



## Research paper

# Integrating multiple elements of environmental justice into urban blue space planning using public participation geographic information systems



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## HIGHLIGHTS

- Present method for considering multiple elements of environmental justice.
- Spatial variations in different combinations of activity and user diversity.
- Types of perceived problems also vary according to each combination.
- Method enables managers to target different elements of environmental justice.

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## ABSTRACT

This study presents a Public Participation Geographic Information System (PPGIS) method for spatially identifying and assessing multiple elements of environmental justice in urban blue space. We used this method in the Helsinki Metropolitan Area, Finland, to examine: (1) the diversity and spatial distribution of clusters based on the activities undertaken in urban blue space; (2) the diversity of users in each cluster, representing a composite measure of income, age and family income, and; (3) the extent of perceived problems and unpleasant experiences (PPUE) in each cluster. Proportionately more high activity and high user diversity areas were found in Helsinki than Espoo and Vantaa municipalities. Contrasting combinations of activity and user diversity (high-low, low-high) show very different spatial distributions, dominant activities and PPUE. The method enables landscape and urban planning strategies to be tailored to different types of activities and users, and to be responsive to the PPUE found in urban blue spaces. We encourage future landscape and urban planning research to further develop and apply this PPGIS method for assessing multiple elements of environmental justice.

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## 1. Introduction

*Urban blue space* represents urban aquatic environments as public spaces, comparable to city parks, plazas and other land-based open spaces (Wessels, 2011). These spaces provide for a range of experiences, including opportunities for recreation, relaxation, socializing with friends and health benefits (Faehnle, Bäcklund, Tyrväinen, Niemelä, & Yli-Pelkonen, 2014; Gobster, Nassauer,

Daniel, & Fry, 2007). Globally, there is increasing policy interest in engaging local stakeholders in the identification and valuation of these attributes, and for including them in land-use planning and decision-making following principles of environmental justice, as reflected in European Union's Green Infrastructure Strategy (European Commission, 2013).

Environmental justice is based on the principle that all people have a right to be protected from environmental pollution and to live in and enjoy a clean and healthy environment (Agyeman & Evans, 2004). The concept is particularly important in urban blue spaces given that these landscapes are highly valued for restorative and perceived health reasons by a range of inhabitants (Korpela, Ylén, Tyrväinen, & Silvennoinen, 2010). It is a broad area of research

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that considers social dimensions of distribution (race, gender, disabilities, income), individual exposure to environmental risks (e.g., air pollution, greenspace, climate change) and recreational opportunities (Walker, 2012).

Here we focus on the role of Public Participation Geographic Information Systems (PPGIS) in elucidating different elements of environmental justice at the place-specific scale. Over the past six years, there have been rapid developments in PPGIS techniques (e.g., Brown & Fagerholm, 2014; Brown, Montag, & Lyon, 2012; Raymond et al., 2009; Sherrouse, Clement, & Semmens, 2011; van Riper, Kyle, Sutton, Barnes, & Sherrouse, 2012). Studies have considered elements of environmental justice in isolation such as perceived or physical access (Wang, Brown, & Liu, 2015) and the abundance or diversity of physical activities and park benefits (Brown, Schebella, & Weber, 2014). The diversity of resident's preferred activities (e.g., fast walking, jogging, cycling) can vary according to a park's type (e.g., sport park, natural park, school park) and an area's size (Brown et al., 2014). This finding is based on the *activity diversity* metric which accounts for the different activity types mapped by survey participants in a given area and the evenness of the mapped activities (Brown & Reed, 2012).

Other important PPGIS attributes relevant to environmental justice issues are *user diversity* and *perceived problems and unpleasant experiences* (PPUE). User diversity can be broadly defined as the mix of users (survey respondents) which access a given area. Although few studies have specifically focused on the attributes of urban blue space users, it is already known that the distribution and type of values and activities assigned to areas by users can vary according to sample type (Brown, Kelly, & Whittall, 2013), and stakeholders with different types of influence can assign values and preferences in different areas (García-Nieto et al., 2015). PPUE refers to the perceived negative qualities of places, such as perceived traffic dangers, unpleasant routes and signs and perceived disorder and care (Kahila & Kyttä, 2009; Kyttä, Kuoppa, Hirvonen, Ahmadi, & Tzoulas, 2014).

