

Urban biodiversity and social inequalities in built-up cities: New evidences, next questions. The example of Paris, France

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ABSTRACT

The preservation of biodiversity, city-dwellers' quality of life and equality are major issues in promoting sustainable cities. We chose to work at the built-up and much-valued heart of an agglomeration: Paris. We attempt to verify whether public semi-natural spaces with spontaneous vegetation and green frames provide ecosystem services to city-dwellers in an equitable way, and what is the role played by urban landscapes in this relation. Based upon existing datasets, a spatial and statistical analysis of relationships between public semi-natural spaces, urban landscapes and socioeconomic profiles of households was carried out. We compare their spatial patterns, which vary considerably. Mean income per vegetal and landscape cluster and correlations between income, ecological parameters and building density show complex and non-linear relationships. According to Multiple Correspondence Analysis, clusters of public semi-natural spaces, floristic richness and ecological diversity are associated with specific household socioeconomic profiles and landscape design. In the western built-up Haussmann districts inhabited by well-off households, public seminatural spaces provide low ecosystem services. Conversely, in the eastern and peripheral quarters where lower-income households live, public semi-natural spaces provide higher ecosystem services. It is not only well-off households which benefit from being close to urban parks and waterways. Blue and green frames cross districts inhabited by different household profiles. The implications of such results on inequalities between city-dwellers depends whether the presence of public semi-natural spaces actually improves their quality of life. These results are highly significant at a time when urban planners are putting the city's Biodiversity Plan in place.

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1. Introduction

As cities expand in size and spread, a steadily rising number of people are concerned with the urban way of life. Making cities fit better with the objectives of sustainable development is a contemporary challenge (UN-Habitat, 2008). Urban planners have to promote environmental quality in more compact cities (EC, 2010; Jabareen, 2006). The presence of public semi-natural spaces with spontaneous vegetation may provide psychological benefits (Fuller, Irvine, Devine-Wright, Warren, & Gaston, 2007; Mayer and McPherson-Frantz, 2004), improvements to human health (De Vries, Verheij, Groenewegen, & Spreeuwenberg, 2003; Tzoulas et al., 2007), urban biodiversity and hydro-climatic regulation. In this way, semi-natural spaces support ecosystem services

and generally, contribute to improving the quality of life in urban environments (Andersson, 2006; Bolund & Hunhammar, 1999; Tratalos, Fuller, Warren, Davies, & Gaston, 2007).

However, are these ecosystem services equitably distributed across the geographic space and equally accessible by all residents? This question brings up an important concern, given that the spatial distribution of urban environments is superimposed with the socio-economic inequalities among the residents (Esponda & Martinez, 2004; Fainstein, 2010; Pinçon & Pinçon-Charlot, 2004; Rhein, 1998; UN-Habitat, 2008). Urban environments affect their residents in many ways, some of which are positive whereas others are negative, such as pollution. In turn, city-dwellers also modify the environments in which they live (Pickett et al., 2011). In this sense, inequalities between city-dwellers may depend on multiple factors: social, economic, cultural, political, spatial and environmental. According to 'environmental justice' studies, minorities or low-income communities tend to be concentrated in polluted and distant urban areas (Agyeman, Bullard, & Evans, 2002; Bullard, 2007). Alternatively, other authors suggest that unequal access to

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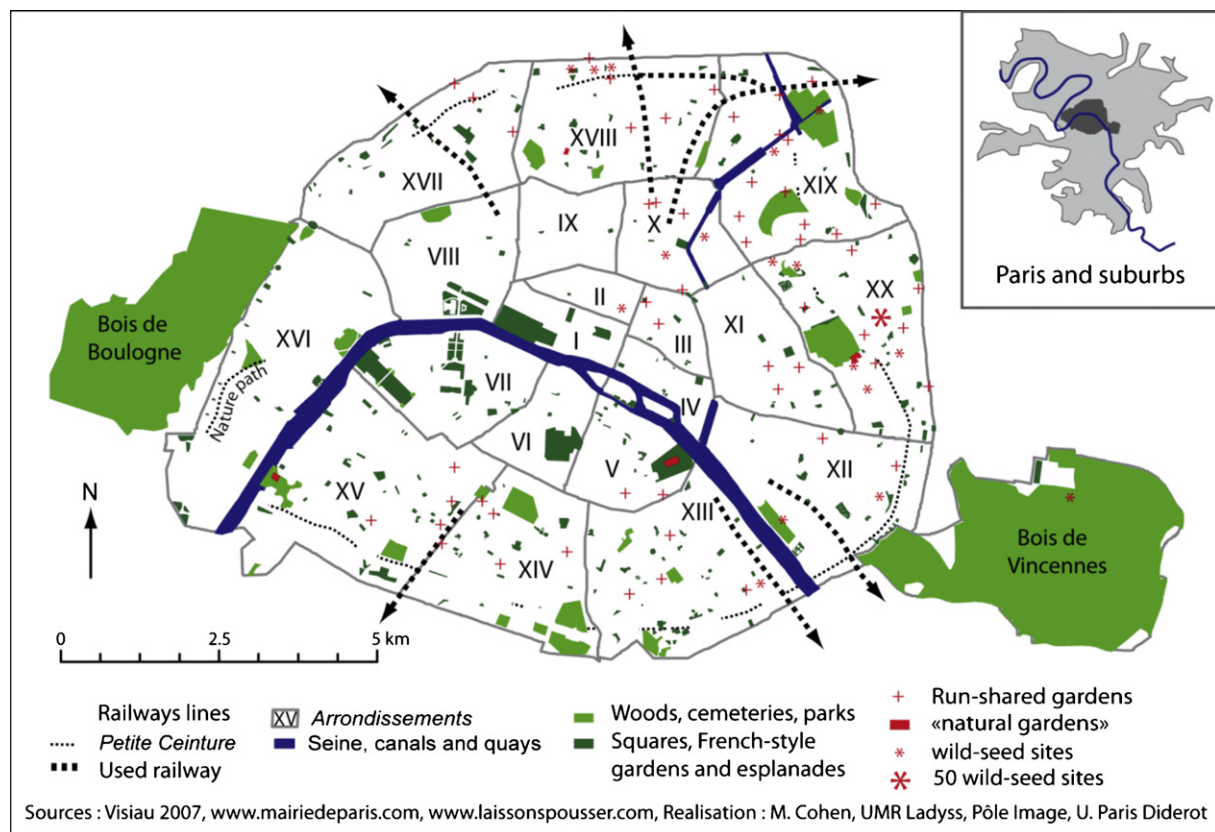


