IDENTIFYING, QUANTIFYING AND QUALIFYING BIOCULTURAL DIVERSITY

Assessment of Biocultural Diversity

GREEN SURGE Deliverable 2.3



Work Package 2
Partners involved:

UH, FFCUL, SRC, TUB, UBER, WU
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1 INTRODUCTION

1.1 Background and objectives of the Deliverable 2.3

Contributing authors: Kati Vierikko, Birgit Elands, Jari Niemelä, Vesa Yli-Pelkonen

In a time of continuing urbanization, there is an increasing focus on developing attractive and healthy urban environments. Green spaces, ranging from woodlands and parks to allotment gardens and green roofs, provide a range of ecosystem services that contribute to healthier cities where people live and interact with nature. Within the GREEN SURGE project we aim to understand how we can strengthen both biodiversity conservation and people's connections to urban nature, taking into account the major urban challenges that cities face (e.g. migration and climate change).

The GREEN SURGE project has identified Biocultural Diversity (BCD) as a key concept for (1) understanding the integration between biological variety in the Urban Green Infrastructure (UGI) and the cultural specificities of the users of UGI, and (2) developing innovative approaches to planning and governance of UGI. Work Package 2 (WP2) aims to apply BCD in the context of Western urban societies, which is an innovative and novel approach to the use of the concept requiring further operationalization in respect of its relevance for UGI planning and governance. To realise these aims, WP2 was divided into three different tasks:

- 1) Development of a conceptual framework for addressing how residents value and interact with biodiversity (BD) and each other in urban regions
- 2) Use of a conceptual framework to assess components of UGI and how residents with different cultural backgrounds and socio-economic situations value and use UGI across European cities
- 3) Development of a database and typology of BCD of UGI components as grounding knowledge for other parts of the project (WP4-7).

This report is the final deliverable of WP2 and belongs to task 2.3 "Development of a database and typology of BCD of UGI components as grounding knowledge for other parts of the project (WP4-7)". BCD research in the GREEN SURGE project was simultaneously carried out in five different phases at multiple scales from the local and context-dependent scale (Urban Learning Lab (ULL) cities, see chapter 3.2) to European level analyses of interlinkages between biodiversity and cultural diversity in European cities. Main research phases were 1) conceptual, 2) policy, 3) governance, 4) biophysical environment, 5) people-biodiversity interactions, and, finally, 6) synthesis of all research (Fig. 1.1.1). Milestone 22 (Vierikko et al. 2017) gives an overview of BCD studies conducted in the WP2 and other WPs. The Deliverable 2.3 introduces BCD research made in the WP2 enriched with methodological details and several notes from the researchers of the project (chapters 2-4).



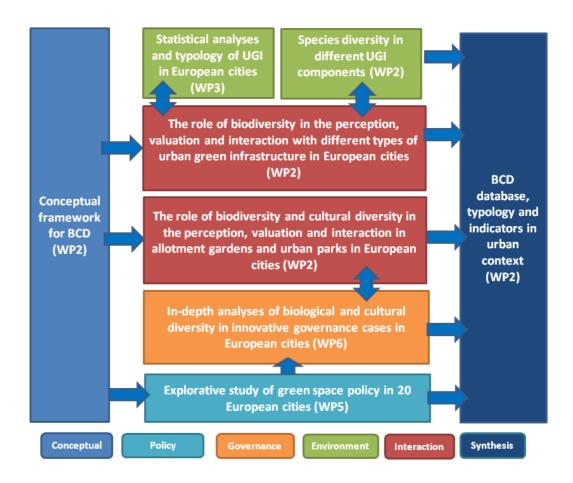


Figure 1.1.1. Six research phases for multi-scale BCD studies (right side): conceptual, policy, governance, environment, interaction and synthesis. Different research phases are presented in more detail in MS22 (Vierikko et al. 2017).

GREEN SURGE's deliverable 2.3 is aimed at managers, planners and researchers of urban green infrastructure (UGI) and other experts who are interested in the BCD concept. The aim of the deliverable is to give an overview of the main results based on BCD research conducted in GREEN SURGE through case study narratives from different aspects of the BCD concept: tangible, lived and stewardship. The report ends up to short conclusions. Each research narrative is an independent story of the BCD research following the same structure.

- Main contributors of the research are presented followed by an information box which gives a
 reader an idea in which BCD research phases the narrative can be anchored (see Fig. 1.1.1),
 what kind of data has been collected and used in analyses and about linkages with BCD
 indicators (introduced in the Milestone 22).
- Main outcomes of the research and what the study tells us about human-nature relationships are highlighted with bullet points.
- Methodological design is presented in a separate box and research's note about strengths and challenges of the case study is included.



