Landscape and Urban Planning 153 (2016) 198–208

Contents lists available at ScienceDirect

Landscape and Urban Planning

journal homepage: www.elsevier.com/locate/landurbplan

Research paper

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

Christopher M. Raymond[a,b,*], Sarah Gottwald[a,c], Jenni Kuoppa[a], Marketta Kyttä[a]

[a] Department of Built Environment, Aalto University, Rakentajanaukio 2 C, P.O.Box 12200, 00076 Espoo, Finland
[b] Department of Landscape Architecture, Planning and Management, Swedish University of Agricultural Sciences (SLU), Slottsvägen 5, S-230 53 Alnarp, Sweden
[c] Institute of Environmental Planning, Leibniz Universität Hannover, Herrenhäuser Straße 2 D-30419, Hannover, Germany

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.

ARTICLE INFO

Article history:
Received 31 October 2015
Received in revised form 5 May 2016
Accepted 6 May 2016

Keywords:
Physical accessibility
Distributional justice
Participatory mapping
SoftGIS
Green infrastructure
Blue infrastructure

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.

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

* Corresponding author at: Department of Landscape Architecture, Planning and Management, Swedish University of Agricultural Sciences (SLU), Slottsvägen 5, S-230 53 Alnarp, Sweden.
E-mail address: chris.raymond@enviroconnect.com.au (C.M. Raymond).

http://dx.doi.org/10.1016/j.landurbplan.2016.05.005
0169-2046/

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, & Whitall, 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 excluded from open space, or in more extreme cases, feelings of discomfort or fear (Agyeman, 2013). Sometimes perceived problems can be overcome by making special provisions in public space for certain groups, and for different activities (Amin, 2008; Low, 2013), and in other cases, installing infrastructure to reduce unpleasant experiences, including receptacles for disposing of litter (Schultz, Bator, Large, Bruni, & Tabanico, 2011).

In this study, we spatially assess the interrelationships between activity diversity, user diversity and PPUE. In doing so, we move beyond single measures of environmental justice that do not take into account of different forms of spatial diversity, and avoid the false assumption that the identities and needs of individuals could be understood by any one social label such as age, gender, ethnicity or social class (following Fincher & Iveson, 2008).

2. Methods

2.1. Study area

The research was conducted in Helsinki Metropolitan Area (HMA) which includes the Baltic Sea (Gulf of Finland), fluvial environments (especially River Vantaa), transitional waters (bodies of water in the vicinity of river mouths which are partially saline as a result of their proximity to coastal waters but which are influenced by freshwater flows), lakes, small urban surface waters (e.g. streams and bonds) and wetlands (Fig. 1). Helsinki is the capital of Finland and has a population of 620 700 residents. The HMA consists of the municipalities of Helsinki, Espoo (265 500 residents), Vantaa (210 800 residents) and Kauniainen (9360 residents).

Helsinki has over 130 km of shoreline and over 315 islands. The shoreline and archipelago carry rich cultural history and there are also significant natural areas for recreational, especially on eastern shores of Helsinki. In Helsinki every urban resident lives less than 10 km away from the shore. Opening this shoreline for everyone has been a long-term goal of city planning in Helsinki (City of Helsinki, 2014, 2015). Many of the important blue spaces in Helsinki city centre are public parks which were built in the nineteenth century mainly for elite classes and to create Helsinki's identity as a West-European metropolitan city (Clark & Hietala, 2006).

Historical planning decisions have contributed to social class divisions in Helsinki. Only a few parks and other green spaces exist to the north and east of Helsinki city centre (the densely built working class districts of Kallio and Sörnäinen) resulting from rapid industrial development in the 20th Century (Schönach, 2014). Since the early 1900s, an east-west divide has existed along Helsinki's shoreline, with "the long bridge" (Pitkäsilta) separating the city's richer and poorer districts. The districts just north-east of the city centre and east of the bridge (Kallio, Hermanni, Sörnäinen, Kyläsaari, Vallila) have historically been identified as working class families with low income and smaller than average housing. These families suffered from being in close vicinity of polluting municipal service facilities and from the lack of availability of environmental amenities. The districts west of the bridge have historically been inhabited by professional families with high incomes. As a case example, housing agglomeration in the early decades of the 20th Century turned Töölö into a prosperous district for city elites or socially privileged middle class groups. Nowadays, this east-west divide is less apparent as a result of more socially inclusive planning in the 1970s and 1980s (Schönach, 2014). Neighbourhoods such as Kallio are now middle class areas and housing here is almost as expensive as the western part of the city. But traces of past (class-related) planning decisions are still visible in the landscape, as highlighted by the spatial distribution of parks.

Urban structure in Espoo is dispersed and networked, consisting of five centres and areas of detached houses located close to nature. Espoo has large natural areas including a seashore of 58 km and 165 islands, as well as almost a hundred lakes (City of Espoo, 2015a,b). Vantaa can be described as semirural. In contrast to the other municipalities (Espoo and Helsinki), Vantaa does not have access to the coast. The River Vantaa is an important landscape feature running through areas characterized by traditional farmlands, natural and urban landscape. Kauniainen is a small suburban, garden town municipality, enclosed by the municipality of Espoo and hence without access to the sea shore. Given the small number of points assigned to Kauniainen, we merged this region with Espoo.

2.2. Study participants

A random sample of 30 000 residents aged between 15 and 75 years old was drawn from the Finnish Population Registry. In autumn 2013 residents were invited by mail to participate in the PPGIS survey. Only a single mailing round was undertaken, resulting in 2 151 survey responses and 27 000 marked points around the HMA. The sample results showed general consistency with the HMA statistics (Statistics Finland, 2014) on most sociodemographic variables (e.g., city of residence, age, gender, family type, income). However, compared to the region, the sample had proportionately more highly educated people (Master's degree: sample 31% vs. HMA 17%), but proportionately fewer renters (sample 32% vs. Statistics Finland HMA 42%) and people living in apartment buildings (sample 62% vs. HMA 75%).

2.3. PPGIS method and process

We collected activity and user data using Maptionnaire, which is an online PPGIS tool for the collection of experiential knowledge about the urban environment and its uses and values (Kyttä & Kahila, 2011). The study website consisted of an opening screen and then a map interface where participants could drag and drop digital points relating to different types of activities on to a map of the HMA. On the map interface we noted: "What water and waterside areas do you enjoy in the Helsinki region? Use the buttons below to mark it on the map! You may mark as many locations as you wish." Survey participants were requested to take into account all seasons when thinking about the use of urban blue spaces. They first identified a place on the map related to each performed activity. For each activity category, there were several types of activities which participants could choose from (recreational activities, relaxing and spending time together; sports activities and nature activities, Table 1).

