

Recreational ecosystem services in European cities: Sociocultural and geographical contexts matter for park use

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ABSTRACT

The role of urban parks in delivering cultural ecosystem services related to outdoor recreation is widely acknowledged. Yet, the question remains as to whether the recreational opportunities of parks meet the demands of increasingly multicultural societies and whether recreational patterns vary at spatial scales. In a pan-European survey, we assessed how people use urban parks (in five cities, $N = 3814$) and how recreational patterns relate to respondents' sociocultural and geographical contexts (using 19 explanatory variables). Our results show that across Europe (i) respondents share a general pattern in their recreational activities with a prevalence for the physical uses of parks, especially taking a walk; (ii) the geographic context matters, demonstrating a high variety of uses across the cities; and that (iii) the socio-cultural context is also important; e.g., the occupation and biodiversity valuations of respondents are significantly associated with the uses performed. The sociocultural context matters particularly for physical park uses and is associated to a lesser extent with nature-related uses. Given that our results attest to a high variety of park uses between sociocultural groups and the geographical context, we conclude that it is important to consider the specific backgrounds of people to enhance recreational ecosystem services in greenspace development.

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1. Introduction

With the increase in urban populations around the globe (UN, 2014a), urban greenspaces have gained importance as places where people come in contact with nature (Soga & Gaston,

2016). Contact with nature is known to benefit human health and wellbeing (Fuller et al., 2007; Hartig & Kahn, 2016; Scopelliti et al., 2016). Consequently, assessing and enhancing related ecosystem services ranks high on the urban agenda (Sandifer et al., 2015). As key components of urban green infrastructure, urban parks provide a number of regulating ecosystem services (Haase et al., 2014a). In particular, urban parks help mitigate environmental pressures (e.g., air and noise pollution, heat stress; Haase et al., 2014a; Mariani et al., 2016). At the same time, they play a pivotal role in delivering a range of cultural ecosystem

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services (Bertram & Rehdanz, 2015) – “the non-material benefits people obtain from ecosystems” (MA, 2005, p. 40). Within the range of cultural ecosystem services relevant to urban parks, recreational ecosystem services are particularly important (Bolund & Hunhammar, 1999) for securing mental and physical wellbeing.

In cities, recreational ecosystem services are largely backed by a wealth of opportunities for leisure activities that urban green-spaces usually offer to urban residents. This is especially true for urban parks that are vegetation-dominated spaces for public use (Nielsen et al., 2014), enabling thus a wide variety of recreational ecosystem services. Such ecosystem services in cities have been assessed from different perspectives, e.g., by observing activities in parks (Florgård & Forsberg, 2006; Rall et al., 2017), identifying preferences for park structures (Lafortezza et al., 2009; Voigt et al., 2014; Shanahan et al., 2015), disclosing the meaningfulness of places (Rall et al., 2017), assessing specific uses (Tzoulas & James, 2010) or by linkages to biological richness (Dallimer et al., 2012; Carrus et al., 2015; Voigt & Wurster 2015). In this study, we assessed recreational ecosystem services by connecting the major uses performed in urban parks to the sociocultural and geographical contexts of the users.

Why does the sociocultural background of park users matter? The mere existence of parks, their spatial patterns (e.g., size, design), in particular, and recreational opportunities (trees for shade, lawns for ball games, biodiversity for nature experiences, etc.) shape urban parks' recreational ecosystem services. Yet, people's needs (comprising those of park users) are also of vital importance to the development and management of urban parks: people with different sociocultural backgrounds can largely differ in how they use greenspaces, perceive, or value nature, as well as interact with nature, and may thereby influence greenspace composition. This is highlighted by the concept of biocultural diversity, which can also be related to the links between biological and cultural diversity in urban settings (Elands et al., 2015). The concept of (urban) biocultural diversity addresses how (contemporary) societies live and engage with urban green by acknowledging the various cultural backgrounds of urban residents—a reflexive concept to support the planning of greenspaces that meet the demands of their visitors (Buizer et al., 2016; Vierikko et al., 2016). By considering the needs of people in terms of their sociocultural background, more insight is needed to elucidate the urban human–nature intersection in greater detail, as the current literature is limited in several ways, e.g., geographically, or when addressing sociocultural dimensions (Botzat et al., 2016). As one example, transdisciplinary research was described to only rarely combine insights on greenspace uses and immigration in detail and, therefore, needs to incorporate more in-depth explanatory factors, particularly on a statistical basis (Kloek et al., 2013).

The diversity of people matters for park use, as has been demonstrated by explaining visitor motivations (Lin et al., 2014) and frequency (Rall et al., 2017), fear-provoking factors (Sreetheran & Konijnendijk van den Bosch, 2014) or collective park use (Sreetheran, 2017) as well as sociocultural background. Studies on nature or landscape preferences have included such information, for example, by targeting ethnic or religious groups (Gobster, 2002; Elmendorf et al., 2005; Qureshi et al., 2013). Research conducted on park use shows that Dutch people cycle and walk more often than do migrants and tend to visit parks alone or in smaller groups (Peters et al., 2010), whereas non-Western migrants (e.g., with Turkish background) spend more time relaxing in larger family groups. However, previous studies have largely assessed the sociocultural background of greenspace users descriptively to characterize the overall sample or by applying qualitative approaches (e.g., in-depth interviews). Moreover, most studies have linked activities to greenspace characteristics without considering the sociocultural background of park users in great detail,

particularly the cultural aspects. Thus, the relationships between activity patterns in parks and a range of sociocultural variables beyond the basic demographic parameters of park users (e.g., age, gender) have rarely been explored through complex statistical analyses or modeling (see, however, Shan, 2014). Understanding the link between park user activity and sociocultural background is nevertheless essential for the successful development, design and management of urban green systems (Elands et al., 2015; Vierikko et al., 2016; Hegetschweiler et al., 2017).

Recreational activities may not only vary among sociocultural groups but also between geographical regions (Bertram & Rehdanz 2015; Hansen et al., 2015). Differences or similarities in park use between geographic regions may thus not only display a variance in the environmental setting but also trace back to cultural properties. In this regard, even the spatial scale at which recreational activities are measured matters, as patterns likely vary, for example, between different parks within the same city (e.g., Qureshi et al., 2013). Until now, only a few studies have assessed park activities at large geographical scales within an urban region (e.g., Rall et al., 2017) or across different cities (e.g., Voigt et al., 2014; Bertram & Rehdanz 2015; Schetke et al., 2016). Important knowledge gaps thus exist in understanding urban recreational ecosystem services in relation to (i) connections between a range of sociocultural variables and people's activities in parks and (ii) the variability of these patterns at different spatial scales.

In this study, we therefore aimed to shed light on how people of different sociocultural backgrounds use urban parks at the European scale. The data were derived from five European cities that cover a geographical range from North to South. We anticipated that differences between cities would reflect geographical and cultural variety at a large geographical scale—a link that has been underrepresented in former research. In parallel, we hypothesized that varieties of urban park use trace back to the sociocultural background of respondents at the European and city level. In this study, we set out to answer the following main research questions: (a) Does the use of urban parks differ among European cities and (b) between the sociocultural backgrounds of the respondents studied? and (c) How do geographic (i.e., attributing respondents' answers in relation to the cities) and cultural variables (e.g., personal migration background) add to traditional sociodemographic variables in explaining urban park activities?

