

Research Paper

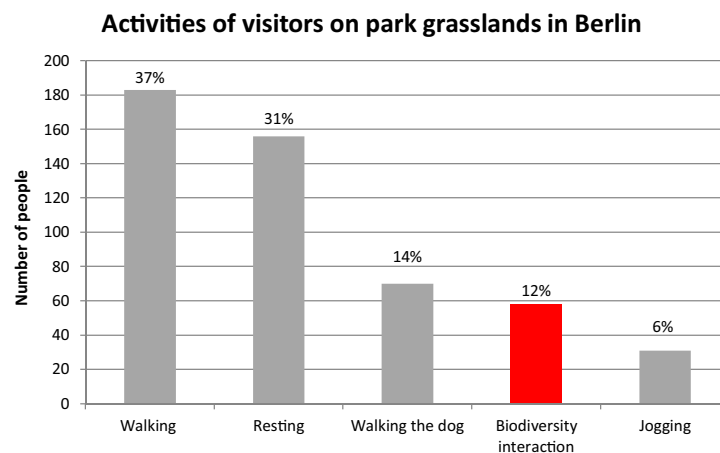
Human-biodiversity interactions in urban parks: The species level matters

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HIGHLIGHTS

- First study on biodiversity interaction in relation to other activities in parks.
- 12% of all observed activities were interactions with individual plant species.
- About 17% of wild or cultivated plants from local species pools were utilized.
- Provisioning services and cultural services of park flora were quantified.
- Gender and cultural diversity play a role in human-biodiversity interaction.

GRAPHICAL ABSTRACT



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ABSTRACT

In a rapidly urbanizing world, people are increasingly at risk of being disconnected from nature. Previous studies demonstrate that urban parks support contact of urban dwellers with “nature”, urban foraging activities and contribute to human well-being. While the importance of biodiversity underlying ecosystem services is broadly acknowledged, the role of individual plant species in the interaction of park visitors with biodiversity has received less attention. By applying a mixed methods approach in two parks in Berlin (biodiversity analysis, observation, interviews), we aimed to (i) determine the importance of biodiversity interaction at the species level in relation to other park activities, (ii) identify the range of used and non-used plant species, (iii) determine purposes underlying the utilization of individual species, and (iv) analyze gender-related differences in these activities. Results indicated a considerable proportion of activities related to individual plant species (12%), compared to other activities in parks. In total, 26 cultivated or spontaneous species (ca 17% of the local species pools), were used for consumption (60%), decoration (21%) and biodiversity experience (17%). Native and non-native plants were utilized proportionally to local supply. More women (78%) than men interacted with plant species. Another 33 species were identified as being gathered in Berlin outside of gardens based on interviews of park visitors. Findings support approaches toward a biodiversity-friendly park design and management. Maintaining and

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facilitating biodiversity interactions for a broad range of park-users is a promising pathway to biodiversity conservation in cities and would help counteract the loss of experience in human-nature interactions.

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1. Introduction

In a rapidly urbanizing world, people are increasingly at risk of being disconnected from nature due to a loss of opportunities to interact with natural elements and because of people's decreasing emotional affinity with nature (Miller, 2005; Soga & Gaston, 2016). Urban green spaces enhance the well-being of urban residents by supporting a range of supporting, regulating, provisioning and cultural ecosystem services (Haase et al., 2014) – and often provide the only access to nature and occasions to interact with it (Dunn, Gavin, Sanchez, & Solomon, 2006; Kinzig, Warren, Martin, Hope, & Katti, 2005). Urban parks can harbor a considerable biological richness (Nielsen, van den Bosch, Maruthaveeran, & Konijnendijk van den Bosch, 2014), and park visitors are known to generally appreciate natural elements (Bertram & Rehdanz, 2015; Özgüner, 2011).

While the importance of biodiversity as a whole in supporting urban ecosystem services is increasingly acknowledged, the role of biodiversity at the species level in providing such benefits is poorly understood (Botzat, Fischer, & Kowarik, 2016; Fuller, Irvine, Devine-Wright, Warren, & Gaston, 2007; Haase et al., 2014). A high biological richness, for example, is crucial for the aesthetic valuation of urban ecosystems (Lindemann-Matthies, Junge, & Matthies, 2010) as well as for psychological and human well-being (Dallimer et al., 2012; Fuller et al., 2007). However, some evidence suggests that preferences for specific nature images and valuation of cultural urban ecosystem services are influenced by the individual cultural backgrounds of park users (Bertram & Rehdanz, 2015; Botzat et al., 2016; Buijs, Elands, & Langers, 2009).