Survey participants were then asked to map the following PPUE: (1) the atmosphere is unpleasant; (2) the scenery is not attractive; (3) the location is crowded; (4) I feel that I do not belong there; (5) I feel like an outsider; (6) certain groups of people or use method bothers me; (7) use of the location requires a membership to an association/club; (8) the location lacks necessary equipment, services, safety structures, routes, etc.; (9) the water quality is poor; (10) I have been harassed or discriminated against, and; (11) environmental protection or other administrative rules restrict use of the location. Finally, respondents were asked to answer question about their background, including income (range), birth year, and family situation.

2.4. Analyses

The analyses comprise of an assessment of activity clusters, activity diversity, user diversity, and quarters based on the combination of activity and user diversity. We also considered the dominance of PPUE.

Fig. 1. The Helsinki Metropolitan Area.

Table 1
Proportional differences in the number of activity points placed inside and outside of the clusters.

Activity type	Total number of points across region	% across region	Points inside cluster: Number of points in cluster	Points inside cluster: % in cluster	Difference (Points in Cluster/Total points)
Walks on the shore	2181	14.6	1351	17.2	1.18
Jogging	1971	13.2	893	11.4	0.86
Spending time with family or friends	1894	12.7	1157	14.7	1.16
Spending time, sitting, sunbathing on the beach	1695	11.4	1073	13.7	1.20
Use of a coffee shop, terrace, etc. by the water	1264	8.5	889	11.3	1.34
Picnics by the water	935	6.3	567	7.2	1.15
Other nature observation	891	6.0	328	4.2	0.70
Hiking	692	4.6	229	2.9	0.63
Skiing on ice or on the shores	635	4.3	185	2.4	0.55
Swimming in natural waters	616	4.1	346	4.4	1.07
Taking the kids swimming	439	2.9	290	3.7	1.26
Birdwatching	334	2.2	124	1.6	0.71
Taking the dog swimming	233	1.6	109	1.4	0.89
Fishing	228	1.5	54	0.7	0.45
Canoeing or rowing	210	1.4	58	0.7	0.53
Ice skating, tour skating on natural ice	153	1.0	30	0.4	0.37
Sailing	144	1.0	37	0.5	0.49
Enjoying sauna by the water	129	0.9	46	0.6	0.68
Motor boating	120	0.8	19	0.2	0.30
Winter swimming	79	0.5	42	0.5	1.01
Water area reconditioning or other environmental management work	34	0.2	10	0.1	0.56
Diving, snorkeling	25	0.2	10	0.1	0.76
Jet skiing, water skiing, or other motorized water sport	14	0.1	3	0.0	0.41
Hunting	13	0.1	4	0.1	0.58
Riding snow mobiles on the shore or ice	3	0.0	1	0.0	0.63
Total points	14 932	100.0	7855	100.0	

Note: If proportional difference >1 then share of points inside cluster are greater than outside cluster; if proportional difference <1 share of points inside cluster are less than outside cluster; if proportional difference = 1 share of points inside cluster and outside clusters are equal; colors: from dark grey to white: recreational activities, relaxing and spending time together; sports activities; nature activities

2.4.1. Activity clusters

A cluster analysis was carried out to create boundaries and define popular areas where people carry out activities related to urban blue spaces. Activity clusters were based on an Average Nearest Neighborhood distance of 70 m which encapsulated over half of the activity points. This threshold ensured an adequate number of both clusters and points for statistical analysis. Only clusters with five or more points were taken into account for further analysis, and clusters belonging to the same areas were merged.

2.4.2. Activity diversity and user diversity

We used the Shannon Diversity Index to examine how diverse each of the clusters were in terms of activities in general, and whether the most diverse clusters were evenly distributed across the HMA. The Shannon's index is calculated as follows:

$$\mathrm{Hs} = \sum_{i=1}^{s} p_i \log p_i$$

where $\boldsymbol{s}$ is the number of data points (number of activity points marked or number of respondents) and $\boldsymbol{p_i}$ the relative abundance of the points (activity types, family situation category) which can vary between 0.0 and 1.0. $\boldsymbol{p_i}$ represents the share of a certain type or category (activity type, family situation category). A high value of Hs indicates that when randomly picking a point of a defined area, it is uncertain to which activity type or family situation the point belongs. Thus Hs is highest when there is the same amount of points in every category.

We adapted this index to measure activity diversity, which was measured as follows:

$$\mathrm{Hs}_{\mathrm{activity}} = \sum_{i=1}^{activitypoints} \frac{\text{number of points of activity type i}}{\text{total number of activity points}} \log p_{\mathrm{i}}$$

To identify the number of activity points, a cell size of 250 m was selected for the defined area in order to include all points in the analyses. The activity diversity index was weighted by the number of activity categories. The cells were joined to each cluster based on an area overlay. Summary statistics were then generated describing the distribution of the popular areas and their diversity.

The user diversity index was based on three background variables: age, family situation (singles, couples with or without children) and median income. Various studies have shown that preferences regarding recreational activities and usage of natural amenities change over the life time (i.e., as one gets older) (Chiesura, 2004; Jim & Chen, 2006; Kemperman & Timmermans, 2006; Payne, Mowen, & Orsega-Smith, 2002). The diversity in age involved calculating the variance in mean ages.

Family situation (e.g., whether you have a partner or children) also influences the types of performed activities (Aminzadeh & Ghorashi, 2007; Arnberger & Eder, 2007; Christie, Hanley, & Hynes, 2007; Lee, Graefe, & Burns, 2008). Family situation is a categorical variable. The diversity of family situation was calculated based on the diversity of responses within a given activity cluster, also using the Shannon Diversity Index. i.e.:

$$\mathrm{Hs}_{\text{family situation}} = \sum_{i=1}^{respondents} \frac{\text{number of respondents of family situation category i}}{\text{total number of respondents}} \log p_{\mathrm{i}}$$

Level of income is one of the factors which most strongly affects accessibility to activity clusters (Laatikainen et al., 2015). Diversity in income was calculated based on the variance of the median values of each of the twelve classes noted in the survey. The thresholds for low and medium-high income were based on median income per household in Finland (4922 € per month, Statistics Finland, 2014).

To create a composite measure of user diversity across the three user variables of age, family situation and income, we first normalized each diversity calculation using a Sigmoid function and then joined them based on their geometric mean.

2.4.3. Combining activity and user diversity

We created a framework representing different mixes of activity and user diversity by calculating the average of each activity diversity and user diversity index inside the activity cluster (Fig. 2). The framework allows analysis of the four possible combinations between low and high user diversity and low and high activity diversity. To assist with the naming of each quarter, we then examined respondent socio-demographics per quarter, the cluster size and dominant activities per quarter and the spatial distribution of each quarter.

