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A planning framework to evaluate demands and preferences by different social groups for accessibility to urban greenspaces

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A B S T R A C T

The role of urban greenspaces is widely considered having positive implications for health and providing a complete set of ecosystem services in cities. This paper presents a planning framework for urban greenspaces that considers demands and preferences for accessibility of different social groups (e.g. children and elderly people). It is designed to achieve different objectives in terms of planning and design of greenspaces and to be used in different urban contexts. The framework is structured in four phases that take place during a planning process of greenspaces: the definition of the objectives, the modelling of accessibility to the new or existing greenspaces, the interpretation of results and the definition of planning decisions. In the framework, accessibility to greenspaces is assessed through spatially explicit GIS-based indicators that combine socio-economic and land-use data with the road network information, so to take into account the interactions between social demands and the presence of greenspaces in cities. Two applications of the planning framework are proposed for the cities of Catania (Italy) and Nagoya (Japan), characterized by different configurations of greenspaces, high urban density urban and presence of particular social groups. Planning implications highlighted by the two case studies are presented and discussed.

1. Introduction

The crucial role of greenspaces (GS) in cities is the focus of a relevant amount of contemporary research on urban and planning issues. It is widely recognized that they are the main suppliers of ecosystem services in cities (La Rosa & Privitera, 2013), preserving biodiversity in urban areas (Farinha-Marques, Fernandes, Gaio, Costa, & Guilherme, 2016), sequestering CO_2 (Nowak, Crane, & Stevens, 2006), producing O^2 (Jo, 2002), reducing air pollution and noise (Selmi et al., 2016), regulating climates (Shin & Lee, 2005). Moreover, GS play a fundamental role in health, well-being and social safety (McCormack, Rock, Toohey, & Hignell, 2010; Paquet et al., 2013), with particular reference to social groups that can benefit highly from them. GS include a varied range of ecosystems, such as woodlands, fringe forests, country/agricultural parks, and peri-urban open spaces, able to provide a diverse kind of 'nature' and satisfy different recreational needs (Rupprecht, Byrne, Ueda, & Lo, 2015).

Highly linked to the concept of ecosystem services is the issue of accessibility to the ecosystems and places providing the services. This is particularly true especially for the provision of cultural ecosystem services, as they are generated by the direct presence of people. Since

access to GS is important to human health and well-being (Kaczynski & Henderson, 2007; McCormack et al., 2010), the reduction of the uneven distribution of GS in cities (especially those most populated) and the relative disparities in the access to GS must be key objectives of sustainable planning (Dai, 2011; Pham, Apparicio, Séguin, Landry, & Gagnon, 2012). To this end, socially inclusive planning approaches to greenery in urban contexts should maximize their social benefits based on convergence of human interests (accessibility and qualities of goods and services, culturally appropriate development and fulfilment, self-reliance, etc.), considering equity and disparity within the current population and between present and future generations (Van Herzele, De Clercq, & Wiedemann, 2005). Particularly, urban planning should ensure the presence of local and neighborhood green areas located within walking distance to residents.

However, clarifying the concept of accessibility is an important prerequisite for any assessment aimed at supporting planning choices on GS. Accessibility is a broad and flexible concept than can be defined as the ability to approach something by someone. It is an attribute of people (and goods) rather than a simple service or transportation facility, and describes an integrated system of facilities/services and users from the user viewpoint. For planning purposes as the ones of this

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paper, accessibility can be considered as a spatial feature that reflects the possibility for people to reach a particular place within the city. According to this feature, accessibility is suitable to be modelled by GIS based models and indicators (Ekkel & de Vries, 2017; La Rosa, 2014).

It is generally agreed that ensuring a good access to GS can generate relevant benefits for specific social groups such as children, people in lower socio-economic groups and people with other mental/psychological illness (Arnberger et al., 2017; Boone, Buckley, Grove, & Sister, 2009). However, accessibility can be perceived by different individual according to their needs or preference. Values attributed by people to GS are varied and change according to the different environmental characteristics (Kemperman & Timmermans, 2006). This is the result of the complex ways people interact with GS and assign them a plurality of values for different purposes (Ives et al., 2017). When looking at the relation between types of GS and users' behavior, Schipperijn et al. (2010) found that different characteristics of GS are likely to influence the behavior of their users, because the likelihood that a person uses different types of GS depends on the individual behavior.

Children and elderly people represent two important social groups that can significantly benefit from an easy access to GS (Maas et al., 2009; Reyes, Páez, & Morency, 2014). Both social groups are also potentially more vulnerable to equity and environmental justice issues, due to their more limited spatial range they can cover and their higher exposure to climate adverse conditions. Physical activity is crucial both to children's health and to elderly people. Matisziw et al. (2016) investigated the relationship between GS and children residences with the time spent in physical activities. Takano, Nakamura, and Watanabe (2002) found that the presence of walkable GS positively influences the longevity of residents in Tokyo, independent of their age, sex and socioeconomic status. Health promotion of elderly people is a prime concern in cities characterized by an aging society, such as the one in Japan or some European countries, as a sedentary lifestyle is a component of risk of premature mortality and other diseases (Takano et al., 2002).

