



## Research paper

# A multi-dimensional classification and equity analysis of an urban park system: A novel methodology and case study application



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## HIGHLIGHTS

- Introduces a novel, multi-dimensional procedure for classifying urban parks.
- Equity analysis compares park types to neighborhood social characteristics.
- Case study application reveals five park types in Phoenix, AZ.
- Four park types are correlated with particular neighborhood social contexts.
- Methods can reveal the composition and equity of other city park systems.

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## ABSTRACT

This study introduces a novel, multidimensional methodology for empirically classifying urban parks according to their physical, land cover, and built features. An equity analysis compares the resulting park types to neighborhood social characteristics, statistically and spatially evaluating who has access to which kind of park. The process can be customized to the built, geographic, and social conditions and public policy goals of other cities, but is here applied to Phoenix, Arizona. The case study application provides a proof of concept, revealing the composition and distribution of various park types and demonstrating the utility and feasibility of the classification procedure and equity analysis. Results reveal five distinct park types in Phoenix – Suburban Amenity Parks, Green Mini Parks, Native Desert Preserves, Green Neighborhood Parks, and Urban Core Parks – each exhibiting a unique mix of physical, spatial, land cover, and built characteristics. The equity analysis highlights priority areas for park improvements, potential equity concerns, and phenomena for future research. A discussion section evaluates the results in light of previous research and suggests how findings can inform sustainable and just urban park policy, planning, and management.

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## 1. Introduction

Cities across the United States are rediscovering the potential of urban parks – including plazas, pocket parks, greenways, nature preserves, and other outdoor public open spaces – to advance socially and environmentally sustainable cities (Chiesura, 2004; Cranz & Boland, 2004; Harnik, 2010; Sherer, 2003). Time and again, access to urban parks has been shown to improve urban quality of life (Harnik, 2010; Maas, Verheij, Groenewegen, deVries, & Spreeuwenberg, 2006), facilitate social cohesion, democracy, and equity (Kazmierczak, 2013; Low, Taplin, & Scheld, 2005; Mitchell, 1995; Volker, Flap, & Lindenberg, 2007), and enhance human

physical, mental, and spiritual health and well-being (Bedimo-Rung, Mowen, & Cohen, 2005; Chiesura, 2004; Maller, Townsend, Pryor, Brown, & Leger, 2005; Sherer, 2003). These outdoor “third places” are unique in that they provide publicly accessible spaces in cities for gathering, socializing, recreating, and rejuvenation, detached from monetary inputs (Oldenburg, 1989). These places also play a vital role in protecting biodiversity, ecological processes and functions, and ecosystem services within cities (Elmqvist et al., 2013; Forsyth & Musacchio, 2005; Haase, Frantzeskaki, & Elmqvist, 2014; Nielsen, van den Bosch, Maruthaveeran, & Konijnendijk van den Bosch, 2014)—even non-native landscapes heavily altered by human activity (Hobbs et al., 2006; Marris, 2009; Rosenzweig, 2003). By increasing property values and attracting tourism, urban parks also contribute to the economic vitality of local communities (Crompton, 2001; Harnik & Welle, 2009; Lutzenhiser & Netusil, 2001; Nicholls & Crompton, 2005).

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However, despite the abundance of research on the benefits of urban parks and widespread consensus that they serve an essential role in the sustainable, economically vibrant, just city (Chiesura, 2004; Low et al., 2005; Mitchell, 1995; Talen, 2009), major gaps in knowledge and understanding exist. Urban park studies often examine individual sites in isolation or emphasize a singular aspect or benefit (recreation or ecological value, e.g. CAFE Space, 2010; Kazmierczak, 2013; Maas et al., 2006; Schilling, 2010). Such approaches disregard the diverse, dynamic, and interacting mix of social, economic, and environmental benefits provided by different types of urban parks across a citywide park system (Chiesura, 2004; Lindsey, 2003; Saurí, Pares, & Domene, 2009). Park assessments also often ignore the distinctive physical and geographic dimensions and context of these spaces, including their available amenities and facilities, landscaping, spatial distribution, built and socio-economic context, and other physical, social, and environmental characteristics of place (Byrne & Wolch, 2009; Gordon-Larsen, Nelson, Page, & Popkin, 2006; Harnik, 2010; Jacobs, 1961; Low et al., 2005; Pares & Sauri, 2007; Pares, Sauri, & Domene, 2006; Talen, 2009).

Urbanist Jane Jacobs argued that orthodox urban planning treats open space in “an amazingly uncritical fashion” though “often, there are no people where the parks are and no parks where the people are” (1961, 90, 95). The underlying assumption in much parks research, planning, and management is that all parks are more or less the same, and that more is always better (Gold, 1972; Harnik, 2010; Jacobs, 1961). Yet, static, generic park models and standardized people-parkland ratios do not always result in socially and ecologically functional urban parks (Harnik, 2010). In many cases, traditional park models have led to underutilized, inequitable, dangerous, and degraded urban public spaces (Boone, Buckley, Grove, & Sister, 2009; Madanipour, 1999; Marne, 2001; Massey, 1994; Weisman, 1992; Whyte, 1980). Further, the unchallenged fetish for urban “greenspace” denies place-specific considerations, such as the water demand requirements for maintaining irrigated green landscaping in water-stressed cities (Jenerette, Harlan, Stefanov, & Martin, 2011). This penchant for “green” space also disregards the social, ecological, and economic value of “brown” and “grey” parks, such as native desert parks, plazas, squares, and playgrounds (Low et al., 2005; Whyte, 1980).