To obtain meaningful user diversities for statistical analyses, only clusters containing more than 7 respondents were considered. The 109 activity clusters contained a total of 3 356 respondents (one respondent could mark activities in several clusters). On average 30.8 respondents marked activity areas in one cluster, varying between two and 279. A total of 91 clusters were considered.

Four quarters showing different levels and combinations of activity diversity and user diversity were then generated based on an average value threshold (activity diversity = 0.66, user diversity = 0.66).

2.4.4. Overlay of activity and user diversity with the negative qualities data

To understand the potential for problems between different activity and user groups, we overlaid the activity and user diversity quarters with the PPUE data. Clusters with more than or equal to 12 problems (based on the 75th percentile) were considered as areas of high potential problem. First we looked at the problems in general without differentiating between the 11 types of problems identified by respondents. Second, we analysed which problems were mentioned most frequently, in which areas and in which of the four combinations of activity and user diversity.

3. Results

We spatially examined the number and types of activities by cluster (Section 3.1), followed by the diversity of activities and users in clusters (Section 3.2). We then combined clusters containing different intensities of activity and user diversity into quarters, and overlaid these results with the dominance of PPUE across the HMA (Section 3.3).

3.1. Activity clusters

The activity points formed 109 clusters, varying between 301 and 185 793 m^2 and containing 4 091 of the original 8 518 points of the HMA (48.0%). The six most frequently mapped activities in the clusters belonged to recreation, except jogging which is a sports activity (Table 1). These recreational activities were non-specialized and included walks on the shore, spending time with family and friends, spending time sitting or sunbathing on the beach, using a coffee shop or picnics by the water. The least frequently marked activities were those requiring either expensive equipment and/or special training. They included sailing, ice-skating/tour skating, motor boating and hunting. This exercise resulted in the mapping of 4091 points and 7855 activities.

The most and the least marked activities inside the clusters were similar to those found across the region without clustering. However, recreational activities dominated when considering only the

Quarter 1	Quarter 2
High user diversity, low activity diversity	High user diversity, high activity diversity
Areas which have a high diversity of different user groups BUT low diversity of activity points.	Areas which have a high diversity of different user groups AND high diversity of activity points.
Quarter 3	**Quarter 4**
Low user diversity, low activity diversity	Low user diversity, high activity diversity
Areas which have a low diversity of different user groups AND low diversity of activity points.	Areas which have a low diversity of different user groups BUT high diversity of activity points.

Fig. 2. The framework for combining activity and user diversity.

areas inside the cluster (Table 1, Difference >1), whereas most of the sports and nature activities dominated when considering all areas marked in the HMA (Difference <1). This finding is further supported by the Average Nearest Neighbor ratio representing the ratio of observed versus predicted distances. All three activity types showed significant clustering patterns (ranging from 0.37 to 0.51). Recreation activities were the most concentrated (0.37), nature activity points were least concentrated (as seen by the dispersed pattern in the Northwestern area of Espoo), and sports activities showed a pattern in between these two extremes.

3.2. *Diversity of activities and users in clusters*

In this section we examine the spatial variability of popular areas (clusters) of activity and user diversity. The activity diversity index of the popular areas ranged from 0.55 to 0.73 (average = 0.66). Most of the clusters had medium-high indices with a large peak around 0.70 and a smaller peak around 0.60. There were no significant differences in activity diversity based on type of water body, character of the environment (central, remote, rural or urban) and type of urbanization (sealed, natural and remote areas) ($p > 0.05$). Both high diversity and low diversity clusters can be found on all kinds of: water bodies; central, remote, rural or urban areas, and; sealed, natural and remote areas (Fig. 3). Low activity diversity areas were found near the market square in the city centre of Helsinki as well as at the remote pond of Haukkalampi in the Nuuksio National Park in Espoo. Conversely, high activity diversity areas were on the island of Seurasaari in Helsinki as well as at the lake of Kuusijärvi situated in inner Vantaa.

We also examined the spatial variability of clusters of user diversity. The normalized diversity varied between 0.57 and 0.69, with a peak around 0.64 and a mean value of 0.63. Clusters of high and low user diversity were found in all municipalities and in central as well as remote areas. The central island of Seurasaari (Helsinki) as well as the remote pond of Haukkalampi in Nuuksio (Espoo) were areas of low user diversity, whereas the central market square in Helsinki and the remote lake of Kuusijärvi (Vantaa) were areas of high user diversity.

3.3. *Combining activity and user diversity*

To understand the interactions between activity and user diversity, and thus gain a better appreciation of the multi-dimensional nature of environmental justice, we identified clusters with different mixes of low and high activity and user diversity (Section 3.3.1), and explained their distribution using the quarters defined in Fig. 2. We then examined the differences in socio-demographics (Section 3.3.2), size and activity (Section 3.3.3) characteristics per quarter. Finally, we examined the differences in abundance of PPUE across the clusters (Section 3.3.4) to further understand the structure of environmental justice.

3.3.1. *Identifying quarters*

When mapping activity and user diversity separately, there were no significant differences among municipalities, and the diversity clusters were distributed rather equally among the region (with many clusters of low diversity located towards the east of the city centre). However, after combining activity and user diversity indices, popular areas in the HMA had different mixes of activity and user diversity, which were subsequently classified into four quarters as guided by our framework (Fig. 2). We identified popular areas containing clusters with high user but low activity diversity (Quarter 1); high user and activity diversity (Quarter 2); low user and activity diversity (Quarter 3), and; low user but high activity diversity (Quarter 4). The majority of clusters were found in Quarter 2.

We then mapped the distribution of clusters within the four quarters (Fig. 4). Overall, the Helsinki area (particularly the western area) had the highest number of Quarter 2 clusters, followed by Espoo and then Vantaa. Quarter 1 and Quarter 4 clusters were mainly found along the shoreline of Helsinki (71.4 and 73.9% respectively). Quarter 3 clusters were located mainly along the shoreline of Espoo and Helsinki, with a further two at the river Vantaa and in the Nuuksio National Park. Approximately 27% of Quarter 2 clusters and 22% of Quarter 4 clusters were located on inland waters. Along the river Vantaa there were clusters of all four quarters.

3.3.2. *Socio-demographics per quarter*

Overall, Quarter 2 had the highest number of respondents ($n = 1$ 471), followed by Quarter 1 ($n = 738$), Quarter 4 ($n = 689$) and Quarter 3 ($n = 367$). The quarters of lower user diversity (Quarters 3 and 4) had proportionately more respondents of working age (25–65 years) than the more diverse user clusters (Quarters 1 and 2). In Quarter 4, the proportion of respondents under 25 years was particularly low. Those who lived alone were overrepresented in Quarter 1 (Table 2).