Fig. 1. Location map.

urban biodiversity has implications for the prevalence of 'environmental justice', therefore representing a challenge for urban planners (Kinzig, Warren, Martin, Hope, & Katti, 2005; Martin, Warren, & Kinzig, 2004; Melles, 2005; Strohbach, Haase, & Kabisch, 2009).

Studies conducted in U.S. cities – and, to a lesser extent, in European cities – reveal a positive correlation between household incomes and urban biodiversity, which is measured, for instance, by the number of native and exotic perennial plant species (Kinzig, 2003; Martin et al., 2004), birds (Loss, Ruiz, & Brawn, 2009; Melles, 2005; Strohbach et al., 2009) and other indicators (Kinzig et al., 2005). Studies have shown that trees are more abundant in districts with higher concentrations of wealthy households (Grove & Burch, 1997; Iverson & Cook, 2000; Talarchek, 1990; Tratalos et al., 2007). Paradoxically, Barbosa et al. (2007) have found that deprived and older households living in Sheffield in the U.K. are among the groups with the greatest access to land parcels that are classified as natural surfaces (living no further than 300 meters from a natural surface).

The spatial analysis of urban landscapes may reveal the relationships between biodiversity and socio-economic profiles, such as whether wealthier households are located in greener districts (e.g., Strohbach et al., 2009). Indeed, the number and proportion of native and exotic species depend on a range of factors related to urban planning, including the density of buildings and other infrastructure (Clergeau, 2007; Kent, Stevens, & Zhang, 1999; Luck, 2007; McKinney, 2008; Muratet, 2006; Vaquin, Moret, & Le Dantec, 2006; Williams et al., 2009), the type of "green spaces" (e.g., natural areas versus parks, Millard, 2008, Strohbach et al., 2009), and the type of land-use function (e.g., residential versus business or industrial districts, Dow, 2000; Godefroy & Koedam, 2007; Pickett et al., 2011;

Ricotta, Celesti Grapow, Avena, & Blasi, 2001). Moreover, urban landscapes are the product of period-specific planning trends that differ across countries (Conzen, 2004; Harvey, 2005; Loss et al., 2009; Panerai, Castex, Depaule, & Samuels, 2004; Schwarz, 2010; Stefulesco, 1993).

While a large body of biodiversity-related research has chosen a gradient approach, comparing urban, suburban and rural areas, we chose to study the densely-built core of a conurbation. Previous research on this area has largely focused on socio-economic factors, including the negative effects of urban density on human health (e.g., Murard and Zylberman, 1996), as well as on native vegetation (Luck, 2007; McKinney, 2008). However, previous research has also shown a positive effect of dense urban centers on the natural environment given their space-saving value and their net carbon emission output (Jabareen, 2006; Tratalos et al., 2007; EC, 2010).

This paper aims to investigate the spatial distribution of public semi-natural spaces and urban landscapes in the urban heart of a conurbation, as well their socio-economic dimensions, by combining data used in different disciplines (Clergeau, 2007; Grimm & Redman, 2004; Mathieu, 2009; Pincetl, 2005). First, we characterize the spatial organization and the various features of public semi-natural spaces in Paris, including the biological traits, the level of biodiversity, and various functions of ecological services. Second, we analyze the relationships between urban landscapes, household socio-economic profiles and public semi-natural spaces. Findings from this study reveal important implications for urban planning, particularly in the creation of policies that encompass conservation issues and equitable access to urban biodiversity for all households along the socio-economic spectrum (Ahern, 1995; Hope et al., 2011).

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