We hope you enjoy reading the deliverable and find new ideas how to study, design or manage urban green spaces to support diverse interactions between culture(s) and nature!



Figure 1.4.1. The team GREEN SURGE ready to start their work in 2014 in Edinburgh (Photo by GREEN SURGE team).

1.2 Why do we need a Biocultural Diversity (BCD) approach?

Contributing authors: Birgit Elands, Kati Vierikko

The concept of Biocultural Diversity (BCD) was introduced for denoting the 'inextricable link' between biodiversity and cultural diversity (Posey 1999). The concept of BCD builds upon the notion that nature is not something that exists 'out there', but is socially constructed (Buizer et al. 2016). Biodiversity and cultural diversity are "made" together and imply each other. BCD focuses on the interrelationships and interdependencies between people and nature, and, as expressed in terms such as 'humans-in-nature', considers humans as agents of ecosystem change (Folke 2006 in Elands et al. 2015). It has been increasingly suggested that in order to successfully protect and enhance biodiversity, the focus should not only be on biodiversity as an ecological or biophysical concept, but also on the social processes that determine success and failure of biodiversity conservation and management efforts, as well as on the relationship with the social and institutional context in which biological diversity develops (e.g. Folke 2006, Young et al. 2006, Ostrom 2007 in Elands et al. 2015).

Secondly, it is widely acknowledged that diversity in ways cultural groups live with biodiversity is a key determinant for the maintenance and adaptation capacity of social-ecological systems (Folke et al. 2005, Maffi 2005, Maffi and Woodley 2010). Therefore, explorations into how different cultural groups in specific contexts (e.g. groups with a different ethnic and/or social-economic background)



interact with or value green open spaces or specific (groups of) plant- or animal species, are an essential ingredient of BCD research (Buizer et al. 2016). It is important to learn about these cultural valuations; first because they might cover different services than those recognized in the typologies based on ecosystem services approach; secondly because different groups of people value nature differently and this may change over time; and thirdly, because they originate from interactions/experiences with nature in specific places. A focus on diversity may come with gains for some populations and/or individuals and losses for others. Urban green spaces may render disservices to humans or vice versa and conflicts may arise between types of biodiversity or cultural preferences. For example, people may value and introduce new attractive species, which may turn out to be invasive, threatening populations of local species. The BCD concept can highlight such potential vulnerabilities (Buizer et al. 2016).

BCD also accentuates the dynamic, constantly evolving, nature of interactions between humans and natures. In many approaches nature "delivers services" to human beings (e.g. MEA 2005) which does not allow for integrating cultural dynamics. Culture often acts as a selective force, with people deliberately choosing from cultural lifestyles they have at their disposal. These lifestyles reflect ancient values and practices as a form of heritage, new values and practices that evolve as a result of cultural modernization, as well as trans-cultural exchange and intercultural hybridization (Cocks 2006). The focus on cultural dynamics is often conceived as negative as modernization and changing and modern life styles are often threatening both biodiversity and cultural diversity (Grimm et al. 2008, Pilgrim et al. 2008, Pretty et al. 2009). On the other hand, innovation originates from cultural dynamics. Consequently, the concept of 'biocultural creativity' has been introduced, which focuses on the creation, rather than the conservation of biological diversity (Elands and Van Koppen 2012). As cultural values and practices are fusions of ancient traditions and new developments within society, and consequently adhere to their own unique dynamics, BCD manifestations are always evolving, but anchored in existing socio-physical contexts.

Finally, the recognition of culturally diverse interactions with biodiversity implies that in future decision-making processes on the natural landscape, stakeholders should recognize that there are different fields of knowledge involved in explorations of BCD (Robertson and Hull 2003). Thus, when exploring BCD in cities — a transdisciplinary inquiry into 'good practices' of BCD may start with the identification of developments that different participants frame as good practice, to be followed by explorations of the criteria of success and failure used by the different participants. What is 'good practice', cannot a priori be established by prioritizing one type of knowledge but may be the outcome of a process of multiple actors and, within the diversity, is likely to have both winners and losers (Buizer et al. 2016).