Gathering individual plant species for consumption or other purposes (e.g. medical herbs) is often deeply rooted in cultural traditions and thus relates to both cultural and provisioning ecosystem services (Hurley, Grabbatin, Goetcheus, & Halfacre, 2012; Poe, McLain, Emery, & Hurley, 2013; Reyes-García et al., 2015). Previous studies analyze corresponding activities in natural, rural and urban areas from a variety of disciplinary angles, including rural and urban ethnobotany (e.g. McLain et al., 2012; Reyes-García, Vadez, Huanca, Leonard, & Wilkie, 2005), natural resource livelihoods (e.g. Kaoma & Shackleton, 2014), and political ecology (e.g. Hurley et al., 2015). The present study emphasizes links between biodiversity research and human-plant interactions.

There is broad evidence that people from indigenous cultures, usually women, gather wild herbs and fruits for various purposes (e.g. Cruz, Medeiros, Sarmiento-Combariza, Peroni, & Albuquerque, 2014; Howard, 2003; Ladio & Lozada, 2000; Reyes-García et al., 2005). Corresponding activities are reported from rural areas in Eastern Europe (Staddon, 2009) and the Mediterranean (Hadjichambis et al., 2008; Pieroni, Nebel, Santoro, & Heinrich, 2005; Reyes-García et al., 2015). Gathered wild plants contribute to the traditional cuisine and are used for medicinal purposes, sometimes simply for economic reasons (Pieroni et al., 2005; Staddon, 2009), mostly by the poor (Gopal & Nagendra, 2014; Shackleton, Chinyimba, Hebinck, Shackleton, & Kaoma, 2015). In sub-Saharan Africa, for example, gathering wild nature resources is an important part of daily life in small towns (Kaoma & Shackleton, 2014; Schlesinger, Drescher, & Shackleton, 2015; Shackleton et al., 2015) and significantly contributes to the household income (ca. 20%; Shackleton et al., 2015; for nontimber tree products).

However, traditional ecological knowledge about wild usable plants is at risk due to urbanization and rural communities adapting to modern ways of life where the gathering of traditional plants plays a minor role (Pieroni et al., 2005; Reyes-García et al., 2005, 2015; Sansanelli & Tassoni, 2014; Schlesinger et al., 2015).

Despite evidence of a general decline in human-nature interactions (Soga & Gaston, 2016), a “back to nature” trend is in vogue in large cities of the western world. People are becoming more concerned about where their food is coming from, and the cultivation of edible plants in a range of urban green spaces is enjoying increasing popularity (Eigenbrod & Gruda, 2015; Müller, 2011). The ways in which urban dwellers use plants grown outside of formal or informal urban gardens for food and other purposes have received less attention, at least in Europe (but see Jay & Schraml, 2009). In contrast, a number of studies from North America demonstrate that the gathering of wild plants is a highly relevant human-plant interaction even in large western cities: a surprising number of wild plant and fungi species are utilized in foraging activities by citizens in U.S. metropolitan areas (Hurley et al., 2015; McLain et al., 2012; McLain, Hurley, Emery, & Poe, 2014; Poe et al., 2013; Robbins, Emery, & Rice, 2008).

While many of these gathering activities focus on urban forests located primarily on the urban fringe, there is also evidence that typical urban green spaces, such as public parks, are also important sites for urban foraging activities (Hurley et al., 2015; McLain et al., 2012, 2014; Poe et al., 2013; Robbins et al., 2008). Various direct human-plant interactions have been documented all over the city by systematic interviews, and motives for gathering specific species for food, medicinal herbs, decoration or other purposes, including as expressions of cultural heritage, have been demonstrated (Hurley et al., 2012; McLain et al., 2012; Poe et al., 2013). Thus, the gathering of plants appears to be a process that evolves at the interface of biological and cultural diversity in urban settings and also suggests the existence of (new) ecological knowledge of urban dwellers (Poe, LeCompte, McLain, & Hurley, 2014).

A number of studies from European, Asian and African cities (e.g. Furukawa, Kiboi, Mutiso, & Fujiwara, 2016; Gopal & Nagendra, 2014; Jay & Schraml, 2009) have contributed to findings from North America indicating that gathering plants outside of gardens is a generally relevant human-nature interaction in large modern cities. This is also mirrored by the existence of specific webpages providing information about edible plants; in Berlin, for example, one site covers “wild herb walking tours” (www.wildkrauterfruhstuck.de), while another offers information on fruit and nut trees that are accessible to residents (www.mundraub.org).

While previous studies have unambiguously demonstrated the substantial significance of urban foraging outside traditional gardens in large western cities (see above), some important knowledge gaps remain. The first is regarding the relative importance of interaction with biodiversity at the species level in general – and of gathering plants in particular – compared to other activities pursued by people in urban green spaces. Quantifying biodiversity interaction at the species level would help assess the role of related provisioning and cultural ecosystem services of urban parks. Moreover, insight into the relative importance of gathering and using specific plant species would assist park managers in incorporating related issues in design and management approaches.

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