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Beyond green: Broad support for biodiversity in multicultural European cities

Leonie K. Fischer[a,b,*], Jasmin Honold[a,c], Rozalija Cvejić[d], Tim Delshammar[e], Sven Hilbert[f,g], Raffaele Lafortezza[h,i], Mojca Nastran[d], Anders Busse Nielsen[j,k], Marina Pintar[d], Alexander P.N. van der Jagt[l], Ingo Kowarik[a,b]

[a] Department of Ecology, Ecosystem Science/Plant Ecology, Technische Universität Berlin, Rothenburgstr. 12, D-12165 Berlin, Germany
[b] Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB), D-14195 Berlin, Germany
[c] German Institute of Urban Affairs (Difu), Team Economics and Innovation, Zimmerstr. 13-15, D-10969 Berlin, Germany
[d] Biotechnical Faculty, University of Ljubljana, Jamnikarjeva 101, 1000 Ljubljana, Slovenia
[e] Street and Parks Department, City of Malmö, 205 80 Malmö, Sweden
[f] Department of Psychological Methods and Assessment, Ludwig Maximilians University, Munich, Germany
[g] Faculty of Psychology, Educational Science and Sport Science, University of Regensburg, Universitätsstr. 31, 93053 Regensburg, Germany
[h] Department of Agriculture and Environmental Sciences, University of Bari "A. Moro", 70126 Bari, Italy
[i] Center for Global Change & Earth Observations, Michigan State University, East Lansing, MI 48823, USA
[j] Department of Geosciences and Natural Resource Management, University of Copenhagen, Rolighedsvej 23, 1958 Frederiksberg C, Denmark
[k] Department of Landscape Architecture, Planning and Management, Swedish University of Agricultural Sciences, Slottsvägen 5, 23053 Alnarp, Sweden
[l] Copernicus Institute of Sustainable Development, Utrecht University, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands

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ABSTRACT

While urban growth contributes to the biodiversity crisis, biodiverse greenspaces within cities could support both human wellbeing and biodiversity conservation. Yet, urban greenspaces are under pressure due to the rapid densification of cities worldwide. Urban conservation policies thus need broad support, ideally from people with different sociocultural backgrounds. Whether urban residents prefer *biodiverse* over simply *green* spaces, however, largely remains an open question. We tested how diverse respondents ($N = 3716$) from five European cities valued three levels of biodiversity (plant species richness) in four ubiquitous greenspace types. Our field survey revealed that biodiversity matters: People largely prefer higher plant species richness in urban greenspaces (i.e., parks, wastelands, streetscapes) and agree that higher plant species richness allows for more liveable cities. Despite variation across European cities, positive valuations of high plant species richness prevailed among different sociocultural groups, including people of migrant background. The results of this study can thus support policies on a biodiversity-friendly development and management of urban greenspaces by highlighting social arguments for integrating biodiversity into urban development plans.

1. Introduction

Urban growth contributes to the biodiversity crisis (Güneralp and Seto, 2013), but cities may also be part of the solution as urban habitats can harbor surprisingly high biological richness (McKinney, 2002; Kowarik, 2011; Nielsen et al., 2014; Shwartz et al., 2014). Yet, urban greenspaces are under pressure due to the rapid densification of many cities around the globe (Lin and Fuller, 2013; Haaland and Konijnendijk van den Bosch, 2015). In parallel, urban areas of high human interest may coincide with places of high conservation value (Kasada et al., 2017). Given the competing interests in urban development, policies aimed at biodiversity conservation in cities thus need substantial support from urban societies. Important arguments are the benefits of urban greenspaces regarding improved human health and wellbeing (Shanahan et al., 2015; Hartig and Kahn, 2016), with people being happier when outdoors in green environments (MacKerron and Mourato, 2013). The vital question on the added value of biodiversity to human health and wellbeing still remains (Botzat et al., 2016; Soga and Gaston, 2016): Is *green* enough, or do residents especially value *biodiverse* greenspaces?