1.2.1 Conceptual framework

Based on previous discussions and main findings presented above we developed a conceptual framework for a BCD typology. Figure 1.2.1 depicts three different aspects: tangible, lived and stewardship, being departure points from which BCD can be studied. A focus on one aspect does not exclude the existence of the other two, rather, they should be considered as interdependent. The concept of BCD typology does not separate humans and nature as a counterbalance system as the ES approach does (Buizer et al. 2016). The core idea of the BCD concept is that there is an innate



connection between biological and cultural diversity. Changes in lived BCD (e.g. use of a UGI) will have an impact on tangible BCD (e.g. facilities, trails, species composition).

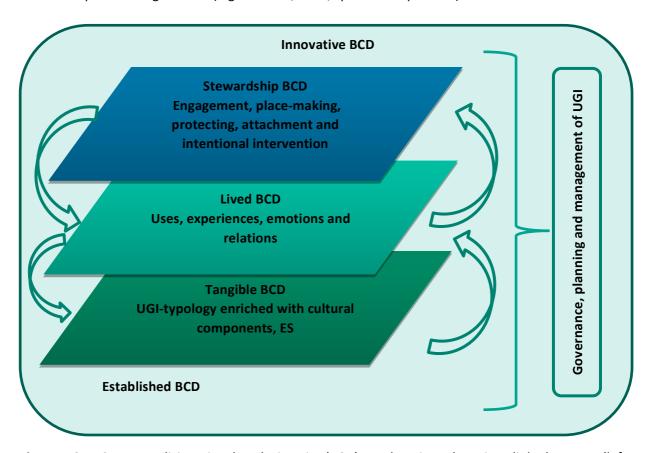


Figure 1.2.1. Conceptualizing Biocultural Diversity (BCD) typology into three interlinked aspects (left side): tangible, lived and stewardship to study relationships between culture(s) and nature at different spatial and social contexts. The framework presents three aspects that can be used as a starting point in studying complexity and multidimensional human-nature relationships of urban green spaces.

1.2.2 BCD indicators – helping to support UGI planning and management

Due to limited resources (in money, time or allocation of working hours) neither science nor practice can take all possible components and factors into account when planning, managing or studying "real-life situations". Although the original aim of the WP2 was not to provide indicators, we realized that introducing some proxies and practical measures could help policy-makers, researchers or practitioners to understand the BCD concept better and stimulate them to adapt new methods and tools to identify diversity of urban green spaces. Therefore, we ended up developing a list of potential BCD indicators for UGI planning and research. BCD indicators, their link with UGI planning, ecosystem services and relevant references are introduced in detail in the Milestone 22 (Vierikko et al. 2017). Those readers who are interested in BCD indicators can download the Milestone22 and table of indicators in the GREEN SURGE website: http://greensurge.eu/products/biocultura-diversity/.



The objective of using these indicators is not definitive, acting as a benchmark of ideal BCD value, but rather to uncover missing or underrepresented components to take them into consideration in UGI planning and management. They are, therefore, designed to be used as a decision-support tool for policy and decision-makers and, thus, mainly based on easily understandable and measurable criteria. Using indicators for studying human-nature interactions or interlinkages or conflicts between biological and cultural diversity can help us to typify urban green spaces (forests, parks, allotment gardens, etc.) in a rather new way (Fig. 1.2.2). BCD indicators guide researchers, managers and policy-makers to rethink the value of urban green space: who benefits and why, is there place attachment involved when people use urban green spaces, is there a continuum between culture and nature or have for instance urban trendy people lost their contact with nature?

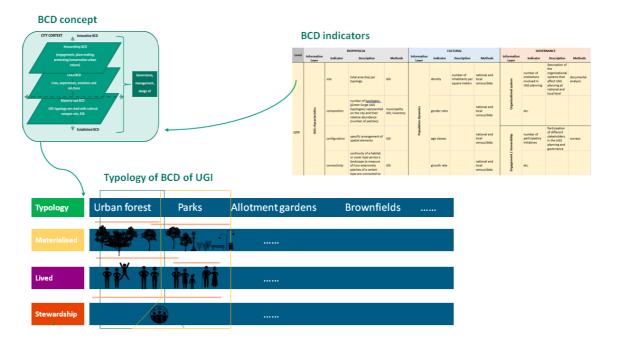


Figure 1.2.2. Illustration of how BCD indicators can be used as a tool for typifying human-nature relationships in different urban green spaces (developed by FFCUL).