2. Material and methods

2.1. Questionnaire study

We conducted a field survey in five European cities (Bari, Italy; Berlin, Germany; Edinburgh, United Kingdom; Ljubljana, Slovenia; Malmö, Sweden; see Fig. 1 for geographic locations) on how people with different sociocultural backgrounds perceive, value, and use urban greenspaces (Fischer et al., 2015). The five cities were part of the European Union-funded GREEN SURGE project that explored the social, environmental and economic virtues of urban green infrastructure. The cities were strategically selected to represent different urban situations in Europe.

For the field survey, we employed questionnaires and photographic stimuli material that addressed nature and biodiversity, the main activities performed in urban greenspaces, and the sociocultural background of respondents. The survey was developed using in-depth qualitative ($N = 7$) and quantitative ($N = 979$) pre-tests in German in the year preceding the study (Fischer et al., 2015). The material was translated into 10 different languages and adapted to the local (geographic, cultural) context for specific sections, resulting in 18 linguistically and culturally comparable

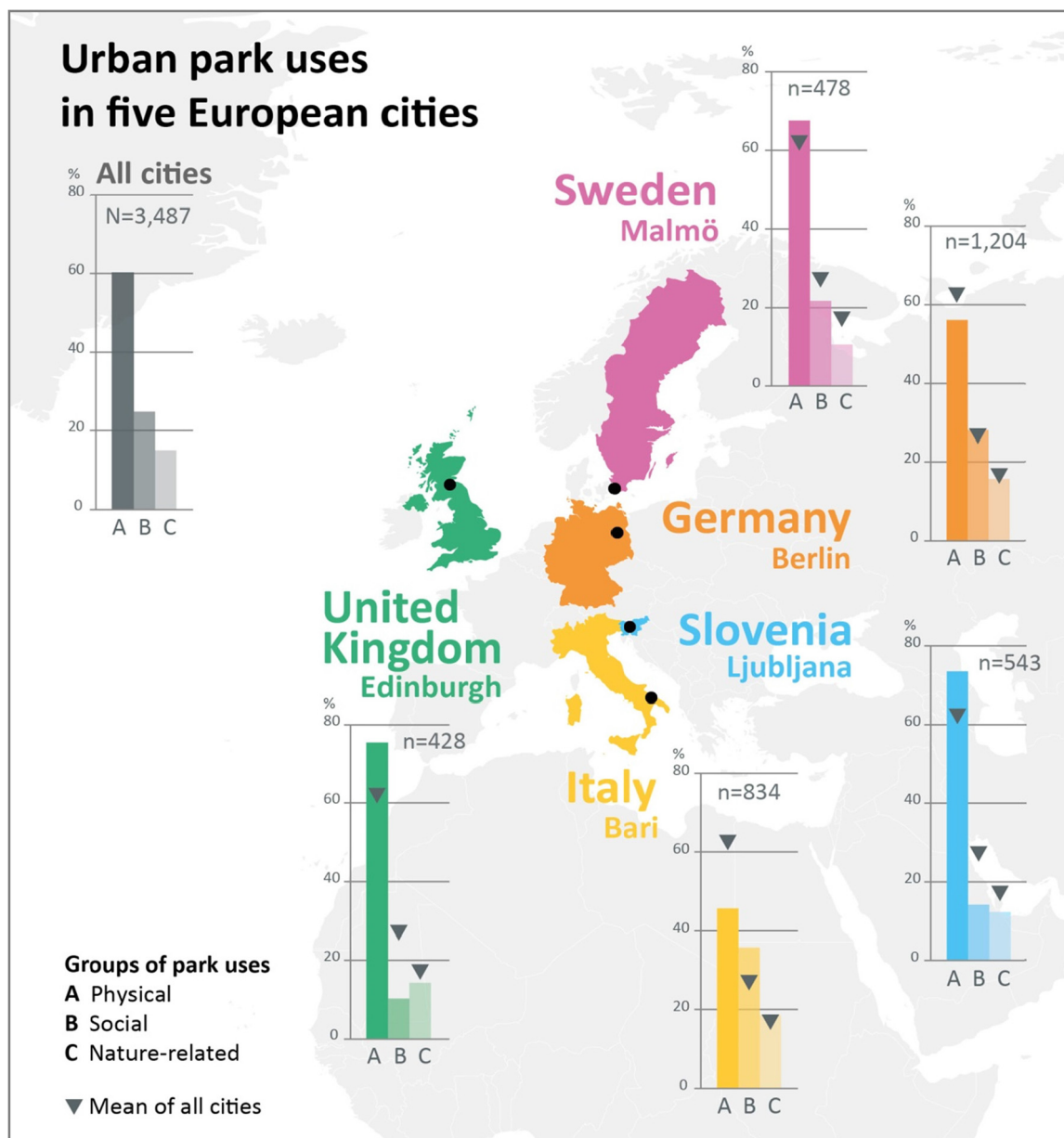


Fig. 1. Prevailing urban park uses across five European cities. Each bar chart displays the proportions of main uses that the respondents reported in the questionnaire survey when visiting an urban park: A, physical uses; B, social uses; and C, nature-related uses. The bar charts refer to each of the five European cities separately and to the entire sample with $N_{\text{tot}} = 3487$. n , sample size within each city.

versions, in accordance with the [International Test Commission \(2005\)](#), to reach a maximum number of potential respondents. With the help of multipliers supporting recruitment (e.g., districts, neighbourhoods, city-wide non-profit organisations and associations), we gained access to highly diverse sociocultural groups. Therefore, we were also able to include groups of people that are often understudied (e.g., the elderly, people with lower educational levels and who do not understand the local language). Our aim in recruitment was to include these groups as distinct subsamples in our statistical analyses; that is, to have a substantial amount of respondents in each category and subcategory.

The data were collected from May to August 2015. The questionnaire was completed either online or during face-to-face interviews conducted by trained staff following standard protocols. The face-to-face interviews were conducted *ex situ* to exclude the potential influence of park characteristics (spatial arrangement, facilities, weather, etc.) on respondents' answers. The rejection rate

in the written interviews was 36%. The database derived from the field survey integrated a total of 3814 valid questionnaires; of these, 3487 entries could be used for subsequent analyses on urban park activities. Slightly more females than males (58%) took part in the questionnaire survey, and about 42% of the respondents received higher-level education. On average, respondents were 39 ± 16 years old. About 14% of the respondents indicated they have a migration history in their family. For more details on sampling procedures and sample characteristics, see [Fischer et al. \(2015\)](#).

2.2. Data on recreational park uses

For the results presented herein, we made use of data on the recreational activities most often performed in urban parks. Respondents were asked what recreational activities they perform most frequently when visiting an urban park ([Tab. S1](#)). Specifically, they were given 12 different options to choose from and asked to

select the main activities performed. Our purpose was to classify distinct user-groups and combine this information with that derived from the sociocultural background of the park users. In other words, we set our focus on the *intersection* of use and user background and did not attempt to identify each respondent's potential variety of park uses.

The variable that described park use was divided into three categories, based on the Common International Classification of Ecosystem Services (CICES, version V. 4.3; cf [Haines-Young & Potschin, 2013](#)). As a categorization framework, the CICES was developed to allow for an enhanced assessment of ecosystem services, including the cultural (recreational) ecosystem services that are the focus of this study. This relatively new classification system was recently evaluated. Until now, it had mainly been applied for mapping and assessing ecosystems (77% of early adopters; see [Haines-Young, 2016](#)). In the CICES guidelines, the authors state that with regard to the classification system, “cultural services are primarily regarded as the physical settings, locations or situations that give rise to changes in the physical or mental states of people, and whose character are fundamentally dependent on living processes; they can involve individual species, habitats and whole ecosystems” ([Haines-Young and Potschin, 2013, p. 6](#)). Because CICES is an important classification system worldwide, we endeavored to interpret our data according to its terminology.