* Corresponding author at: Department of Ecology, Ecosystem Science/Plant Ecology, Technische Universität Berlin, Rothenburgstr. 12, D-12165 Berlin, Germany.
E-mail addresses: leonie.fischer@tu-berlin.de (L.K. Fischer), honold@difu.de (J. Honold), rozalija.cvejic@bf.uni-lj.si (R. Cvejić), tim.delshammar@malmo.se (T. Delshammar), sven.hilbert@psy.lmu.de (S. Hilbert), raffaele.lafortezza@uniba.it (R. Lafortezza), mojca.nastran@bf.uni-lj.si (M. Nastran), abn@ign.ku.dk (A.B. Nielsen), marina.pintar@bf.uni-lj.si (M. Pintar), a.p.n.vanderjagt@uu.nl (A.P.N. van der Jagt), kowarik@tu-berlin.de (I. Kowarik).

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There can be a significant gap between conservation objectives and perceived wellbeing (Clayton et al., 2017). Whether biodiversity really matters for urban residents remains unclear, since previous studies on the valuation of urban biodiversity are scarce, difficult to compare (Botzat et al., 2016) and yield ambiguous results (e.g., Fuller et al., 2007; Carrus et al., 2015 vs. Dallimer et al., 2012; Qiu et al., 2013). Botzat et al. (2016) report that only 51 out of 200 studies on urban biodiversity valuation and perception addressed the community, species or genes scale, although species level matters most for biodiversity conservation. Furthermore, the majority of studies focused on formal greenspace types (e.g., Johansson et al., 2014 for forests, Qiu et al., 2013 for parks, Lindemann-Matthies and Marty, 2013 for gardens), and only few studies exist on informal greenspace types, such as roadsides (Todorova et al., 2004; van Dillen et al., 2011; Weber et al., 2014) or wastelands (Brun et al., 2017; Mathey et al., 2017). For the most part, they do not consider that people of diverse backgrounds may have different views on urban biodiversity (Botzat et al., 2016).

In addition, some previous studies suggest that transnational surveys can provide further insights into how environmental or geographic settings may influence greenspace preferences while operating at different biodiversity scales (e.g., Lafortezza et al., 2009 for parks, Loder, 2014 for green roofs, Rupprecht et al., 2015 for informal greenspaces). At the same time, valuation studies on urban green that assess sociodemographic or cultural characteristics use such background variables largely in describing the sample and rarely include or even combine them in statistical modeling (however see, e.g., Shwartz et al., 2013; Lindemann-Matthies, 2017). The remaining knowledge gaps are critical, since identifying relationships with nature in times of a biodiversity crisis should also take into account the sociocultural context of individuals (Clayton et al., 2017; Dickinson and Hobbs, 2017; Fischer et al., 2018) and integrate social concepts into both urban ecology (Jorgensen and Gobster, 2010) and biodiversity conservation (Rissman and Gillon, 2017). In cities that act as human population hubs, in particular, greenspace management needs to account for the manifold needs and perceptions of the users (Vierikko et al., 2016; Aronson et al., 2017; Fischer et al., 2018).

Herein, we report results from a first international survey on urban biodiversity valuation at the species scale. Our field survey assessed how residents of five European cities, covering a range from northern to southern Europe, value biodiversity (plant species richness) in four ubiquitous greenspace types: parks, wastelands (a novel type of urban nature arising naturally on abandoned land; Kowarik, 2011), streetscapes with trees, and forests. To account for multicultural urban societies, our study includes people from different sociocultural backgrounds. Respondents were asked to rate photo collages showing scenes with different levels of plant species richness within each greenspace type—first, regarding their personal preferences and, second, the contribution of such scenes to creating liveable cities. We hypothesized that the valuation of greenspace settings (*i*) increases with higher biodiversity level (plant species richness) and is related to (*ii*) the geographic context and (*iii*) sociocultural background of the respondents.