1.3 Methodological approaches to study Biocultural Diversity (BCD)

Contributing authors: Erik Andersson, Birgit Elands, Kati Vierikko

This methodological section provides an overview of research fields and some of the theoretical framings relevant for the different dimensions of BCD. It will only provide a quick orientation, not an exhaustive summary or representation of the scholarly traditions potentially relevant for the future development and implementation of the BCD framework.

The BCD approach, as developed in the GREEN SURGE project, is a many-faceted framework. As such, it comes with a rich toolbox of methodological options as well as transdisciplinary challenges. There is no one 'right' way of studying BCD; depending on the question and the context in which it is asked, different methodological approaches will make more or less sense. Potentially, BCD can bring together multiple ways of understanding human-nature relations. By its emphasis on diversity, the



BCD concept acknowledges the different fields of knowledge (e.g. expert, tacit and traditional), meanings and values, and can reveal conflicts and ambivalence that may be at stake. Therefore, the BCD approach calls for genuinely transdisciplinary thinking in research to cross borders between disciplines or scholars, and to give way to new, "intermediate" research. Research itself should also maintain methodological and epistemological diversity.

However, diversity (e.g., in values, interests, uses) can also cause problems and conflicts, and therefore the BCD approach requires careful reflection from the investigator on how values are reported or synthesized, and power issue is inherent in value articulation (Lang et al. 2012). Also, being a multi-faceted approach, the BCD approach needs an understanding of epistemological traditions and ways of producing knowledge, and how to relate these to each other. While the individual dimensions of BCD – tangible features, lived experiences and the intentional stewardship – can be studied separately and used to contextualise each other, they can also be integrated. A comprehensive BCD framework is needed to facilitate linkages between the different dimensions. By adding layers of meanings and time to the physical objects of BCD they become quantifiable at some level and unique, relational elements in other ways.

Cultural meanings and manifestations can be sought through observational studies, through discourse analysis of dominant narratives and symbolic representations or in the over-time co-evolved cultural landscapes that most of us live in. It can be the object of individual understanding through the subjective mind, discursive group processes, or dialectic, embodied interactions. Or, it can be present in the species communities of domesticated landscapes. BCD has both quantitative and qualitative aspects, and the scholarly traditions for addressing these tend to differ. Some of this tension may be eased by a recognition of BCD manifestations as both expressions of an objective 'reality' and as interpretive qualities given meaning through human perception and sense-making.

The next sub-sections will provide some background to each of the three BCD dimensions before sections 2-4 go on to exemplify the type of studies that could inform each dimension. The methods used within GREEN SURGE's WP2 are summarised in Table 1.3.1.

1.3.1 Tangible BCD

Tangible BCD is primarily concerned with the identification and quantification of the physical expressions of BCD. These can be the composition of ecological communities, social or technical artefacts or the features of a cultural landscape. While relying on different data, the features still share an ontological assumption that there are discrete objects that exists regardless of our perception, and that these can be measured and quantified. Tangible BCD lends itself relatively well to large scale monitoring and cross-case translation and replication, although which features and indicators that may be most relevant in any given case may of course vary. Within this category fall biodiversity surveys, cultural landscapes, biological heritage, co-evolution etc. Data sources and harvesting methods include census data, surveys, inventories and historical records. While arguably objects can be said to have individual, independent identities they also have the additional levels of meaning that we attach to them, which is something more akin to and expressly addressed under 'lived BCD'.



1.3.2 Lived BCD

There is a growing recognition of the emergent, co-produced outcome of human-nature interactions. Lived BCD is concerned with the perceived and experienced qualities. These are mediated by our senses and minds, and concerns complex systems of values, norms, traditions, knowledge, and sensory perceptions. Different approaches and conceptualisations emphasize different aspects and factors – under some circumstances knowledge and active cognition may be imperative, in other situations relational and embodied perspectives may be more informative. Data and analyses tend to be more qualitative and context sensitive. Within this category fall sense of place research, narratives, environmental history, artistic research, interpretive reading, observational studies and value orientations. Lived BCD also has aspects that can be captured by more quantitative methods such as questionnaires and visitor counts, investigating for example how different groups make use of different natural resources. Quantitative methods tend to answer the question what while the qualitative methods explore the why. Data sources and harvesting methods include interviews, text analysis, observational studies, surveys and cognitive studies.