To build the categories of our variable on park use, we employed two categories of the CICES that we combined with a third, which includes social activities that could not be directly attributed to categories within the CICES framework ([Tab. S1](#)). This procedure resulted in the following three categories: (i) physical uses including the activities *take a walk, practice sports, pass through the park, walk a dog, and play with children*; (ii) social uses including the activities *relax/be lazy and meet friends/relatives*; and (iii) nature-related uses including the activities *watch specific animals/plants, experience nature, and collect nature products*. We are aware of the fact that these three categories partly overlap, since all activities in green environments are to some extent related to “nature”, involve physical activities that usually (at least indirectly) support recreation and, for the most part, include social components when not performed alone. *Playing with children*, for example, is clearly both physical and social. *Collecting nature products* is obviously related to nature, but searching for edible plants, for example, also requires physical movement and often has a social component when performed in groups (e.g., [Palliwooda et al., 2017](#)). Yet, we think that applying these categories is profitable for understanding the variability in patterns of park use at a large geographic scale. Moreover, insight into the varying relevance of the three categories helps linking what urban parks have to offer with what people need. Park use related to the first category (*physical*) requires space or specific opportunities for pronounced activity, while the second use category (*social*) would benefit from spaces that support leisure and socializing; the third category (*nature-related*), finally, is linked to the biological richness of parks and related management practices.

2.3. Data on sociocultural backgrounds

To understand whether the park uses of respondents are connected to their sociocultural background, we embedded basic sociodemographic information (i.e., respondents' age, gender, occupation and education) in our analyses. We further included parameters that cover respondents' health status and cultural background, thus exceeding former studies. An overview of all variables used, the variable categories and underlying questions is provided in [Tab. S2](#).

To describe the demographic background of respondents, we asked for their *gender, marital status*, and whether or not they have

children. The respondents then stated their *age* and (perceived) *health status* and shared information about their potential *chronic illness*. To describe respondents' education and work status, we included the variables *occupation, current work*, whether the person was an *expert* in “green” issues, and *education*. For the variables *occupation* and *expert*, we derived the name or title of the main occupation the respondent was engaged in at the time of the interview. We categorized the answers according to the International Standard Classification of Occupations (cf [ILO, 2010](#)). The same answers were used to describe the respondent's “green” expertise, e.g., as a biologist, environmental or landscape planner, or professional gardener. We were aware that using a person's current occupation as proxy for green expertise might exclude expertise in the population sampled. This may, for example, refer to immigrants that have an occupation in the adopted country that is different from the one they had in their home country. Also, many people engage in nature-related activities apart from their jobs, such as a hobby or volunteer work. We therefore included other variables to describe respondents' bonds with nature and interaction with green.

Because the nature-relatedness of people was important for park visitation motives in previous studies ([Lin et al., 2014](#)), we included five variables that describe how a person relates to and interacts with nature. This comprised variables inquiring on the *nature orientation* of respondents, their *frequency of greenspace use*, the *role of nature* during greenspace visits, and their practical interaction with nature when *gardening*. We further operationalized the topic by using the variable *biodiversity valuation*; we obtained information relevant to this variable from a companion study that disclosed the valuation of different levels of plant species richness in park grassland by each respondent ([Fischer et al., 2018](#)). The variable assessed how a person liked three standardized photographic stimuli displaying low, medium and high plant diversity on a seven-point Likert scale. This variable adds a novel scale of nature-relatedness to our analyses, as the perception and preference of biodiversity at the species level have rarely been assessed in urban studies on the human–nature intersection ([Botzat et al., 2016](#)). The inclusion of a biodiversity-related variable deepens the understanding of how people interact with urban nature; to our knowledge such information has not been incorporated in former studies on the uses of urban green.

Furthermore, migration background was assumed to impact preferences for urban greenspace activity ([Peters et al., 2010](#)). We therefore included the variable *personal migrant background*, which refers to the respondents' country of birth, and used it to reference the geographical background of each respondent. The variable is categorized according to the United Nations macro-geographical (continental) regions into major regions ([UN, 2014b](#)). On the other hand, the variable *migration history in family* describes whether at least one of the respondents' parents or grandparents was born in a country other than the country in which the respondents were interviewed. Hence, it includes a temporal scale of respondents' migrant background. As both variables perhaps do not fully indicate the degree of integration into local society, we also included the variable that refers to the *languages spoken at home* as an indicator of integration of those with a migration history. We also recorded the European city in which each of the respondents participated in the survey as an additional geographical variable.

2.4. Data analyses

2.4.1. Differences in park use between the five European cities

Chi-square tests were carried out to detect associations among the uses of urban parks by the respondents across the five European cities. We determined Cramer's V as a measure of association,

using R package *vcd* (Meyer et al., 2015; Friendly 2016). We thereby tested the associations between the frequencies of the three park use categories in each of the cities with those of the frequencies of the remaining four cities, respectively. A Bonferroni correction was conducted to account for multiple testing of the sample.

2.4.2. Differences in park use between sociocultural groups

We applied statistical testing, using Chi-square and Fisher's tests, to the entire sample of respondents across the five European cities to determine whether the uses of urban parks were associated with the sociocultural background of the respondents. All 18 sociocultural variables that were tested for associations are depicted in Tab. S2. Fisher's tests were applied when the expected frequency of a sample category fell below five. We then adjusted the *p*-value to multiple testing. Each of the use categories (*physical*, *social*, *nature-related*) was tested separately and accounted for the European city of each respondent by including a 19th variable describing the city in which the respondent was interviewed (Bari, Berlin, Edinburgh, Ljubljana or Malmö) in each of the tests. The results were complemented visually by mosaic plots depicting each of the five European cities and the categories of each of the variables characterizing the sociocultural background of the respondents (Figs. 2–4). The residual-based shading and HCL (Hue-Chroma-Luminance) space features were applied to the mosaic plots, as proposed by Zeileis et al. (2007). Hence, the colours display the expected observations under the null model (independence), with bright red or blue indicating a marked significance ($p < 0.01$), grey a non-significance ($p > 0.1$), and light red or light blue a weak significance ($0.01 \leq p \leq 0.1$). We used R package *vcd* to generate the mosaic plots (Meyer et al., 2015; Friendly 2016). All analyses were conducted using open-source R statistical software (R Core Team, 2016); the figures were created in base R.

3. Results

3.1. Main uses of urban parks in Europe

A total of 3487 survey participants (i.e., 94% of respondents) across the five European cities answered the question concerning their most frequently performed activities when visiting an urban park. Physical park uses were the most prevalent, both at the European level (60%) and in each of the five cities (Fig. 1, Table 1).

With 46% of the respondents, Bari showed the lowest percentage of physical uses at city level, and Edinburgh, with 75%, the highest (Table 1). Social uses were indicated by one fourth of all respondents across Europe, ranging from 10% in Edinburgh to 36% in Bari. In all cities except for Edinburgh, respondents visited parks least often for nature-related uses (15% across Europe). Bari was the city with the most respondents that visited parks for nature-related uses (18%), and Malmö the city with the fewest respondents in that category (11%).