Research on urban park accessibility by vulnerable populations has proliferated in recent decades, identifying inequitable access in cities around the world—including Seoul, Korea; Leicester, UK; Baltimore and Atlanta, USA; Tainan City, Taiwan; and Melbourne, Australia (Boone et al., 2009; Chang & Liao, 2011; Comber, Brunson & Green, 2008; Dai, 2011; Koohsari, 2011; Oh & Jeong, 2007). Some of these studies reveal that disadvantaged groups have access to fewer park spaces, while others reveal that these disadvantaged populations have higher access to more parks, in number, but access to less park acreage and smaller spaces (Boone et al., 2009; Wolch, Wilson, & Fehrenbach, 2005). These studies advance methods for measuring access, but the validity of the results is limited as they fail to consider park quality beyond size. Although size is one measure of park quality, it is not the only relevant feature. Preferences for different types of parks, with distinct features, aesthetics, recreational opportunities, etc., vary among different social and cultural groups (Byrne & Wolch, 2009; Cordell, Betz, & Green, 2002; Gobster, 2002; Payne Mowen, & Orsega-Smith, 2002). As such, the amenities and facilities present, landscaping features, geographic context, and other social, environmental, and built characteristics represent other important measures of quality park space, beyond size. Byrne and Wolch (2009) synthesized literature on ethno-racial differences in park perceptions, preferences, and behavior. Latinos purportedly prefer more developed parks with picnic areas, restrooms, and parking and tend to visit parks to play soccer, camp, hike, and engage in sedentary activities such as socializing

and picnicking, particularly with extended family. Whites exhibit a preference for solitary recreation in secluded natural settings, particularly camping, hiking, swimming, dog walking, water sports, and cycling. African-Americans display preferences for socializing spaces and organized recreational activities, such as basketball (*ibid.*). In a survey of park preferences and behavior in Chicago, Gobster (2002) noted that Latinos were some of the most frequent park users and often visited in large groups. Minority groups overall participated more in passive social park activities, while whites participated more frequently in active individual sports. Travel time to parks was negatively correlated with rates of park visitation among minorities, suggesting proximity to parks is particularly important for attracting minority users (*ibid.*). Byrne and Wolch (2009) caution that these diverse patterns of urban park use are not simply a function of the socio-demographic characteristics of users and non-users, but also of: (1) the political, social, historical, and economic context of park spaces, (2) park amenities and environmental characteristics (e.g. landscaping, facilities, surrounding land uses), and (3) differing perceptions with regards to park accessibility, safety, and convenience. As such, a thorough understanding of these various dimensions of parks and their users is needed to inform the customization of park spaces for diverse preferences, a task increasingly important given the rapidly changing demographics of U.S. cities towards an older and more Latino and Black population (Byrne & Wolch, 2009; Payne et al., 2002). Advancements in this field are also critical considering the growing impact of human use on ecological systems necessary for the maintenance of human health and well-being (Elmqvist et al., 2013; Haase et al., 2014; Millennium Ecosystem Assessment, 2005).

Calling for a more multifaceted and meaningful evaluation of urban parks, Talen (2009) argues for improved methods of measurement, assessment, and visual representation that integrate spatial contextual considerations, including how parks are distributed relative to social need and elements of the built environment. Song and Knaap (2007) propose that a multi-dimensional, quantitative classification of complex urban phenomena, such as parks, can facilitate understanding, discussion, and analysis of these features, and as such, meaningfully inform equitable and sustainable public policy. This research responds to these recommendations while addressing numerous gaps in urban parks scholarship.

The specific objectives of this research are three-fold. First, it introduces a multi-dimensional procedure for empirically classifying city parks according to their physical, built, and landscaping characteristics to advance urban park research methods, practice, and theory. Second, an equity analysis compares the park classifications with neighborhood social characteristics to facilitate a nuanced, meaningful measure of park equity that reveals *who* has access to what *type* of park. Guidelines for the classification procedure and equity analysis are clearly outlined so the approach can be replicated in other cities and customized to reflect their unique social, built, and geographic conditions and public policy goals. Lastly, this study offers a case study application of the classification and equity analysis in Phoenix, Arizona. This proof of concept demonstrates the utility and feasibility of the approach as applied to an extensive and diverse urban park system. The classification procedure and equity analysis also provide the first large-scale assessment of urban parks in Phoenix, as well as a point of departure for the development of geographically contextualized public policy, planning, and management aimed at strategically and equitably enhancing the multiple benefits of the city's park system.

## 2. Study area

Phoenix, Arizona is the sixth most populous city in the United States and one of the largest by land area. Home to nearly 1.5

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