Children usually demand for easily accessible spaces with a good amount of features, such as playgrounds, basketball courts, walking paths, running tracks, swimming areas, lighting, shade, and drinking facilities (Cohen et al., 2006). Elderly people have different preferences for social, managerial and physical aspects of urban green spaces compared to other social groups, as they tend to prefer calm and shaded areas, with relaxing activities such as soft sports, dancing, observing animals and plants, feeding animals, or spending time in socializing (Davies, Fuller, Dallimer, Loram, & Gaston, 2012; Loukaitou-Sideris, Levy-Storms, Chen, & Brozen, 2016). At the same time, they also dislike the absence of visitors in GS and aim at having safe and guarded environments (Arnberger et al., 2017).

All these issues delineate a complex picture of how different values are assigned to GS, and highlights the need for planners to differentiate the design of systems of GS to take into consideration the demands and requests by many social groups living in cities (Ives et al., 2017). Urban planning can to increase the overall accessibility to GS and for this reason it is important to carefully quantify the accessibility to GS by different social groups and consequently propose precise planning choices about GS. These choices should be based on the general aim of maximize the accessibility to GS of the highest number of people and at the same time to qualify the existing GS to meet the specific demands of different social groups.

In this paper we present a framework for GS planning in high density urban contexts that integrate the demands of accessibility to GS of different social groups (e.g. children and elderly people). We test the framework with two exemplar case studies that respond to different planning needs and objectives: the cities of Catania (Italy) and Nagoya (Japan), both characterized by high density urban contexts and the relevant presence of particular social groups, such as children and elderly people. The paper is structured in the following way. The planning framework is presented in Section 2. The two study areas where

the framework is tested are described in Section 3. The application of the framework with relative results is presented in Section 4 for the two case studies. Discussion are reported in Section 5 and finally some conclusions are drawn in Section 6.

2. Method: a planning framework for urban greenspaces

As anticipated in the previous section, urban research on GS is highly active and many tools for are available for planners and decision makers. Recently, Douglas et al. (2017) reviewed existing literature on GS planning to propose a theoretical framework with a set of design principles for the provision of more inclusive GS able to respond to the needs of people across all life-course stages. Rigolon & Nèmeth (2016) developed a tool to evaluate the quality of existing parks and derive planning proposals for the improvement of their quality. Dai (2011) analyzed the spatial accessibility of parks in Atlanta to identify particular neighborhoods and social groups suffering from unequal distribution of parks and therefore identify deprived areas where establishing new parks or expanding existing parks. Norton et al. (2015) proposed a framework to develop guidelines for the implementation of an urban green infrastructure to maximize the potential of GS to cool down urban surface temperature. Although conceived to support planning decisions, the outputs from such tools and frameworks are sometime not directly usable in planning processes that are supposed to generate practical decision on the future of GS configurations in different cities. Furthermore, the need of specific type of data and information might burden the transferability and usability of tools and frameworks to different geographical areas than the ones they were designed on. This also implies that some of these tools are designed and used only for particular and local objectives or tailored to specific geographical contexts.

To partially overcome this limitations, the Planning Framework (PF) that we present is designed to achieve different objectives in terms of the planning and design of GS and to be easily used in different urban contexts (Fig. 1). It is structured in four interrelated phases that take place during a general urban planning process of greenspaces: the definition of the planning objectives, the modelling of accessibility to the new or existing greenspaces, the interpretation of results from the accessibility modeling and finally the definition of planning decisions to achieve the objectives that have been defined.

2.1. Setting planning objectives

The objectives that the planning process intends to achieve can be quite different from case to case, according to the characteristics and needs of the urban context. Planning objectives are intended as decisions about activities in a certain space which should be better than the existing state without planning and encompass the three major dimensions of sustainability for urban contexts, such as environment, economy, and social sphere (Berke and Conroy, 2000). Some of the possible objectives include the following: increasing the amount of GS to reaching a minimum, desirable or mandatory quantity of GS per resident (Chiesura, 2004; La Rosa, 2014); changing functions and/or qualities of existing GS to best meet the needs and demands of particular social groups or to follow their changing composition after immigration or gentrification processes (Arnberger et al., 2017; Douglas, Lennon, & Scott, 2017; Rigolon and Nèmeth, 2016); increase the use of GS by citizens (Reyes et al., 2014); increase the general accessibility of GS (Fan, Xu, Yue, & Chen, 2017; Wright Wendel, Zarger, & Mihelcic, 2012); minimize unequal access to the existing GS (Pham et al., 2012; Rigolon, 2016; Talen & Anselin, 1998). Each of these objectives is linked to one or more planning choices or decision to be implemented by spatial planning instruments that are developed in the considered urban context.