PPGIS studies rarely consider how multiple elements of environmental justice are spatially distributed across the landscape. Understanding environmental justice from multiple perspectives is crucial to ensuring that urban settings are designed in ways that contribute to a range of place-based experiences (Amin, 2008; Low, Taplin, & Scheld, 2005), including social interactions between diverse user groups (Leikkilä, Faehnle, & Galanakis, 2013), as well as provide possibilities for connection to nature (Raymond, Brown, & Weber, 2010). This is particularly important given that privatization of urban space is weakening access and decreasing urban inhabitants' options to meaningfully interact with local environments and each other (Colding & Barthel, 2013). It also may assist in engaging under-represented people in land use planning and management, which has been noted as an important area of future PPGIS research (Brown & Kyttä, 2014).

In this study, we present a PPGIS method for spatially identifying and assessing multiple elements of environmental justice (i.e., activity diversity, user diversity and PPUE) in popular areas by the water in Helsinki Metropolitan Area (HMA), with the goal of informing urban blue space design and management. Our research is guided by the following objectives:

- 1) To present a method for spatially comparing activity diversity, user diversity and PPUE in clusters within the HMA, and;
- 2) To discuss the implications of considering different spatial measures of environmental justice in the planning and management of urban blue spaces.

The results are based on 2151 responses (8518 activity points) to a PPGIS survey conducted around the HMA. We first provide a

theoretical background to environmental justice. We then discuss the survey and analyses methods and report on the key findings.

### 1.1. Multiple elements of environmental justice

The environmental justice concept was developed in the United States in connection to the social movement fighting the uneven distribution of environmental risks among ethnic and racial groups. Justice research there has emphasized social and environmental inequality grounded in race relation concepts of ethnicity; minority, race and racial classification; and prejudice, discrimination and racism. For example, the segregation of housing, parks, beaches and transportation systems between blacks, whites and Native Americans (Taylor, 2009). Globally, environmental justice has been extended to encompass not only environmental risks and harms to disadvantaged groups, but also access to environmental goods and amenities, such as those provided by urban spaces (Agyeman et al., 2002; Agyeman, Bullar, & Evans, 2002; Agyeman, 2005; Elvers, Gross, & Heinrichs, 2008). Even wider interpretations of environmental justice exist, with the concept embracing not only issues of equity and access, but also recognition, participation, and the basic needs and functioning of individuals and communities. This pluralistic view has been reflected in a capabilities approach to environmental justice which encompasses basic needs, social recognition and economic and political rights (Schlosberg, 2013).

Within an environmental planning context, European (including Finnish) and Australian environmental justice research has focused on the assessment of environmental risk and access to environmental goods and amenities (Agyeman et al., 2002; Agyeman, 2005; Elvers et al., 2008), as well as links between environmental quality and human equality in public spaces, parks and leisure spaces (Agyeman, 2013; Low et al., 2005). Numerous studies have measured access to urban green areas and the problems associated with lack of access by different socio-demographic groups (see Wolch, Byrne, & Newell, 2014 for a review); for example, the relationships between perceived accessibility and park use behavior (Wang, Brown, Liu, & Mateo-Babiano, 2015).

User socio-demographics also influence the usage of urban blue spaces. A study on accessibility of recreational activities by the water in day trips in the HMA showed that the mere vicinity of the shore does not always mean that urban residents enjoy a range of activities there. Factors such as income status had a greater influence on usage patterns (Laatikainen, Tenkanen, Kyttä, & Toivonen, 2015). Important factors found to influence usage patterns in other areas include ease of social access to facilities and services for diverse social groups (Fincher & Iveson, 2008; p. 35; Low et al., 2005), age (Kemperman & Timmermans, 2006) and family situation (Aminzadeh & Ghorashi, 2007). Here, we measure this *user diversity* by combining age, income level and family situation (further defined in Section 2).

Environmental justice also has an experiential dimension in that people can perform various activities in urban areas, including urban blue spaces (Laatikainen et al., 2015). PPGIS studies have explored and examined the experiential qualities of areas, showing that activities and place-based values are not randomly distributed across the landscape, but rather cluster around special areas such as urban woodlands (Tyrväinen, Mäkinen, & Schipperijn, 2007) and tourism nodes (Raymond & Brown, 2007). Different types of urban spaces can also be associated with different performed activities (Brown et al., 2014). Hence, *activity diversity* is another important consideration in environmental justice studies.

PPUE also needs to be considered with respect to environmental justice in urban blue space. Efforts to promote multiplicity as a principle of urban inclusion might also result in a range of PPUEs, including conflicts between activity groups (Tynon & Gomez, 2012; Vaske, Needham, & Cline, 2007), which can lead to people feeling

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