Of the physical activities reported, *take a walk* was the most frequent response at the European level and in all cities (28% of the overall sample, corresponding to 47% of the physical uses; Table 1). Throughout Europe, respondents who visited parks for social uses did so mostly to *relax* (15% of the overall sample, corresponding to 62% of the social uses; Table 1); only in Berlin and Malmö did nearly as many respondents report using parks to *meet friends or relatives*. Of the nature-related uses reported, *experience nature* was the most prominent category in all cities (12% of the overall sample, corresponding to 78% of the nature-related uses; Table 1).

The statistical analysis shows that the activities performed in the five urban parks (referring to the added frequencies of physical, social, and nature-related uses, respectively) differed significantly

between each city and the remaining four cities (Table 2). We thus found significant variation in the overarching pattern of decreasing importance of physical vs. social vs. nature-related park uses among the cities.

3.2. The sociocultural and geographical contexts

At the European level, the sociocultural background of respondents influenced their use of parks (Table 3). All three park use categories related significantly to the variables *marital status*, *having children*, *age*, *chronic illness*, *occupation*, *current work*, *education*, *biodiversity valuation*, *frequency of greenspace use*, *gardening*, *personal migrant background*, *migration history in family* and *language*. Additionally, the physical park use category was significantly associated to the variables *gender*, *health*, and *nature orientation*. Moreover, the physical and social park use categories were significantly associated with the variables *expert* and *role of nature*.

The mosaic plots shown in Figs. 2–4 detail the above findings. The plots report the categories for each of the sociocultural variables that were associated with the frequencies in park use at city level. The blue-shaded boxes show if there were more people than expected in a given category, while the red-shaded boxes display if there were fewer respondents than expected in a given category (i.e., statistically they indicate departures of the expected frequencies from the observed). Bright red or bright blue boxes show the strongest and most significant associations between the categories, respectively, whereas light red or light blue boxes indicate weak significance. The grey boxes indicate no significant associations between the given categories (cf Zeileis et al., 2007).

Additionally, the mosaic plots illustrate the associations of the five European cities—with each column of boxes representing a city—in relation to the extent to which the geographic context matters. The width and height of the boxes indicate the share of respondents that fell within a specific combination of two categories; i.e., a wider or taller box accounts for more answers in this category than does a shorter and narrower box. In parallel, each row of boxes indicates one of the categories of a sociocultural variable. In the range of physical uses (Fig. 2), there was a broad array of significant variables; this array narrowed down for the social uses (Fig. 3), where associations were determined particularly in the context of respondents' *education* and *occupation*. In the nature-related uses (Fig. 4), respondents showed the fewest number of associations.

For example, our results for Bari show that slightly more male respondents than expected visited urban parks for physical uses (light blue-shaded box for Bari, Fig. 2A). On the contrary, slightly fewer males than expected visited parks to perform physical activities in Ljubljana (light red-shaded boxes for Ljubljana, Fig. 2A). There were more people than expected aged 60 and older that visited parks for physical uses in three of the five cities (blue-shaded boxes for Berlin, Edinburgh and Malmö, Fig. 2D, bottom row). In contrast, there were significantly fewer respondents than expected in that age-group who engaged in physical park uses in Bari and Ljubljana (red-shaded boxes, Fig. 2D, bottom row). Interestingly, the personal orientation towards nature and the role that nature plays when visiting an urban greenspace had very little influence on respondents who use parks preferentially for physical activities (Fig. 2K,N). Nevertheless, how respondents valued biodiversity had an influence (Fig. 2L); respondents with a neutral or negative valuation of biodiversity reported fewer physical park uses than expected in all European cities, except Bari. The situation was the opposite particularly in Berlin and Edinburgh, where respondents' positive valuation of biodiversity was related to a higher frequency of physical park use.

In the category of social park uses, several sociocultural background variables were significantly associated with park use and