We also found significant proportional differences related to income level ($p < 0.05$). Respondents who reported a household monthly gross income of 4800 € or less were assigned to low income households and those who reported 4801 € or more were assigned to medium to high income households. Members of low income households composed 48% of respondents in each of Quarters 1 and 3, compared with 43% and 42% in Quarters 2 and 4 (Table 2).

3.3.3. *Size and activity characteristics of each quarter*

All quarters differed in terms of the number of clusters; average area of their clusters; and the proportions of different activity categories (Table 3). Quarter 2 was largest in area, and also has the highest number of markings, while the Quarter 3 was considerably smaller. Quarters 1 and 2 (representing a high diversity of users) contain a high proportion of recreational activities while Quarter 3 had a high proportion of sport activities (especially jogging). The

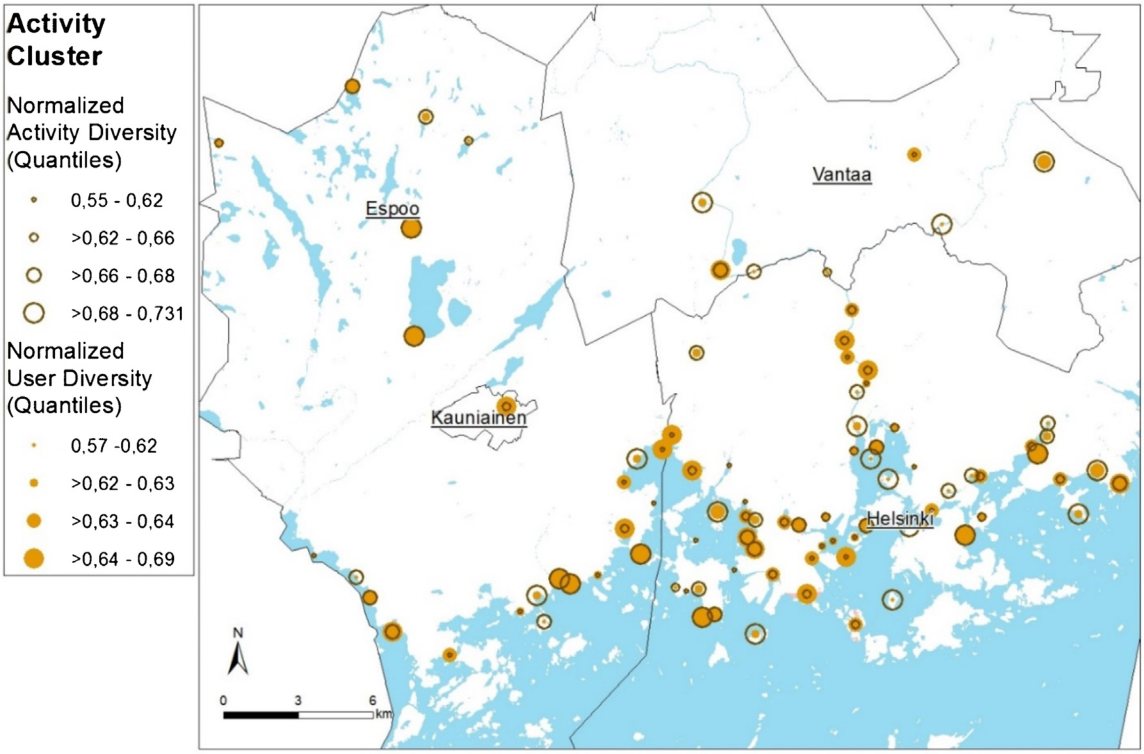

Fig. 3. Diversity of activities and users in the clusters.

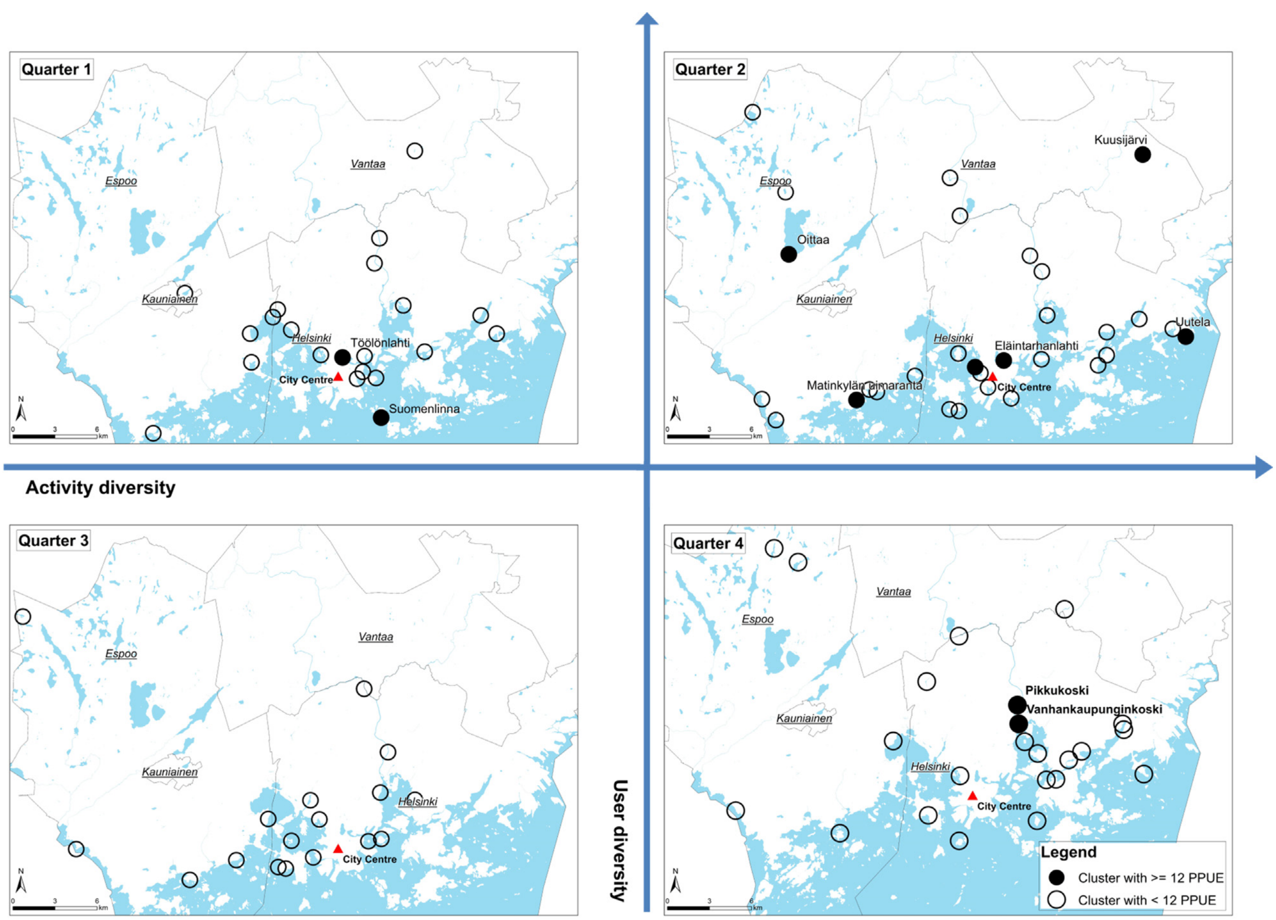

Fig. 4. Spatial distribution of clusters in the different quarters.