1.3.3 Stewardship

While lived BCD in some ways can be said to be more passive and primarily mediated through perception, stewardship is an active, conscious engagement in the shaping of a social-ecological system. Stewardship overlaps with lived BCD in its interest in motivations, values, actions, norms, etc. In addition, it highlights knowledge in its different forms and how knowledge informs and influences the co-evolution of the system. Stewardship is connected both to individuals and to group processes, and share the qualitative – quantitative split with lived BCD. Fields relevant to stewardship include social movements and social organisation, local ecological knowledge, environmental psychology, narratives and social-ecological memory. Data sources and harvesting methods include interviews, text analysis, observational studies, surveys and cognitive studies.

Table 1.3.1. Methods used within GREEN SURGE's WP2.

	Study	Quantitative	Qualitative	Data collection method
	(chapter)			
Tangible BCD	2.1	Х		GIS land-use data, species records
	2.2	X		Species surveys, questionnaires
	2.3	X		Environmental data, species surveys
Lived BCD	3.1	Χ	Χ	GIS land-use data, preference surveys
	3.2	Χ		Field surveys and interviews
	3.3	Χ	Χ	Interviews, questionnaires, field
				observations
Stewardship	4.1	Χ	Χ	Interviews, questionnaires, land-use data



2 TANGIBLE BIOCULTURAL DIVERSITY (BCD) OF URBAN GREEN INFRASTRUCTURE (UGI)

Tangible BCD identifies components and composition of diversity in an urban landscape and at different spatial and temporal scales. The dimension explores how BCD manifests itself through material elements in the UGI or through historical documents, visual maps and policy documents (e.g. land-use planning documents, nature conservation programs, green management plans). When studying tangible BCD the focus is on the first hand on direct human-nature interactions and linkages that can be identified in a landscape, or within a single green area, e.g. park. On the other hand, by analyzing present UGI components, species composition or policy documents we can reveal earlier shared human-nature connections, e.g. past actions implemented in policy-making and landscape planning. Tangible BCD can also identify the presence of ecological and/or social memory, i.e. inherited human-nature connections (Schaefer 2011, Andersson and Barthel 2016). These can be signs of caring or "cues to care" i.e. cultural symbols that make places more meaningful to residents (Nassauer 1995). Next we give three different examples on how tangible BCD can be identified and how tangible data of urban green spaces provide valuable information about dynamic human-nature relationships in cities.

2.1 Urban Green Infrastructure (UGI) and associated biodiversity in Berlin and Helsinki

Contributing authors of this chapter: Kati Vierikko, Dagmar Haase, Jari Niemelä, Vesa Yli-Pelkonen

Research phase: Environment

Database: GIS-based data, species records **BCD indicators:** UGI typology, biodiversity

- Loss of nature experience in cities is a phenomenon that has been identified by scientists. We showed that cities can harbour a great proportion of e.g. red-listed species meaning that citizens still have a relatively good opportunity to experience species richness in Helsinki and Berlin
- Composition of urban habitats and species richness indicates long-term human-nature
 interactions and cultural history in Berlin and Helsinki. If people have close-to-home green
 spaces and a green network that covers the entire city, opportunities to have daily nature
 experiences are better than if there are only large green areas situated in periphery

Urban green infrastructure (UGI)¹ provides multiple benefits for citizens (Chiesura 2004, European Commission 2012). Green areas can also provide habitats for different species shown by the fact that many cities around the globe are rich in their species composition (McKinney 2008, Elmqvist et al. 2013, Aronson et al. 2014). Every city has its unique green infrastructure. By classifying and studying urban green infrastructure, we can analyze how previous human-nature relationships and decisions

¹Urban green infrastructure in this chapter refers to urban vegetated areas, including water bodies, that have either natural, cultivated or planted vegetation and their primary use is for recreation, food growth or agriculture. The soil can be partly impermeable (e.g. asphalt or rocks).



to 'build a park' or 'keep an area wild' manifest themselves in the current UGI (Pungetti 2013). Recognizing different types of urban green spaces or present-day vegetation structure in urban landscape reflects not only materialised elements of BCD, but also legacies of past human-nature relationship (Boone et al. 2010, Andersson and Barthel 2016). This chapter shortly presents UGI and associated biodiversity in two European capitals, Berlin and Helsinki.

The cities of Helsinki, in Finland and Berlin, in Germany, are both called green cities, putting much effort on UGI planning. Both cities are growing capitals and cultural meeting points with a diverse population, however differing greatly regarding land area and the amount of population. Administrative boundaries of Berlin extend over a region of more than 89,000 ha (Davies et al. 2015). Green areas cover almost 40% of the city area. Administrative boundaries of Helsinki extend to 71,550 ha of which 2/3 is water (land surface 21,380 ha) and green spaces cover 47 % of the land area (Vierikko et al. 2014, Davies et al. 2015). Helsinki is the largest city in Finland with 635,000 inhabitants in 2016. The current population of Berlin is over 3,5 million inhabitants (Davies et al. 2015). UGI in Berlin and Helsinki was grouped under four categories and 15 different urban habitats were identified based on their land-cover and land-use type, soil and vegetation characteristics (Table 2.1.1). The typology describes fundamental differences in land-use history and vegetation composition at the city level.