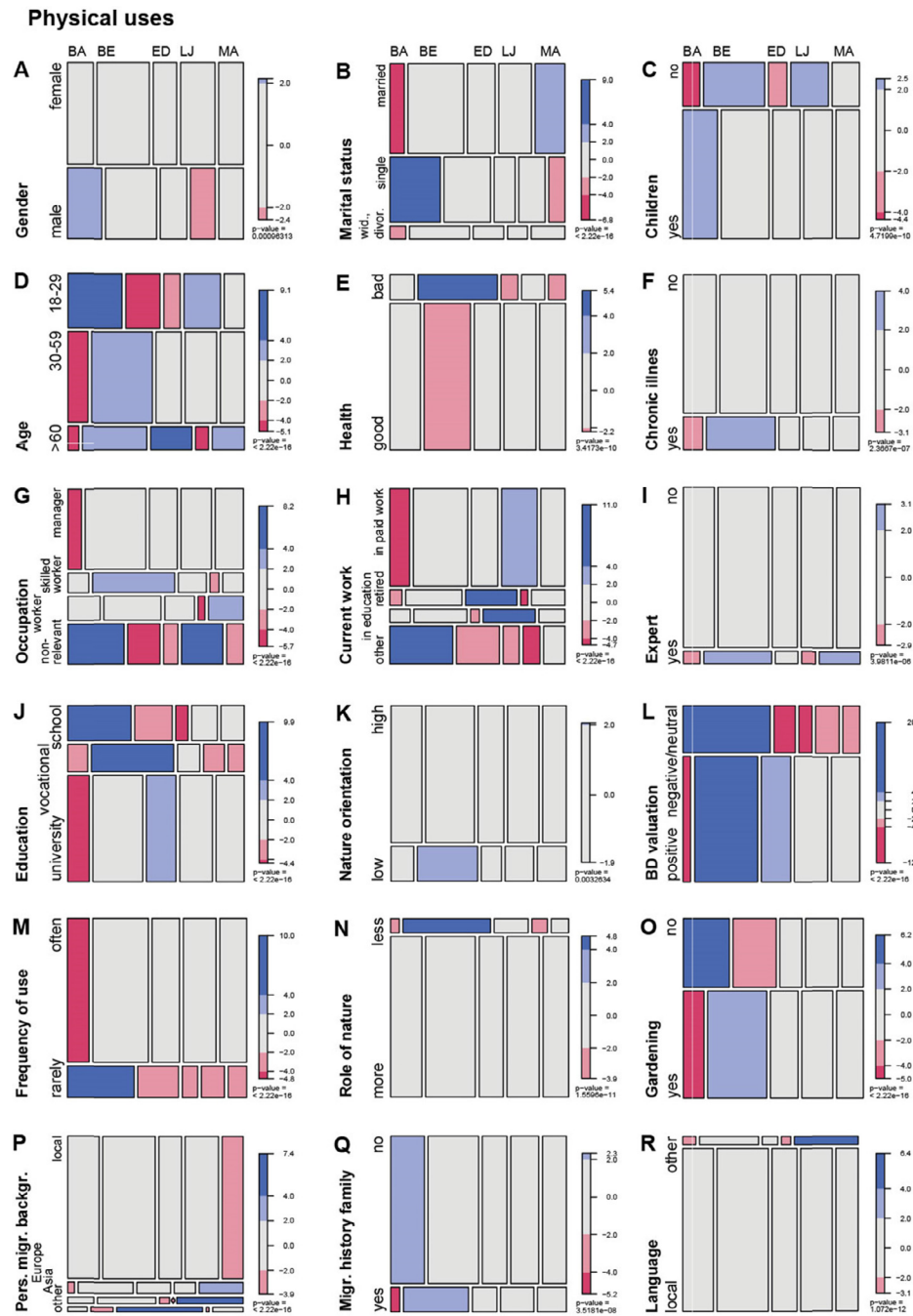


Fig. 2. Mosaic plots displaying the frequencies of physical park uses associated with the sociocultural backgrounds of respondents and European cities studied. Each column of boxes represents a city; i.e., the first column stands for Bari (BA), the second for Berlin (BE), the third for Edinburgh (ED), the fourth for Ljubljana (LJ) and the fifth for Malmö (MA). Each row of boxes depicts one of the categories of a variable. Blue-shaded boxes indicate whether there are more respondents than expected in a given category; i.e., a category of a variable is significantly more (blue) or less (red) often represented in one city sample than in the remaining four city samples and/or than in the other categories of the sociocultural variable. The darker the red or the blue, the stronger the association between the categories. Grey boxes indicate no significant association between the given categories. The width and height of the boxes reflect the share of respondents that fell within a specific combination of two categories; i.e., the width of a box represents the relative amount of respondents from each of the five cities within a specific variable category, while the height of a box represents the relative amount of respondents within each variable category in the total sample. The bar at the side of each plot indicates the corresponding residuals on which the shading of the boxes is based. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

city (Fig. 3). For example, in Malmö, more people than expected aged 60 and over visited parks for social uses (blue-shaded box for Malmö, Fig. 3D) compared to slightly fewer young people aged 18–29 years (light red-shaded box for Malmö, Fig. 3D). The social uses of parks were especially associated with respondents' *occupation*, *current work*, *education* and *biodiversity valuation* (Fig. 3). For

example, in Berlin and Edinburgh, respondents who are engaged in paid work and received post-secondary education reported more often than expected that they visit parks for social uses, while the opposite is true for respondents in Bari (Fig. 3H). In the two European cities Berlin and Malmö, respondents who had a neutral or negative valuation of biodiversity reported fewer social

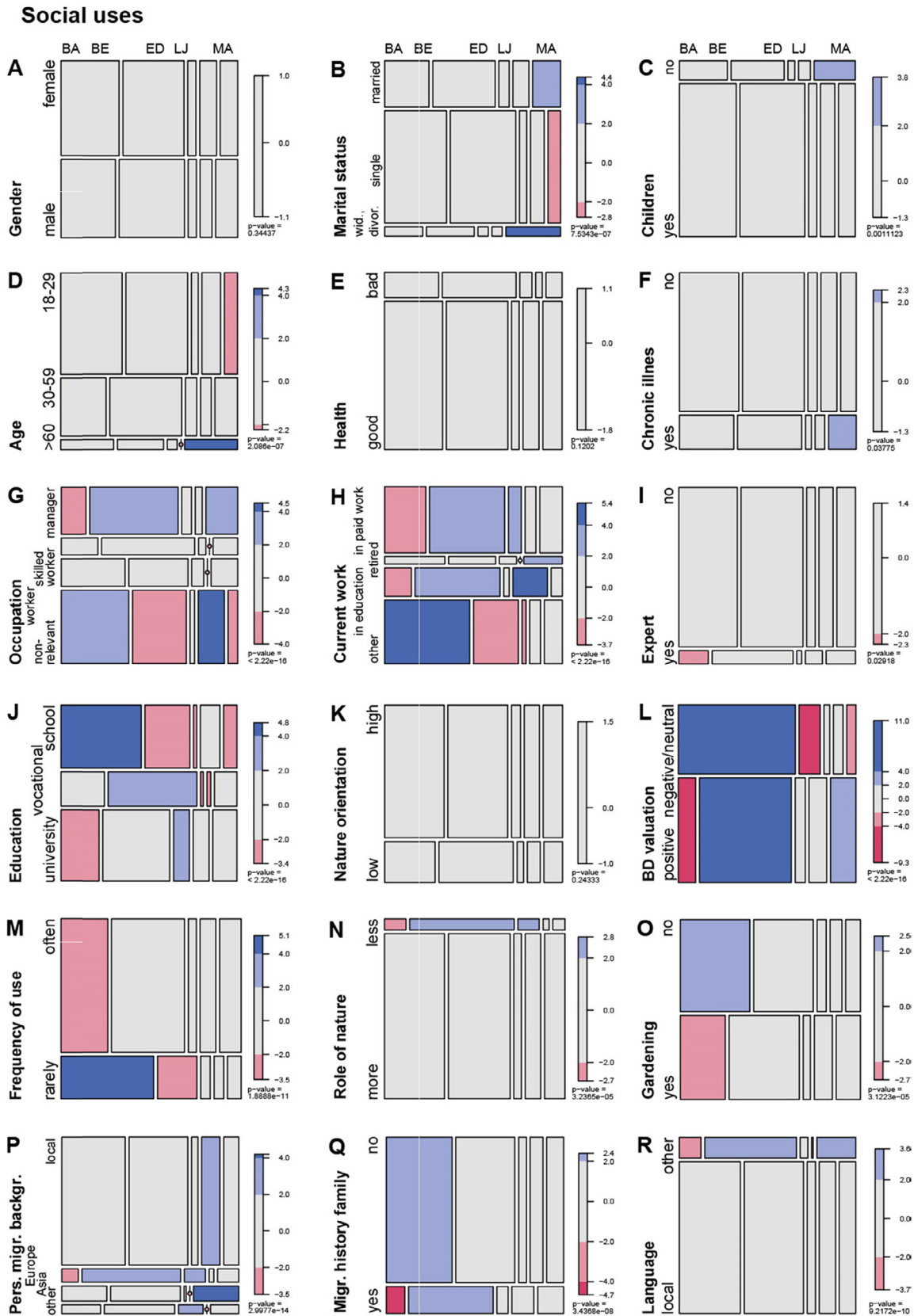


Fig. 3. Mosaic plots displaying the frequencies of social uses associated with the sociocultural backgrounds of respondents and European cities studied. BA, Bari; BE, Berlin; ED, Edinburgh; LJ, Ljubljana; MA, Malmö (See Fig. 2 for details on how to read the mosaic plot.).