Table 2
Comparison of socio-demographics by quarter.

Response variables	Categories	n	Quarter 1 %	Quarter 2	Quarter 3	Quarter 4	x^2	p
Family type	Living alone	762	27.4	22.7	22.7	21.2	9.17	0.027
	Other family types	2 490	72.6	77.3	77.3	78.8		
	Total	3 252	100	100	100	100		
Age	Under 25	299	10.7	11.5	9.8	4.7	25.83	0.000
	25–65	2 638	84.6	83.1	85.6	90.7		
	Over 65	154	4.7	5.4	4.6	4.6		
	Total	3 091	100	100	100	100		
Income per month	<HMA median	1 366	48.1	42.9	47.9	41.7	8.82	0.032
	≥HMA median	1 711	51.9	57.1	52.1	58.3		
	Total	3 077	100	100	100	100		
	Less than 1600	329	13.2	10.9	10.3	7.8	68.52	0.000
	1601–3200	500	17.7	16.3	18.2	13.5		
	3201–4800	537	17.2	15.7	19.4	20.4		
	4801–8000	1 022	30.6	32	33.2	38.5		
	8001–12800	537	15.9	17.8	17.9	18		
	More than 12801	152	5.3	7.2	0.9	1.8		
	Total	3 077	100	100	100	100		

Table 3
Size and activity characteristics per quarter.

			Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total (all quarters)
	Cluster	Count	21	30	17	23	91
	Area in m^2	Total	336 013.50	768 974.70	166 325.30	304 160	1 575 473
		Average per Cluster	16 000.64	25 632.49	9 783.84	13 224.35	17 312.89
	Respondents	Total	738	1471	367	689	3265
		Average per Cluster	35.14	49.03	21.59	29.96	35.88
Activity areas	Total	Count	850	1916	397	800	3963
	Recreation	Count	482	1099	193	420	2194
		%	56.7	57.4	48.6	52.5	55.4
		Standardized Residual	0.5	1.2	−1.8	−1.1	
	Sport	Count	287	586	155	227	1 255
		%	33.8	30.6	39.0	28.4	31.7
		Standardized Residual	1.1	−0.8	2.6	−1.7	
	Nature	Count	81	231	49	153	514
		%	9.5	12.1	12.3	19.1	13.0
		Standardized Residual	−2.8	−1.1	−0.3	4.8	

Note: The overall association between quarters and activity categories is significant (X2 = 50.03, df = 6, p < 0.001), standardized residuals less than −2.0 (light grey) and greater than 2.0 (dark grey) are highlighted.

proportion of nature points was highest in Quarter 4. When comparing activity types across quarters, disproportionate associations were found between nature activities in Quarter 4 (standardized residual = 4.8) and sports activities in Quarter 3 (standardized residual = 2.6). Nature activities were significantly under-represented in Quarter 1 (standardized residual = −2.8) compared with Quarter 4 (standardized residual = 4.8). The associations between all other variable are relativelyweak.

3.3.4. *Spatial comparison of activity and user diversity with PPUE areas*

The total number of PPUE in clusters varied between 12 and 61. The most frequently cited PPUE (>10% of all points) throughout all the clusters were “certain group of people or use method bothers me” (15.8%), “the environment is littered or not cared for”, “the water quality is poor” (both 15.5%), and “the location is crowded” (13.6%).

Spatial analysis revealed high PPUE clusters: Hietaranta Beach, Kuusijärvi, Eläintarhanlahti, Pikkukoski, Suomenlinna, Vanhankaupunginkoski, Matinkylä Beach, Uutela, Oittaa and Töölönlahti (Fig. 4). These clusters were located in all three municipalities, with the majority in Helsinki (7), two in Espoo and one in Vantaa. High problem clusters contained proportionately more respondents (44–162; average 89.4). The most frequently cited activities in the problem clusters were walking (17.3%) followed by meeting with family/friends (16.3%), going to the beach (14%), having coffee (11.3%), jogging (9.4%) and picnicking (9.2%).

Quarter 1 had two high PPUE clusters in close proximity of the Helsinki city centre, located at Töölönlahti and Suomenlinna. Quarter 1 and 4 each had two high PPUE clusters in close proximity of the Helsinki city centre, located at Töölönlahti and Suomenlinna (Q1) and in the Northern part of the Vanhankaupungin bay (Q4). These findings align with known uses of the areas. Töölönlahti is a bay close to the main rail way station, where people mainly jog, but also have coffee or spend time with friends and family. Suomenlinna, the island connected to the city centre, is a famous recreational destination, mostly used for spending time with friends and family, and walking. Also the Vanhankaupungin bay is a famous recreational destination, where enjoying coffee, jogging, nature observing and swimming dominated.

In Quarter 2, six clusters contained high numbers of PPUE (this is more than half of all high problem clusters). Of those, two clusters were found in each of Vantaa, Espoo and Helsinki. In Vantaa, the problem cluster was located on the only lake, which is mostly used for swimming. In Espoo, one of the two clusters was located on the biggest lake of the municipality, which is also dominated by swimming activities. The other cluster can be found in the recently developed area of Matinkylä on the sea shore. Respondents used this spot mainly to enjoy coffee. In Helsinki, there were problem areas close to the city centre (with a dominance of jogging and coffee drinking), but also in the east in a forested area where nature observation was the dominant activity.

Analysis of the geographic distribution of high problem clusters reveals that those areas with high diversity of users and low diversity of activities, and vice versa (Quarters 1 and 4), were concentrated in the city centre of Helsinki. However, when both diversities are high (Quarter 2), problem clusters were present in all municipalities. There were no problem clusters when both user and activity diversity were low. The activity diversity inside the high problem clusters varied between 0.65 and 0.73, with an average of 0.69. This is higher than the average activity diversity of all clusters (Dact = 0.66). The user diversity in the problem clusters varied between 0.62 and 0.66, with an average of 0.64 (Duser = 0.63).

