraint to the development of multi-domain decision support systems.

Up to now, evaluation criteria based on arbitrary population density thresholds and/or population size thresholds remain the most commonly implemented to identify densely or sparsely populated areas (Craig, 1987; Hall et al., 2006; Hahs and McDonnell, 2006). In fact, population data are widely (and freely) disseminated through official statistics on satisfactory detailed spatial scales. The great mass of data made available from national censuses of population (see, for instance, the IPUMS-International, a project dedicated to collecting and distributing integrated time series census microdata from around the world: https://international.ipums.org/international/), supports further investigation in the field of indicators assessing urban centrality, with the aim to improve systems classifying urban and rural areas.

Based on previous findings (Salvati and Rontos, 2014), the change over time in the ratio of present to resident population was proposed as an indicator of urban sprawl on a local scale. The present paper generalizes this framework verifying if the ratio of present to resident population can be regarded as a proxy of urban centrality. The spatial pattern of this indicator was studied along the urban gradient in Greece (1991–2011) and allows for an original classification of urban and rural areas with implications for both regional planning and environmental policy. The Greek urban system evolved rapidly during the last two decades owing to suburbanization and coastalization, offering an interesting opportunity to test the behaviour of the above-mentioned indicator during different urban phases.

2. Methodology

2.1. The study area

The investigated area covers the whole of Greece (301,330 km^2). According to the most recent administrative system (the 2011 'Kallikratis' law), our observation units are 326 municipalities ('dimi' in Greek) in turn organized into 51 prefectural departments ('nomi') and 13 regional authorities ('periferias'), corresponding respectively to the NUTS-5, NUTS-3 and NUTS-2 territorial levels of the European Union (Fig. 1). Municipalities in Greece reflect homogeneous areas from the administrative (and possibly economic) perspective at an enough detailed spatial scale allowing to assess the role of key geographical gradients (e.g. urban–rural, coastal–inland). The Greek urban system is centred on two metropolitan areas (Athens and Salonika) and several medium-size cities (Iraklio, Patra, Larissa, Volos, Kalamata, Chania, among others) being satisfactory represented by the administrative partition selected in this study, as illustrated in Fig. 1. Internal, rural areas are exposed to depopulation and contrast with more dynamic, tourism-specialized coastal regions including Ionian and Aegean islands.

2.2. Statistical data

The analysis covers a time frame of 20 years between 1991 and 2011 which encompasses the last urbanization wave in Greece with moderate expansion in both Athens and Salonika and sprawl outside the consolidated urban areas, especially along the coasts and in the internal lowlands (Couch et al., 2007). Two population figures (resident population and present population) are derived from the elementary information collected on the behalf of the Greek national census of population. Population census is carried out every 10 years by the Hellenic Statistical Authority (ELSTAT) in accordance with methodological principles as defined in the European Regulation 763/2008, in order to be used in population censuses in member states of the European Union (see ELSTAT press releases downloadable from www.statistics.gr for technical details).

The resident population refers to the number of individuals who had their usual residence in every municipality of the country. The resident population includes all the individuals, irrespective of citizenship (Greek or foreign), who declared during the Population Census that the place of their usual residence is within the Greek territory. Usual residence of an individual is considered to be the place where he/she has lived continuously for a period of at least 12 months before the reference date of the Census, or arrived during the 12 months prior to the reference date of the Census with the intention of remaining there for at least one year. The recording of

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