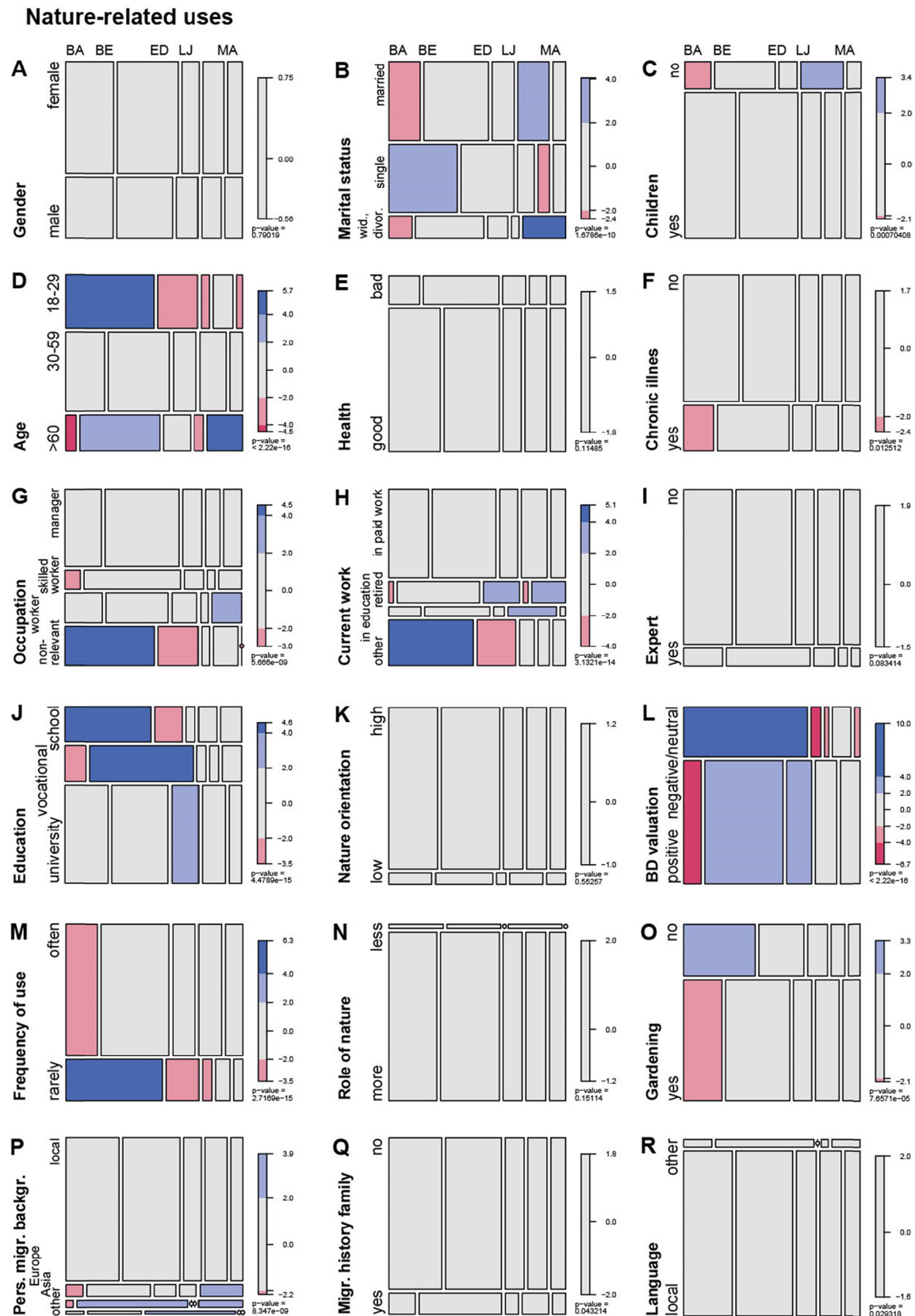


Fig. 4. Mosaic plots displaying the frequencies of nature-related uses associated with the sociocultural backgrounds of respondents and European cities studied. BA, Bari; BE, Berlin; ED, Edinburgh; LJ, Ljubljana; MA, Malmö (See Fig. 2 for details on how to read the mosaic plot.).

Table 1

Reported frequencies and proportions of major urban park uses in five European cities. Displayed are the frequencies and proportions of preferred park uses in the five European cities, differentiated for each of the use categories that were assessed in the survey and combined in the main uses, based on the Common International Classification of Ecosystem Services (CICES) (see Tab. S1 for details). Proportions given for the non-aggregated uses display the share of uses within a park use category, i.e., physical, social or nature-related, respectively. Each respondent was asked to choose one of 12 options to indicate the main activities that he/she performs in urban parks.

	All cities		Bari		Berlin		Edinburgh		Ljubljana		Malmö	
	N	%	N	%	N	%	N	%	N	%	N	%
<i>Physical uses</i>	2102	60	381	46	676	56	323	75	399	73	323	68
Take a walk	980	47	189	50	329	49	146	45	157	39	159	49
Practice sports	391	19	111	29	106	16	26	8	91	23	57	18
Pass through the park	257	12	17	4	93	14	43	13	68	17	36	11
Walk a dog	205	10	38	10	35	5	72	22	34	9	26	8
Play with children	269	13	26	7	113	17	36	11	49	12	45	14
<i>Social uses</i>	862	25	299	36	338	28	44	10	77	14	104	22
Relax/am lazy	536	62	218	73	171	51	31	70	60	78	56	54
Meet friends/relatives	326	38	81	27	167	49	13	30	17	22	48	46
<i>Nature-related uses</i>	523	15	154	18	190	16	61	14	67	12	51	11
Experience nature	406	78	122	79	148	78	50	82	46	69	40	78
Collect nature products	28	5	5	3	10	5	2	3	5	7	6	12
Watch specific animals/plants	89	17	27	18	32	17	9	15	16	24	5	10
Total	3487		834		1204		428		543		478	

Table 2

Results of Chi-square tests that compared frequencies between categories describing the main uses of urban parks (physical, social, and nature-related) across five European cities. The frequencies of the main park use categories were compared between each city and the remaining four cities, respectively. χ^2 , Chi-square value; N_{city} , subsample size of a city; DF, degrees of freedom; p_{adj} , p adjusted for multiple testing; Cramer's V, measure of association.

City	χ^2	N_{city}	DF	p_{adj}	Cramer's V
Bari	102.472	834	2	<0.001	0.171
Berlin	14.328	1204	2	0.019	0.064
Edinburgh	59.999	428	2	<0.001	0.131
Ljubljana	50.525	543	2	<0.001	0.120
Malmö	13.775	478	2	0.026	0.171

Table 3

Associations between the main uses of urban parks and the sociocultural backgrounds of respondents. The sociocultural backgrounds assessed in the survey are reported, with associations between the main uses (frequencies). Chi-square (C) and Fisher's exact (F) tests were used to detect significant associations between sociocultural background variables and park uses. Fisher's test was corrected for multiple analyses. Significance levels (p -value) indicate associations between categories: * $p < 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$; n.s., not significant. The lowest p value of a series of Fisher tests for a variable is provided. The European city is included in all analyses as a covariate. n , subsample size; DF, degrees of freedom; p_{adj} , corrected p value to account for multiple testing in some Fisher test series.

	Physical uses					Social uses					Nature-related uses				
	n	DF	Test	p	p_{adj}	n	DF	Test	p	p_{adj}	n	DF	Test	p	p_{adj}
<i>(a) Demographic background</i>															
Gender	2087	4	C	***	–	858	4	C	n.s.	–	522	4	C	n.s.	–
Marital status	2001	8	C	***	–	837	8	F	–	***	486	8	C	***	–
Children	2059	4	C	***	–	848	4	F	**	–	511	4	C	***	–
<i>(b) Age & health</i>															
Age	2044	8	C	***	–	836	8	F	–	***	513	8	C	***	–
Health	2037	4	C	***	–	836	4	C	n.s.	–	503	4	C	n.s.	–
Chronic illness	2049	4	C	***	–	831	4	C	*	–	512	4	C	*	–
<i>(c) Work & education</i>															
Occupation	1485	12	C	***	–	643	12	F	–	***	361	12	F	–	***
Current work	2059	12	C	***	–	849	12	F	–	***	515	12	F	–	***
Expert	2102	4	C	***	–	862	4	F	*	–	523	4	C	n.s.	–
Education	2038	8	C	***	–	836	8	C	***	–	511	8	C	***	–
<i>(d) Nature-relatedness</i>															
Nature orientation	2075	4	C	**	–	854	4	C	n.s.	–	519	4	F	n.s.	–
Biodiversity valuation	2081	4	C	***	–	850	4	C	***	–	519	4	C	***	–
Frequency of use	2081	4	C	***	–	848	4	C	***	–	515	4	C	***	–
Role of nature	2086	4	C	***	–	855	4	F	***	–	522	4	F	n.s.	–
Gardening	2075	4	C	***	–	854	4	C	***	–	517	4	C	***	–
<i>(e) Culture</i>															
Personal migrant background	2073	12	C	***	–	855	12	F	–	***	516	12	F	–	***
Migration history in family	2020	4	C	***	–	831	4	C	***	–	505	4	C	*	–
Language	2090	4	C	***	–	858	4	C	***	–	523	4	F	*	–

park uses than expected (Fig. 3L); a positive biodiversity valuation corresponded to more social uses than expected. In Bari, the reverse applied (Fig. 3L).