4. Discussion

4.1. Strengths and limitations of the spatial method

The aim of this study was to present a method for spatially identifying and assessing multiple elements of environmental justice (activity diversity, user diversity and PPUE) in the context of recreational uses of urban blue space. Using this method, we found distinguishing sets or Quarters based on the diversity of user profiles and performed activities (as summarized in Table 4). The method provides a means for assessing multiple dimensions of environmental justice. Landscape planners can use it to spatially identify opportunities for recreation, sport and leisure infrastructure management in a fair and just manner, which entails respecting the activity choices of different users and providing spaces affording both high and low diversity of activities. It also provides a way to spatially target management to areas of perceived problems and unpleasant experiences, reducing the potential for conflict among different user groups; and preventing unequal distribution of poor environmental qualities (e.g., water pollution).

The method also builds on the PPGIS literature which has traditionally focused on spatially assessing single elements of environmental justice such as the links between preferred activities and park type or size (Brown et al., 2014), or the modelling of the determinants of perceived accessibility (Wang, Brown, Liu, & Mateo-Babiano, 2015; Wang, Brown, & Liu, 2015). We found that the diversity metric (Brown & Reed, 2012) was a useful way to integrate different components of activity and user diversity. Environmental justice considerations for landscape planning does not only depend on the perceived accessibility of a given area and the type of activity undertaken there, but represents a complex relationship between the type of activity, the socio-demographic characteristics of the user, and the perceived problems associated with the urban blue space experience. Future PPGIS research would benefit from taking such an integrated and multi-dimensional understanding of environmental justice in other contexts such as green space, protected area management and private land conservation contexts.

Our methods have some important limitations. We focused on performed activities (actual behavior) as opposed to activity preferences. The activity diversity metric therefore provides a representation of current activity needs, but no clarity on future, desired needs across different seasons which is often needed in regional planning contexts. Future work could compare and contrast the results generated through the measurement of performed vs. preferred activities, and how such activities vary across seasons. While our method for spatially presenting environmental justice is more nuanced than previous PPGIS work, we acknowledge further research is needed to understand the complexities of environmental justice at the place-specific scale. Qualitative research, for example, could investigate the generalizations in activity and user diversity made here. We did not include minorities, such as different ethnic groups in our analysis. Their performed activities could be included in urban blue space planning instead of just groups with different age, family situation or income profiles. We also did not consider strategies for resolving conflict in problem areas, which would require follow up work regional planners in the HMA.

4.2. Justification of findings and their implications for the planning of urban blue space

We focus the remainder of this discussion on two important findings. First, younger respondents with lower income (Quarter 1) carry out different types of activities, and in different areas, compared with older respondents with higher income (Quarter 4) (Table 4). Clusters in Quarter 1 had a relative high amount of respondents under 25 years old, singles and with low income (<median income). The clusters were mainly distributed in the city centre of Helsinki and the western part of the municipality. In contrast, Quarter 4 had proportionately fewer respondents under 25 years old, the lowest share of singles and the highest share of medium-high income (≥median income) respondents. The clusters were distributed mainly outside of the Helsinki city centre, and respondents in this cluster engage in proportionately more nature activities.

Urban form and travel distance may help explain why Quarter 4 clusters were more commonly located in peri-urban and rural areas, and were associated with nature activities such as hiking. Single, young, and older respondents more frequently live in urban environment and city cores where there are fewer possibilities for nature activities, while families and middle-aged people (particularly affluent families) tend to move to single family houses closer to nature. Income differences have significantly explained differences in leisure trip frequency to peri-urban and rural areas in Finland, with higher income respondents more able to travel further distances for recreation (Laatikainen et al., 2015; Lankia, Kopperoinen, Pouta, & Neuvonen, 2015).

Leisure motivations may also help explain these differences. People can be motivated to recreate for a range of reasons such as health and fitness (e.g., weight loss); performance of the activity (e.g., adrenalin, excitement); place in nature (e.g., appreciation of beauty); and social position (e.g., enjoyment in sharing an activity with others) (Buckley, 2012; Manfredo, Driver, & Tarrant, 1996). While motivation was not tested here, respondents in Quarter 4 may be more motivated by being in nature than respondents in cluster Quarter 1, and thus more willing (or able) to travel further distances for benefit obtainment. It also may relate to uneven possibilities for recreation. There is some evidence to support this view. Leisure in urban socio-economic disadvantaged neighborhoods among young people (particularly girls) have been associated with intrinsic motivation (e.g., running to get fit) and, to a lesser extent, relaxation goals for being physically active (Santos, Ball, Crawford, & Teixeira, 2016).

The higher proportion of respondents and activity clusters in Quarter 1 (as well as Quarter 2) than Quarter 4 can also be partly attributed to travel distance and urban form. Quarter 1 clusters were more commonly found in urban areas. A recreation preference study across Finland also revealed that Finnish people most highly value recreation in the surroundings of their home, with respondents willing to pay the most for recreation close to their abode (Lankia et al., 2015).

A second important finding is that there is an uneven distribution of PPUE. In quarters of low activity diversity (Quarters 1 and 3), PPUE were related to the condition of the environment (poor quality, littered), and are associated with more vulnerable respondents under 25 years of age, and singles with low income. In quarters of high activity diversity (2 and 4) the PPUE were more likely to be associated to intra- and intergroup issues (e.g., crowded place and

Table 4
Summary of key findings from the assessment of the spatial interactions between activity diversity, user diversity and PPUE.

Quarter	Distribution	Description
Quarter 1 (high user, low activity diversity)	Mainly in Helsinki: Western part of the municipality	• 21 clusters • Low income • High share under 25 • Highest share living alone • Recreational activities • 'The water quality is poor' (20%) • 2 high intensity problem clusters
Quarter 2 (high user, high activity diversity)	Vantaa and Espoo, shoreline of Helsinki, many inland waters	• 30 clusters (majority of clusters) • Medium–high income • Highest under 25 • Low share living alone • Recreational activities • 'The location is crowded' (17%) • 6 high intensity problem clusters • Highest number of respondents and markings • Largest cluster (size)
Quarter 3 (low user, low activity diversity)	Mainly along the shorelines of Espoo and Helsinki, and Nuuksio	• 17 clusters • Low income • Working age people • Low share living alone • Sport activities • 'The environment is littered or not cared for' (29%) • 0 high intensity problem clusters
Quarter 4 (low user, high activity diversity)	Mainly in Helsinki: close to the city centre and eastern shoreline	• 23 clusters • Medium–high income • Working age people • Lowest share living alone • Nature activities • 'Certain group of people or use method bothers me' (23%) • 2 high intensity problem clusters

feeling bothered by a group of people or their activities). Hence, areas of higher environmental quality and intergroup issues are associated with respondents with higher incomes that have the ability to access areas further away from the city. The presence of diverse activities also seems to magnify intergroup conflicts which is consistent with findings from the recreation literature (Carothers, Vaske, & Donnelly, 2001). Problems also varied in magnitude, with the most problems found in Quarter 2, and the least problems found in Quarter 3. Most respondents were found in Quarter 2 suggesting that the magnitude of problems is related to the number of users within a given area.