Table 2.1.1. Four urban green infrastructure (UGI) types based on their land-use history and vegetation, and 15 urban habitats identified in Berlin and Helsinki (adapted from Kowarik 2011).

Туре	Land-use history and vegetation	Habitat	
Original	Natural vegetation dominating in the	Forests	
	original landscape, but vegetation often	Open rocks	
	modified by human management (e.g.	Open wetlands	
	forestry)	Sands and gravels	
Agricultural	Semi-natural and man-made ecosystems	Fields	
	resulting from early habitat transformation	Semi-natural grasslands	
Horticultural	Designed and strongly controlled with decorative vegetation	Allotment gardens	
		Cemeteries	
		Parks and public gardens	
		Lawns	
		Street green	
Spontaneous	Spontaneous vegetation emerging after destruction of original vegetation	Open ruderals	
		Brownfields	
		Spontaneous bushes	
		Pre-forest vegetation	

The proportion of original habitats (forests, open rocks, open wetlands, sands and gravels) in relation to total land surface is still relatively high in both cities: Berlin 20% and Helsinki 31%. Forests are the most common UGI habitats in both cities (Fig. 2.1.1). The share of agricultural habitats (fields, seminatural grasslands) in Berlin and Helsinki is 5% and 8%, respectively, and horticultural habitats (parks, lawns, gardens, cemeteries, street green) 10% and 8.5%, respectively. Of spontaneous habitats, open ruderals and brownfields were recorded under semi-natural grasslands in Helsinki, while in Berlin



brownfields are identified separately. In Berlin, street green was separated from public parks, while in Helsinki constructed street green was included in parks. Berlin has no open rocks, which is one of the key characteristics in the landscape of Helsinki.

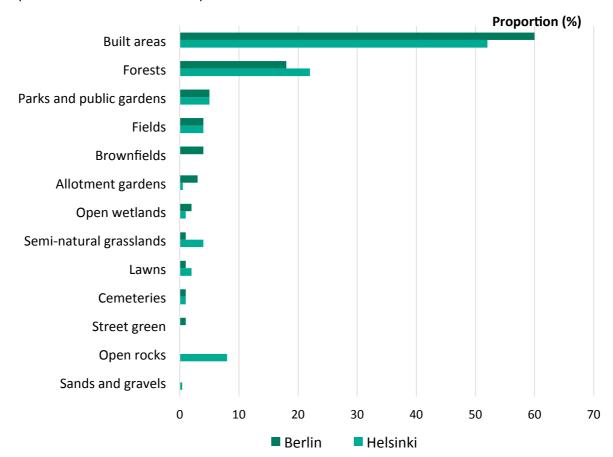


Figure 2.1.1. Proportion (%) of built areas and 13 different green habitats in relation to the total land area in Berlin and Helsinki.

Biodiversity based on number of species (including natives and non-natives) is extremely high in both cities, and they are harbouring relatively significant number of all species recorded in Germany and in Finland (Fig. 2.1.2). In Berlin, over 8,000 species (2179 vascular plants, 185 birds (165 breeding birds among them) and 59 mammals) have been recorded. This number includes natives, non-natives and neobiota. However, typical for urban environments, few generalist species usually dominate the abundance, while the majority of species exist in low abundance. Based on current records, there are over 1,600 species in Helsinki. Plant and insect species diversity is high especially in semi-natural grasslands and ruderals (Vierikko et al. 2014). Especially biodiversity values of forests, e.g. for polypores, are well recorded in Helsinki. Conservation values of forests in Helsinki have been estimated to be high even at the national level (Vierikko et al. 2014), which makes them potential habitats for species that cannot survive in intensively managed commercial forests in rural landscapes (Kowarik 2011).