Our results show that for nature-related uses of parks some variables describing the sociocultural background of respondents did not matter at all (Fig. 4, variables *gender*, *health*, *expert*, *nature orientation*, *role of nature*, *migration history in family*, and *language*). Nevertheless, significantly more than expected 18- to 29-year-old respondents, for example, visited parks for nature-related uses in Bari, while significantly fewer than expected aged 60 and older did so (Fig. 4D). *Biodiversity valuation* was significantly associated with nature-related park uses in all cities except Ljubljana (Fig. 4L). In Berlin and Edinburgh, more respondents than expected went to parks for nature-related uses when they had a positive valuation of biodiversity, and fewer than expected did so when they valued biodiversity negatively or neutrally. On the contrary, in Bari, fewer respondents than expected visited parks for nature-related uses when they had a positive valuation of biodiversity, while the reverse applied to those who valued biodiversity negatively. The frequency of nature-related park use was also associated with the *personal migration background* of respondents from other European and Asian countries and world regions. There were no such associations for the children and grandchildren of migrants (variables *personal migration background*, *migration history in family*, Fig. 4P,Q). Specifically, more respondents than expected reported visiting parks for nature-related activities if they were born in Asian countries (respondents in Berlin & Malmö), in other European countries (respondents in Malmö), or in other world regions (respondents in Edinburgh).

4. Discussion

This study addressed important knowledge gaps in the understanding of recreational ecosystem services in cities, i.e., how activities in urban parks relate to the sociocultural background of park users and whether these relationships vary at larger spatial scales. In contrast to previous studies, our research (i) considered variations in park use at a European scale by including five cities spanning Northern to Southern Europe, and (ii) elucidated the human–nature intersection in park activities and its geographical variance by including multiple parameter associations in statistical analyses that have not been analysed before in this context. The inclusion of 19 variables, which amongst others cover information on health status, biodiversity valuation and the cultural background of respondents (e.g., migration history), exceeded by far the traditional variable data sets of previous studies. The large sample size of the data set ($N = 3487$) not only enabled us to search for general patterns at the European scale but also allowed us to go into detail for each of the five cities in relation to the remaining four, and with high analytical reliability.

Overall, our results demonstrate that people use urban parks predominantly for engaging in physical activities with some variation in social and nature-related park uses, depending on the geographic context (Fig. 1, Table 2). The sociocultural context mattered for how parks are used both at the European (Table 3) and city level (Figs. 2–4), demonstrating that the sociocultural and geographical contexts are interconnected. Across all five European cities, many different categories of the sociocultural background variables related to physical park use (Fig. 2), whereas many fewer categories linked to nature-related park use (Fig. 4). From these findings we infer that urban park users with nature-related motives seem to be the most independent from sociocultural conditions; vice versa, park users with physical activity motives may have the most varied needs because they are the most socioculturally diverse group. In-depth elucidation of the

human–nature intersection is urgently needed to enable multicultural societies to benefit from the recreational ecosystem services that urban parks offer.

4.1. The geographic context matters

At the European as well as at the city level, physical activities prevailed as the main reported park use (Fig. 1, Table 1). This is in line with previous studies from other geographic regions for which the importance of engaging in physical activities, such as walking, was also identified (Zhang et al., 2015 for China, Schetke et al., 2016 for Pakistan and Vietnam). In our study, we also show that the sociocultural background of respondents matters in predicting the type of physical activities they perform in relation to the geographical context (Fig. 2). In this perspective, the patterns showing how sociocultural groups use parks in the five cities vary greatly. This highlights the fact that urban recreational ecosystem services depend on the local context and may be traced back to interactions of sociocultural groups with varying demands and specific environmental or cultural settings. These include, for example, pressures from local climate and benefits of greenspaces in times of heat stress (Lafortezza et al., 2009), legacies of greening policies, such as those ensuing from the historic separation of Berlin (Lachmund, 2013), and the potential of open areas in times of transition (Cvejić et al., 2015) or within shrinking-regrowth contexts (Haase et al., 2014b; Wolff et al., 2017).

4.2. The sociocultural context matters

The activities people perform in urban parks differ especially in regard to a person's occupation, current work and education (Figs. 2–4; panels G, H, and J, respectively). The effects that these demographics have on park use are more heterogeneous in the physical and social uses categories, and more homogeneous in the nature-related uses category. Other studies have determined positive relationships between the educational level of people, the valuation of landscape scenes for recreation (Bjerke et al., 2006; Rall et al., 2017), and whether people used or did not use parks at all (Lin et al., 2014). In keeping with these studies, our results emphasise the considerable role education may play when sensitising people to outdoor activities and connecting with nature. However, the causal effect of education versus highly correlated variables, such as level of income and leisure-time mobility (e.g., Kabisch & Haase, 2014; Schetke et al., 2016), remains to be explored in future studies.

In our investigation, retirement was associated with social park use only for Malmö, with a high number of retired respondents using parks for social activities (Fig. 3H). Likewise, in a large Chinese city, retirees were more likely to relax outdoors than people working regularly (Shan, 2014). This result may also connect to the age of park visitors, as age was similarly associated within the context of social park uses in Malmö (Fig. 3D). In our classification the social uses included the option to *relax*, which was what 54 out of 478 respondents (13%) did when visiting parks in Malmö, as well as 15% of the respondents across all five cities (Table 1). In the physical and nature-related uses, most cities showed quite heterogeneous associations for the same categories (>60 years of age, retirement; Figs. 2D,H; 4D,H). Similarly, older people have been reported to engage more in nature-related activities in urban greenspaces than their younger counterparts (Sang et al., 2016). In the face of an ageing world population, which is concentrated in urban areas (UN, 2015), adjusting greenspace planning to the older age-groups of society may help ensure wellbeing at all ages. This may include, e.g., the availability of benches (Schetke et al., 2016) or shade (Arnberger et al., 2017).

Greenspaces are an important prerequisite for social inclusion (Peters et al., 2010). Young people with migrant backgrounds, for example, meet here and make friends while engaging in outdoor activities (Seeland et al., 2009). Few previous studies have disclosed differences in park preferences or uses between people with or without a migrant background. Peters et al. (2010) found that Dutch people with a Turkish or Moroccan background use urban parks less than Dutch natives. The authors reported that the Moroccan community, in particular, visits parks less frequently and less than the Turkish community. This might be explained by the fact that the Turkish community has a strong park culture, exemplified by families spending entire days at a park (Peters et al., 2010; Kabisch & Haase, 2014).

