Differentiating peri-urban areas: A transdisciplinary approach towards a typology

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ABSTRACT

Peri-urban areas have no clear boundaries, both in geographic and conceptual terms. This paper presents a transdisciplinary approach for the identification of typologies of peri-urban areas and applies it to the Lisbon Metropolitan Area (LMA), Portugal. It is based on the assumptions that more than one type of peri-urban region around an urban core can exist, and that a transdisciplinary approach, linking the physical, economic, social and personal aspects, is needed to capture the intrinsic variability and the complexity of the peri-urban character. The approach is based on four sequential steps: (i) identifying the important peri-urban dimensions to be considered, based on expert-knowledge and stakeholder perspectives; (ii) defining a set of indicators for each dimension; (iii) summarizing redundant information for each dimension; and (iv) applying cluster analysis to identify typologies of peri-urban. This approach was applied to the 211 parishes comprised in the LMA. Seven types of parishes were identified, of which two can be considered urban and five peri-urban, although with quite distinct features. This approach has the potential to be applied to other metropolitan regions, and the resulting peri-urban (and urban) typologies can contribute to a better understanding of the peri-urban character, and to a more targeted implementation of planning and management strategies taking into consideration the diversity and specificities of each peri-urban type.

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1. Introduction

Both demographic and economic growth over the last decades has put pressure on European metropolitan areas which resulted in the traditional compact city extending into adjacent rural areas (Bruegmann, 2001). The pace of this process has been changing over time, with intensive pressure for urban development in the post-war period (1945–1975) (Cupers, 2011) and a subsequent slowing down of this process (Martinez-Fernandez et al., 2012), which resulted, in Europe, in a multiplicity of urban expansion patterns in the areas surrounding compact cities (Kasanko et al., 2006; EEA, 2013; ESPON, 2007, 2013; EC, 2004).

This diversity of shapes and patterns in land use is the result of the action of multiple agents, and new concepts, methodologies and tools for the representation and analysis of this complexity are needed (Antrop, 2013). In Europe, this effort has resulted in innovative proposals for the representation of urban and metropolitan areas, using methodologies that are able to integrate, in high resolution, an appreciable number of dimensions of analysis and indicators (EEA, 2013; ESPON, 2007, 2013; EC, 2004). For the Portuguese metropolitan areas, Abrantes et al. (2010) have proposed an interesting categorization of the metropolitan dynamics in Portugal where the indicators should result from consideration of the following criteria: dynamic; distance; density; scale. However, most existing approaches to characterize peri-urban areas did not use stakeholder consultation as a source of user-relevant information, and representation scales do not allow intra-metropolitan analysis of possible different types of peri-urban areas.

The conceptual definition of peri-urban is still controversial (Kurtz and Eicher, 1958; Thomas, 1974), with these "transitional spaces" remaining unclearly defined, both in geographic and in conceptual terms. Geographically, they include landscapes of mixed

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land use and livelihoods (Simon, 2008), encompassing characteristics of both the urban and rural world, and are located somewhere in-between the urban core and the rural landscape (Díaz-Caravantes and Sánchez-Flores, 2011). In general, peri-urban areas have a high population density compared to rural areas, and also are responsible for generating a higher share of GDP (van Eupen et al., 2012). They have been traditionally approached from an urban planning perspective as the terrain for urban sprawl, the favored location for regional and trans-regional infrastructures (Aguilar et al., 2003; Couch et al., 2008; Huang et al., 2009; Jacquin et al., 2008) and a good location for some tertiary sector structures (e.g., outlets, office parks, logistics). As a result of this planning practice, land use for agricultural production has been declining (Jacquin et al., 2008; van Eupen et al., 2012; Verburg et al., 2010). However, this urban-rural interface cannot be understood simply in spatial terms, but rather more broadly as an array of networks connecting urban agents and rural producers (Browder, 2003; Hernández-Guerrero et al., 2012). That is why an integrated analysis to these areas should address multiple dimensions involving not only spatial land use patterns but also aspects such as identity and lifestyles, kinds of family, mobility patterns or economic activities.

Traditional approaches to identify and characterize urban and peri-urban areas have relied mainly on sectorial and land use perspectives. One type of approach relies on variables such as population size, population density in built-up areas, infrastructural characteristics, administrative boundaries and predominant economic activities (Iaquinta and Drescher, 2000). This approach defines peri-urban areas based on the "loss of rural" characteristics (e.g., fertile soil, agricultural land, natural landscape) but a "lack of urban" attributes (e.g., low density, lack of accessibility, lack of services and infrastructure) (Allen, 2003). A second type of approach, which overwhelmingly dominates the debate on the spatial definition of peri-urban areas, uses population density and distance to existing urban centers. As an example, the typology put forward by the Organization for Economic Cooperation and Development (OECD) classifies peri-urban areas as "intermediate", located between "predominantly urban" and "predominantly rural" regions, based on criteria such as population density and size of the urban centers located within a region (OECD, 2010).