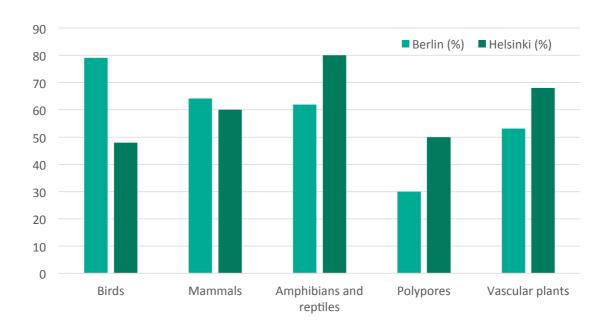


Figure 2.1.2. Proportion (%) of recorded species of different taxonomic groups in Berlin and Helsinki in relation to total number of species recorded in Germany and Finland, respectively (Data sources: Berliner Strategie zur Biologischen Vielfalt 2012, City of Helsinki 2015, Rassi et al. 2010).

Our general comparisons of UGI and urban biodiversity showed that despite the two capitals differ greatly in the size of land area and population, and the amount of green areas, the proportion of different UGI types (e.g. forests: 22% and 18 %, public parks: 5 % and 5% in Helsinki and Berlin, respectively) are quite similar in both cities. The mixture of different habitats (e.g. forests, seminatural grasslands, brownfields) is one of the key determinants of biological diversity and diverse nature experiences in the city. Changes in UGI diversity i.e. composition of different habitats reflect dynamic human-nature interactions in time and cultural history of cities over centuries (Kurtto and Helynranta 1998). Cultural history of cities is one of the main factors contributing to species richness especially regarding plant species in European cities (Pyšek 1998, Kühn et al. 2004). For example, old parks and especially old estate gardens with large trees can be very diverse in vegetation and insect species. Many traditional cultivated taxa can only be found in estate gardens (Kurtto and Helynranta 1998). Old, large oaks (*Quercus* sp.) and ashes (*Ulmus* sp.) are habitats for many polypores, mosses, lichens and invertebrates (Vierikko et al. 2014).

However, despite Berlin and Helsinki have similarities in proportions and in the relative amount of the identified 15 urban habitats, their proximity, ecological and social values can differ a lot. For example in Berlin large forest areas are situated in peri-urban districts while in Helsinki the forest network of small and large forest patches covers almost the entire city excluding the city centre (Fig. 2.1.3). Forest patches in Helsinki are strongly fragmented and the majority of 600 patches are less than 3 ha in size. This kind of forest network on one hand provides more opportunities for residents to have close-to-home nature experiences, but on the other hand decreases ecological quality of forests through trampling and wear (Hamberg et al. 2009). Small forest patches (< 3ha), on the



contrary, can be important recreational sites for children, dog walkers and elderly people for daily use (see more in chapter 3.2).

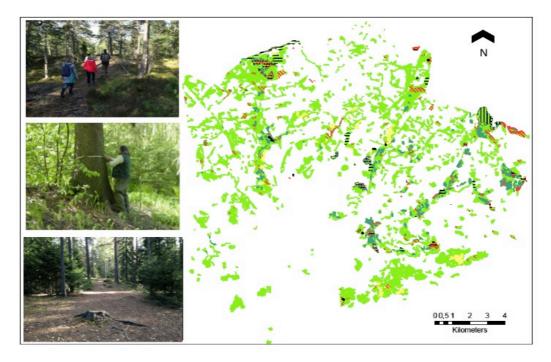


Figure 2.1.3. The forest network covers almost the entire city of Helsinki. Biodiversity values of forests are well-documented (middle picture). Forests are strongly fragmented and the size of forest patches varies between 0.01-375 ha. This offers more equal opportunity to use forests (upmost picture), but on the contrary increases trampling pressure causing changes in forest structure and ecosystem function (lowest picture) (Photos and map: Vierikko et al. 2014).

Box 2.1. Methodological design

We compared urban green infrastructure (UGI) and biodiversity in Berlin and Helsinki based on available GIS-based data and database records. For Berlin, we used GIS-data produced by previous research (Larondelle and Haase 2012, Urban Atlas 2010) and a map of the urban green structure provided by the city administration (Senatsverwaltung in German). The GIS database on aerial photos as well as biotope and habitat maps were formal inventories mapped by experts. There are extensive literature and database records on biodiversity values including species records available for Berlin (Berliner Strategie zur Biologischen Vielfalt 2012). As for Helsinki, taxon group (e.g. bats, birds, vascular plants) specific information was used to analyze general biodiversity values at the city level and delineate respective hot-spot areas (places with many different species records). For Helsinki, the GIS map was produced by using multiple data resources: Urban Atlas (2010), open access geospatial data from the National Land Survey (2010), aerial photos and management classification map provided by the city of Helsinki (Vierikko et al. 2014). The Environment Centre of the City of Helsinki is keeping up the Nature Information System (NIS) that is an Internet service, which enables visitors to browse mapbased nature information on nature reserve areas, and areas valuable for fauna and flora (City of Helsinki 2015). The NIS is updated continuously based on formal inventories of the city and informal observations made by volunteer citizen experts.