Given the potential for perceived problems, considering aspects of procedural justice alongside elements of environmental justice is an important future research direction. One possibility is to empirically compare and contrast the results of instrumental and deliberative paradigms to valuation (Raymond, Kenter, Plieninger, Turner, & Alexander, 2014) with respect to different indicators of procedural justice such as the level of self-reported trust in the process, and the perceived legitimacy, transparency and accountability of the process. Further, studies could examine whether the diversity of activities mapped by different user groups vary across different types of mapping procedures and planning processes.

5. Conclusion

The methods and results of this study provide support for the spatial integration of multiple elements of environmental justice into urban blue place planning, including activity diversity, user diversity and perceived problems and unpleasant experiences. Contrasting combinations of activity and user diversity (high-low, low-high) show different spatial distributions, dominating activities and problems, and socioeconomic characteristics. Looking at only one of these two dimension could lead to the omission of potential planning and management areas. We encourage landscape planners to cater for the activity choices of different users and provide spaces with a high diversity of activities, but also a low diversity of activities. The framework and methods provide a means for spatially targeting recreation, sport and leisure infrastructure to these different mixes of activity and user diversity.

Acknowledgement

The authors would like to acknowledge the support of the Academy of Finland who funded the research project named ENJUSTESS (Environmental Justice and ecosystem services: Access, equity and participation in the use and management of aquatic environments in the Helsinki region) from which this paper derives. We also wish to thank all project partners as well as the residents of Helsinki Metropolitan Area who participated in the project, and the Innovatiivinen Kaupunki® program which also funded this research. The authors are very grateful for the support of the Sports Department and the Environment Center of the City of Helsinki.

References

Agyeman, J., & Evans, B. (2004). Just sustainability: the emerging discourse of environmental justice in Britain? *The Geographical Journal*, *170*(2), 155–164.
Agyeman, J., Bullar, R., & Evans, B. (2002). *Just sustainabilities: development in an unequal world*. London: Earthscane.