Using the same type of approach, peri-urban areas have also been defined as "discontinuous built development, containing settlements of less than 20,000 people, with an average density of at least 40 persons per km^2 (averaged over $1 km^2$ cells)" (Piorr et al., 2011). The spatial relationship to urban areas has been emphasized by Reginster and Rounsevell (2006), who defined peri-urban areas as areas that are close to large cities (distance < 30 km), in a large buffer zone around large cities (distance between 30 and 100 km), close to medium-sized cities (distance < 30 km), or close to small cities (distance < 10 km). A different type of approach focuses on land use and land cover patterns to characterize peri-urban regions (Aguilera et al., 2011; Brinkmann et al., 2012; Korcelli et al., 2009).

Independently of the used approach, most existing studies on peri-urban areas do not address two important issues. The first is the intrinsic variability expected to occur within peri-urban areas. As the focus, has been placed on differentiating peri-urban areas from urban and rural areas, the literature has been pauper in addressing the internal variability in a peri-urban context and has, therefore, failed to demonstrate that these areas can reveal multiple facets. The second is that they mostly used a sectorial view of peri-urban (e.g. land cover patterns, population density, or distance to urban centers). However, the "peri-urban character" is likely a mixture of multiple disciplinary aspects including settlement patterns, accessibility of infrastructure, diversification of the economy, territorial impacts of structural change in land use, conservation and enhancement of the natural capital (Hornis and Eck, 2008),

cultural heritage, cooperation between rural and urban authorities at the local administration level (Korcelli et al., 2009), underlying urbanization processes (Iaquinta and Drescher, 2000) or mobility patterns (Allen, 2003). Dealing with these aspects separately proved to be not suitable for peri-urban areas (Allen, 2003).

We argue that (i) there is not just one type of homogenous peri-urban area around an urban core in metropolitan regions, as different types of peri-urban areas can be found, each with distinguishable features; and (ii) multiple dimensions have to be taken into account to characterize the complexity of the peri-urban character, which requires a transdisciplinary approach linking the physical, economic, social and personal aspects, and taking into account the views of local and regional stakeholders (the people living in the peri-urban). Therefore, in this paper a methodological approach is proposed for the identification of typologies of peri-urban areas taking into account these aspects. It is based on four sequential steps: (i) identifying the important peri-urban dimensions to be considered, based on expert-knowledge and stakeholder perspectives; (ii) defining a set of indicators for each dimension; (iii) summarizing redundant information for each dimension; and (iv) applying multi-dimensional cluster analysis to identify transdisciplinary typologies of peri-urban.

The proposed approach strongly builds on what is commonly called a transdisciplinary approach or integrative approach (Antrop and Rogge, 2006; Tress et al., 2005; Winder, 2003). This aims at bringing together different types of knowledge bases – academic and non-academic (Antrop and Rogge, 2006). While dealing with territorial aspects, integrating perspectives from those that on a daily basis interact with people and space, can be pivotal in getting a more grounded identification of the main issues at stake that need to be addressed by the scientific community. Transdisciplinary approaches have been used to produce research that is socially relevant and where people need to be actively involved. This public participation fosters consensual outcomes or solutions to a specific problem (Polk, 2014). In fact, not engaging in a transdisciplinary approach runs the risk to miss real-world issues and thereby provide solutions that are not capable to deal with the specific character of peri-urban areas, and thus lead to policy and planning action that might produce new land use conflict and finally degrade quality of life (Dunk et al., 2011).

2. Material and methods

2.1. Study area

The study area for this research project is the Lisbon Metropolitan Area (LMA), located on the west coast of mainland Portugal (Fig. 1). The LMA is divided by the River Tagus estuary into a northern section and a southern section. The southern section is bordered to the south by the River Sado estuary. The LMA has the highest concentration of population and economic activity in Portugal. It occupies roughly 3000 square kilometers (3.3% of national territory) and is home to roughly 3 million people (1/3 of the Portuguese population). At the economic level, the LMA contains about 25% of the active population and 30% of the business enterprises in Portugal, accounts for 33% of national employment and is responsible for more than 36% of the national GDP (LMA, 2013). Administratively speaking, the LMA is divided into 211 civil parishes in 18 municipalities ranging in size from $0.05 km^2$ to $212.80 km^2$.

2.2. Methodological approach

The first two steps of the methodological approach consisted of (i) selecting the relevant dimensions to characterize peri-urban