2. Materials and methods

2.1. Study design

This field survey addresses cities as socio-ecological systems by coupling social and ecological variables (Pickett et al., 2011; Rissman and Gillon, 2017) to investigate how diverse human urban population groups value biodiversity. We assessed the respondents' valuation concerning four urban greenspace types (park, wasteland, streetscape, forest), and in five European cities: Bari (Italy), Berlin (Germany), Edinburgh (United Kingdom), Malmö (Sweden), Ljubljana (Slovenia); see Fischer et al. (2015) for details. As indicator for biodiversity, we chose plant species richness. The term biodiversity in this study, therefore, refers to the diversity between species, and details the existing knowledge on biodiversity valuation below the ecosystem or community level (Botzat et al., 2016; Pett et al., 2016). Species richness of one taxonomic group is frequently used as a biodiversity indicator (Heink and Kowarik, 2010); indeed, Pearman and Weber (2007) showed that richness in common plant species is positively correlated with species richness in other taxonomic groups (birds, butterflies). In our study, we operationalized this indicator by differentiating between three levels of plant species richness (i.e., low, medium, high), based on measured plant species richness.

To increase sample diversity, responses were collected using two survey media: a self-administered online questionnaire with embedded photographic stimuli and standardized face-to-face interviews that were combined with the same images, and during which the respondents answered the questions without interviewer assistance. Respondents were either randomly (online version) or rotationally (face-to-face interview version) presented with one of three survey combinations. Each combination showed photo collages of an urban park, the most important greenspace type, and either (a) an urban wasteland, (b) an urban streetscape, or (c) an urban forest.

The total sample size (N = 3716) included respondents from Bari (n_1 = 868), Berlin (n_2 = 1324), Edinburgh (n_3 = 460), Ljubljana (n_4 = 558), and Malmö (n_5 = 506). There were n_a = 1630 paper-and-pencil and n_b = 2086 online survey version respondents. Numerous cases (N = 1606) were excluded from the analyses due to incomplete or missing age data. The age of respondents ranged from 18 to 99 years (M = 38.85, SD = 16.11), and 58% were female. Fifteen percent of the survey sample had a personal migrant background (i.e., were born in a different country), and an additional 14% reported a migration history in their parents' or grandparents' generation. Fig. S1 shows the origins of these subsamples per European city.

2.2. Materials

The visual stimuli for the evaluations were three city-specific photographic images (compiled collages) of standard scenes in each of the four urban greenspace types. Their foreground showed (partly multiplied) sections of local greenery. For streetscapes, a fourth photograph was included that showed bare ground, that is, a no-vegetation condition because this setting prevails in many cities. Thus, we created 13 city-specific but comparable visual stimuli (Fig. 1) that represent scenes at human eye level and field of vision with similar light conditions (Latimer et al., 1981) and flat topographic structures (Hagerhall et al., 2004; Kaplan, 2007; Kaplan et al., 1989) without aspects that might bias vegetation evaluations such as humans, animals, litter, or open water (e.g., Dallimer et al., 2012; Gobster and Westphal, 2004; Han, 2007; Hull and Stewart, 1992; Kaplan, 2007; Patsfall et al., 1984; Ulrich, 1981, 1986; van der Jagt et al., 2014).

The raw photographic material and the corresponding vegetation surveys with measurements of plant species richness were collected in late spring/early summer, according to common detailed standard protocols and under continuous review to maximize comparability (Fischer et al., 2015). For example, general camera settings were defined in the protocols, including specific lens height and camera angle, as well as general environmental settings (i.e., weather and light conditions or even topographic structures). The aim of the standard settings was to provide the highest comparability between the series in each of the cities and between each of the biodiversity levels, already in the raw material. We selected the final raw photographic material by comparing the visual appearance of the photographic material (highest comparability within the city scenes and between the corresponding scenes of the other cities) and species richness according to the vegetation lists in the series in one greenspace type across the cities (Table S1). Differences in species numbers between the raw material allowed us to determine three disctinct levels of plant species richness, i.e. three biodiversity levels within each series of stimuli that displayed low, medium and high biodiversity. Although the different local vegetation and