Agyeman, J. (2005). *Sustainable communities and the challenge of environmental justice*. New York: New York University Press.
Agyeman, J. (2013). *Introducing just sustainabilities*. London: Zed Books.
Amin, A. (2008). Collective culture and urban public space. *City*, *12*(1), 5–24.
Aminzadeh, B., & Ghorashi, S. (2007). Scenic landscape quality and recreational activities in natural forest parks, Iran. *International Journal of Environmental Research*, *1*(1), 5–13.
Arnberger, A., & Eder, R. (2007). Monitoring recreational activities in urban forests using long-term video observation. *Forestry*, *80*(1), 1–15.
Brown, G., & Fagerholm, N. (2014). Empirical PPGIS/PGIS mapping of ecosystem services: a review and evaluation. *Ecosystem Services*, *13*, 119–133.
Brown, G., & Kyttä, M. (2014). Key issues and research priorities for public participation GIS (PPGIS): a synthesis based on empirical research. *Applied Geography*, *46*, 122–136.
Brown, G. G., & Reed, P. (2012). Social landscape metrics: measures for understanding place values from public participation geographic information systems (PPGIS). *Landscape Research*, *37*(1), 73–90.
Brown, G., Montag, J. M., & Lyon, K. (2012). Public participation GIS: a method for identifying ecosystem services. *Society & Natural Resources*, *25*(7), 633–651.
Brown, G., Kelly, M., & Whitall, D. (2013). Which public? Sampling effects in public participation GIS (PPGIS) and volunteered geographic information (VGI) systems for public lands management. *Journal of Environmental Planning and Management*, *57*(2), 190–214.
Brown, G., Schebella, M. F., & Weber, D. (2014). Using participatory GIS to measure physical activity and urban park benefits. *Landscape and Urban Planning*, *121*, 34–44.
Buckley, R. (2012). Rush as a key motivation in skilled adventure tourism: resolving the risk recreation paradox. *Tourism Management*, *33*(4), 961–970.
Carothers, P., Vaske, J. J., & Donnelly, M. P. (2001). Social values versus interpersonal conflict among hikers and mountain bikers. *Leisure Sciences*, *23*(1), 47–61.
Chiesura, A. (2004). The role of urban parks for the sustainable city. *Landscape and Urban Planning*, *68*(1), 129–138.
Christie, M., Hanley, N., & Hynes, S. (2007). Valuing enhancements to forest recreation using choice experiment and contingent behaviour methods. *Journal of Forest Economics*, *13*(2–3), 75–102.
City of Espoo. (2015a). *Information about Espoo*. , accessed 8.10.15. http://www.espoo.fi/en-US/City_of_Espoo/Information_about_Espoo
City of Espoo. (2015b). *Population structure in Espoo 2014/2015*. , accessed 8.10.15. http://www.espoo.fi/download/noname/%7BBB6B16E5-EB94-4399-A80B-9856590AABE7%7D/60182
City of Helsinki. (2014). *City Planning Department's Report on Sea Areas of Helsinki for Proposal for Helsinki City Plan*. , accessed 8.10.15. http://www.hel.fi/hel2/ksv/julkaisut/yos_2014-15.pdf
City of Helsinki. (2015). *Facts about Helsinki 2015*. , accessed 8.10.15. http://www.hel.fi/hel2/tietokeskus/julkaisut/pdf/15_05_28_Facts_about_Helsinki_2015_Askelo.pdf
Clark, P., & Hietala, M. (2006). Helsinki and green space, 1850–2000: an introduction. In P. Clark (Ed.), *The european city and green space. London, Stockholm, Helsinki and St. Petersburg 1850–2000*. Aldershot: Ashgate.
Colding, J., & Barthel, S. (2013). The potential of Urban Green Commons in the resilience building of cities. *Ecological Economics*, *86*, 156–166.
Elvers, H.-D., Gross, M., & Heinrichs, H. (2008). The diversity of environmental justice. *European Societies*, *10*(5), 835–856.
European Commission. (2013). *Green Infrastructure (GI)—Enhancing Europe's Natural Capital*. Retrieved: October 10, 2015, from http://eur-lex.europa.eu/resource
Faehnle, M., Bäcklund, P., Tyrväinen, L., Niemelä, J., & Yli-Pelkonen, V. (2014). How can residents' experiences inform planning of urban green infrastructure? Case Finland. *Landscape and Urban Planning*, *130*, 171–183.
Fincher, R., & Iveson, K. (2008). *Planning and diversity in the city. Redistribution, recognition and encounter*. New York: Palgrave Macmillan.
García-Nieto, A. P., Quintas-Soriano, C., García-Llorente, M., Palomo, I., Montes, C., & Martín-López, B. (2015). Collaborative mapping of ecosystem services: the role of stakeholders' profiles. *Ecosystem Services*, *13*, 141–152.
Gobster, P. H., Nassauer, J. I., Daniel, T. C., & Fry, G. (2007). The shared landscape: what does aesthetics have to do with ecology? *Landscape Ecology*, *22*(7), 959–972.
Jim, C. Y., & Chen, W. Y. (2006). Recreation-amenity use and contingent valuation of urban green spaces in Guangzhou, China. *Landscape and Urban Planning*, *75*(1–2), 81–96. http://doi.org/10.1016/j.landurbplan.2004.08.008
Kahila, M., & Kytta, M. (2009). *SoftGIS as a bridge builder in collaborative urban planning. In planning support systems best practice and new methods*. pp. 389–411. UK: Springer.
Kemperman, A., & Timmermans, H. J. P. (2006). Heterogeneity in urban park use of aging visitors: a latent class analysis. *Leisure Sciences*, *28*(1), 57–71.
Korpela, K. M., Ylén, M., Tyrväinen, L., & Silvennoinen, H. (2010). Favorite green, waterside and urban environments, restorative experiences and perceived health in Finland. *Health Promotion International*, *25*(2), 200–209.
Kyttä, M., Kuoppa, J., Hirvonen, J., Ahmadi, E., & Tzoulas, T. (2014). Perceived safety of the retrofit neighborhood: a location-based approach. *Urban Design International*, *19*(4), 311–328.
Laatikainen, T., Tenkanen, H., Kyttä, M., & Toivonen, T. (2015). Comparing conventional and PPGIS approaches in measuring equality of access to urban aquatic environments. *Landscape and Urban Planning*, *144*, 22–33.
Lankia, T., Kopperoinen, L., Pouta, E., & Neuvonen, M. (2015). Valuing recreational ecosystem service flow in Finland. *Journal of Outdoor Recreation and Tourism*, *10*, 14–28.
Lee, B., Graefe, A., & Burns, R. (2008). Family recreation: a study of visitors who travel with children. *World Leisure Journal*, *50*(4), 259–267.
Leikkilä, J., Faehnle, M., & Galanakis, M. (2013). Promoting interculturalism by planning of urban nature. *Urban Forestry & Urban Greening*, *12*(2), 183–190.
Low, S., Taplin, D., & Scheld, S. (2005). *Rethinking urban parks public space and cultural diversity*. Texas: University of Texas Press.
Low, S. (2013). Public space and diversity: distributive, procedural and interactional justice for parks. In G. Young, & D. Stevenson (Eds.), *The ashgate research companion to planning and culture*. Surrey, UK: Ashgate.
Manfredo, M. J., Driver, B. L., & Tarrant, M. A. (1996). Measuring leisure motivation: a meta-analysis of the recreation experience preference scales. *Journal of Leisure Research*, *28*(3), 188–213.
Payne, L. L., Mowen, A. J., & Orsega-Smith, E. (2002). An examination of park preferences and behaviors among urban residents: the role of residential location, race, and age. *Leisure Sciences*, *24*(2), 181–198.
Raymond, C. M., & Brown, G. (2007). A spatial method for assessing resident and visitor attitudes toward tourism growth and development. *Journal of Sustainable Tourism*, *15*(5), 520–540.
Raymond, C. M., Bryan, B. A., MacDonald, D. H., Cast, A., Strathearn, S., Grandgirard, A., et al. (2009). Mapping community values for natural capital and ecosystem services. *Ecological Economics*, *68*(5), 1301–1315.
Raymond, C. M., Brown, G., & Weber, D. (2010). The measurement of place attachment: personal, community, and environmental connections. *Journal of Environmental Psychology*, *30*(4), 422–434.
Raymond, C. M., Kenter, J. O., Plieninger, T., Turner, N. J., & Alexander, K. A. (2014). Comparing instrumental and deliberative paradigms underpinning the assessment of social values for cultural ecosystem services. *Ecological Economics*, *107*, 145–156.
Santos, I., Ball, K., Crawford, D., & Teixeira, P. J. (2016). Motivation and barriers for leisure-time physical activity in socioeconomically disadvantaged women. *Public library of science*, *11*(1), e0147735.
Schönach, P. (2014). Historical paths of environmental injustice: a century of placing industrial facilities in Helsinki, Finland. *Local Environment*, *21*(4), 397–413.
Schlosberg, D. (2013). Theorising environmental justice: the expanding sphere of a discourse. *Environmental Politics*, *22*(1), 37–55.
Schultz, P. W., Bator, R. J., Large, L. B., Bruni, C. M., & Tabanico, J. J. (2011). Littering in context: personal and environmental predictors of littering behavior. *Environment and Behavior*, *45*(1), 35–59.
Sherrouse, B. C., Clement, J. M., & Semmens, D. J. (2011). A GIS application for assessing, mapping, and quantifying the social values of ecosystem services. *Applied Geography*, *31*(2), 748–760.
Taylor, D. (2009). *The environment and the people in American cities, 1600–1990s: disorder, inequality, and social change*. Chapel Hill, NC: Duke University Press.
Tynon, J. F., & Gomez, E. (2012). Interpersonal and social values conflict among coastal recreation activity groups in Hawaii. *Journal of Leisure Research*, *44*(4), 531–543.
Tyrväinen, L., Mäkinen, K., & Schipperijn, J. (2007). Tools for mapping social values of urban woodlands and other green areas. *Landscape and Urban Planning*, *79*(1), 5–19.
Vaske, J. J., Needham, M. D., & Cline, R. C. (2007). Clarifying interpersonal and social values conflict among recreationists. *Journal of Leisure Research*, *39*(1), 182–195.
van Riper, C. J., Kyle, G. T., Sutton, S. G., Barnes, M., & Sherrouse, B. C. (2012). Mapping outdoor recreationists' perceived social values for ecosystem services at Hinchinbrook Island National Park Australia. *Applied Geography*, *35*(1–2), 164–173.
Walker, G. (2012). *Environmental justice: concepts, evidence and practice*. New York: Routledge.
Wang, D., Brown, G., & Liu, Y. (2015). The physical and non-physical factors that influence perceived access to urban parks. *Landscape and Urban Planning*, *133*, 53–66.
Wang, D., Brown, G., Liu, Y., & Mateo-Babiano, I. (2015). A comparison of perceived and geographic access to predict urban park use. *Cities*, *42*, 85–96.
Wessels, A. T. (2011). The ultimate team sport: urban waterways and youth rowing in Seattle. In S. Kemp, & S. P. Kemp (Eds.), *He paradox of urban space. inequality and transformation in marginalized communities*. Palgrave Macmillan.
Wolch, J. R., Byrne, J., & Newell, J. P. (2014). Urban green space, public health: and environmental justice: the challenge of making cities just green enough. *Landscape and Urban Planning*, *125*, 234–244.