We established differences in park use between people with and without migrant background, both across the European cities and the three use categories (Figs. 2–4; panels P and Q, respectively). Our variables specify this in two regards: the geographic world region in which a person with migrant background was born, and whether the person him/herself or the parent/grandparent moved to the specific country. By comparing the outcomes for these two variables, our results suggest that differences determined for the first generation diminish in the following generations—a finding that is in line with others on biodiversity, nature and landscape preferences (Buijs et al., 2009; Fischer et al., 2018). This suggests that adolescents are more likely to adapt to local recreational practices than their parents. As cities become more culturally diverse (UN, 2014a) and places where refugees are progressively settling (UNHCR, 2016), greenspaces will gain importance as places for encounters among urban residents. Adjusting park design to the diverse demands on urban recreational ecosystem services is thus a crucial challenge for fostering multicultural societies.

4.3. High importance of biodiversity valuation

Previous studies have demonstrated that nature-relatedness is an important predictor of people's attitudes or behaviour towards environmental features (e.g., Lin et al., 2014; Shanahan et al., 2015). Yet, neither a strong nor a clear pattern was shown as to whether nature plays an important role in a person's life, in general (variable *nature orientation*), or while visiting parks (variable *role of nature*) in relation to the main park activities in our study (Figs. 2–4). A companion study revealed that urban residents value various levels of plant species richness in park grassland differently, with a preference for higher biodiversity levels (Fischer et al., 2018). The study at hand demonstrates that people's valuation of biodiversity matters for performing outdoor activities, but not if they have strong ties to nature. The pattern of associations between park use and biodiversity valuation is especially important for the park uses that most directly connect to nature. In our sample, these include activities such as experiencing nature, collecting nature products or watching specific plants and animals (Table 1), which 15% of the respondents reported to perform most often when visiting parks. This finding is in keeping with a local study in Berlin reporting that about 12% of park users interact with plant species (Palliwoda et al., 2017).

While the importance of spatial or structural features of greenspaces for park use has been widely demonstrated (e.g., Brownson et al., 2001; Hanibuchi et al., 2011; Voigt et al., 2014; Bertram et al., 2017), our results indicate that the ways in which people appreciate biodiversity at species level (i.e., below the structural or habitat level) may highly influence their use of urban parks. This finding points to positive feedback between biodiversity within parks and the attractiveness of parks for outdoor activities, as it suggests that (creating) biodiverse greenspaces may improve people's attitudes towards outdoor recreation on a broad social basis. More-

over, our findings support policy that favours biodiversity-friendly park management from a public health perspective as well, since physical activity largely translates into positive effects on human health and wellbeing (Penedo & Dahn, 2005). In parallel, increasing the appreciation of biodiversity (e.g., through biodiversity education in society) could induce closer contact with nature in urban surroundings.

4.4. Low importance of the gender of park users

Gender is one of the most frequently assessed variables in studies on greenspace use, in terms of both describing the study sample (e.g., Tzoulas & James, 2010; Bertram & Rehdanz, 2015) and the sociocultural background in statistical analysis (e.g., Flørgård & Forsberg, 2006; Shan, 2014). Previous local studies have found some gender-related differences in park use. More women than men, for example, were reported to be active in parks (Sang et al., 2016), interact with plant species (Palliwoda et al., 2017) and play with children, while the reverse applied for park visits for the purpose of relaxing (Shan, 2014). In our study at the European scale, however, the preference for social- and nature-related park uses was largely independent of gender (Figs. 3A and 4A) and only weakly associated for two cities and the male respondents in the physical uses category (Fig. 2A). Our results thus suggest that other variables are more important than gender when looking at differences in how parks are used across Europe.

4.5. Classification of park uses – an unresolved challenge

Although the CICES approach (cf Haines-Young & Potschin, 2013) inspired us to classify the recreational park uses assessed in our study, attribution remained a challenge. The CICES categorizations necessitated adjustment and discussion (Haines-Young & Potschin, 2013) most importantly in the area of cultural ecosystem services and with reference to the term “recreation”. In our study, the challenge of assigning the park uses we assessed to the CICES categorizations was in relation to: (a) the specific urban context; (b) the specific European setting; and (c) the overlap between categories. For example, we were unable to attribute the park activities we found with a distinct social component to the CICES categorizations. One reason for the difficulty in adopting CICES might be attributed to the fact that we limited the assessment of recreational uses to a specific urban setting, while such uses could be different in rural areas based on a set of different cultural ecosystem services (e.g., Schmidt et al., 2016). Similarly, the ecosystem services approach embraces all the different cultures on earth, and some of these services may be of minor importance to European urban residents. In this regard, most of the spiritual uses that are listed in CICES are rarely found within our specific European (urban) setting (e.g., the ritual identity of places). This is in agreement with a recent evaluation of the CICES framework: Although the CICES classification was received well by many users, some general shortcomings were identified and a revision was deemed necessary, especially in the area of cultural services and their framing (Haines-Young, 2016). Working on unifying the classification of urban cultural ecosystem services that deliberately includes social values in the urban context thus appears a promising future direction to improve the assessment of the human–nature intersection in cities within the framework of an ecosystem services-based approach.

5. Conclusions

Based on a pan-European, comprehensive and in-depth analysis of the human–nature intersection of urban park use, our study

demonstrates the importance of parks for delivering recreational ecosystem services in cities and the relevance of underlying sociocultural and geographical dimensions. Nearly all study respondents (94%) are active park users, with only a slight variation between cities ($\pm 3\%$). Cities from different geographical regions share a general pattern in preferred park use, with physical uses being the most dominant. At the same time, significant differences exist between various sociocultural groups at city level. This highlights, with broad empirical support, the challenge to consider the sociocultural variation in human–nature interactions in urban development (Pett et al., 2016; Vierikko et al., 2016).

Considering all cultural identities in city planning and development is essential for ensuring tolerant and inclusive societies and promotes social justice in the long run (UNESCO, 2016). While the unequal provision of greenspaces prevents some people from receiving the benefits of recreational ecosystem services provided by urban greenspaces (Kabisch & Haase, 2014; Shanahan et al., 2014), a mismatch between specific park features and those that are needed to satisfy a variety of sociocultural groups can lead to additional inequality; for example, when design or management practices fail in meeting the preferences of (potential) park visitors. Enhancing recreational ecosystem services in parks is therefore not only a matter of providing space and structure but also of designing and managing urban green according to the needs of the local community to ensure that all components of urban society derive the related benefits.

The fact that the sociocultural diversity of people and the geographical context matter more for physical and social activities in urban parks than for nature-related activities was a surprising outcome of our study. This indicates that interacting with nature in parks is an activity that is largely unrelated to sociocultural background. Considering the important role that urban parks can play in harbouring a wealth of animals and plants (Nielsen et al., 2014; Fischer et al., 2016), our findings present a social argument for biodiversity-friendly management practices in parks. Biodiversity-friendly management should, of course, not exclude park uses that rely on management practices which are not so supportive of biodiversity, e.g., tending lawn areas. In respect thereof, the outcomes of this study highlight the importance of considering the relation between local context and today's multicultural societies to account for various requirements, especially in enabling physical park uses. The main insights from this study have important implications for urban planning and governance. They support green policy aiming to develop urban greenspaces by considering the demands for park use and their variance within local communities and across European cities.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.ecoser.2018.01.015>.

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