2.2 Multitaxa assessment of Urban Green Infrastructure (UGI) – species diversity in cities

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Research phase: Environment

Database: Species inventories in the field

BCD indicators: UGS typology, biodiversity, UGS origin and evolution

- Urban parks make a large contribution to urban biodiversity in Lisbon and parks showed differences in diversity of all taxa, particularly evident in plants and soil invertebrates
- Communities in these taxa are dominated by a small set of species showing the human intervention in the space, as vegetation assemblages reflect both the past history and current management of the spaces
- Perceived biodiversity by park users does not correlate with assessed biodiversity highlighting the need for more proactive engagement actions
- Our results support the multi-taxa approach to assess the effects of human-nature interactions and ecosystem services provided

The city of Lisbon, confined by the river Tagus in its southern and eastern limits, has expanded along the river and into the interior in a crown shape, growing in a steady pace until the 1940s-1950s. By this time many new neighbourhoods and large avenues (*Avenidas Novas*) began to be built. After the 1970s-1980s, the city experienced a very sharp growth with the urban fabric sprawling into rural areas, occupying former farms (*Quintas*) and woodlands (*Matas*), which designations are still present in parks, places and streets toponymies (Fig. 2.2.1).

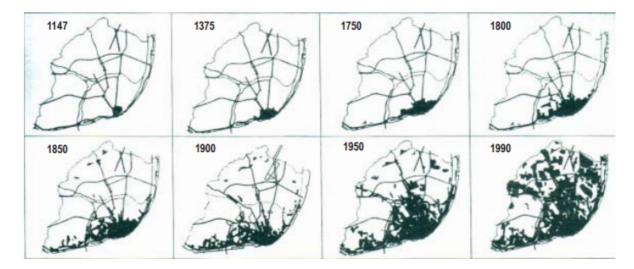


Figure 2.2.1. Evolution of urban sprawl in Lisbon until the 1990s.



Nowadays, Lisbon municipality has most of its total area (8,545 ha) covered by urban fabric of varying density, with urban green spaces (UGS) occupying around 22% (1,868 ha) of which nearly 900 ha correspond to a large forested area (Parque Florestal de Monsanto), created in the 1940s by the afforestation of former crop and pasture fields, to both ameliorate the city climate and create a monumental leisure park at the likeliness of Bois de Bologne in Paris. Of the remaining, 446 ha are occupied by parks, either public or private, from large urban parks, botanical and zoological gardens, to neighbourhood parks, with the other being occupied mainly by agricultural and semi-natural areas (530 ha) and derelict lands (140 ha) (EEA 2017). Urban parks represent therefore the dominant typology of Lisbon's UGI (Fig. 2.2.2) and are expected to be the major contributor for the city biodiversity.

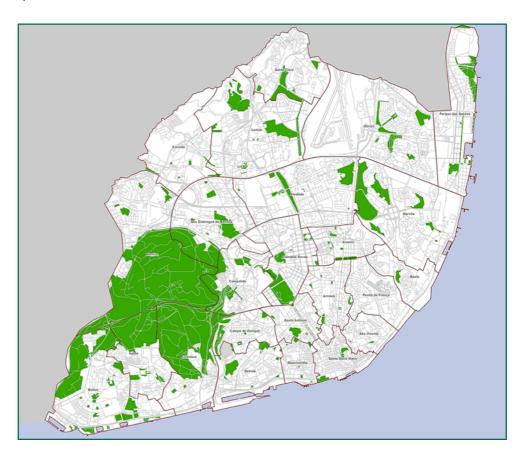


Figure 2.2.2. Current aspect of Lisbon municipality with parks depicted in green.

We selected twelve parks with the characteristics described in Table 2.2.1, to assess biodiversity and users' perception of biodiversity (see Figs. 2.2.3 and 2.2.4 as examples of two of the studied parks). Biodiversity assessments followed a multi-taxa approach by sampling lichens, vascular plants, trees, soil invertebrates, butterflies and birds, while users' perceptions were obtained through face-to-face questionnaires.



Table 2.2.1. Characteristics of sampled parks according to their age, origin and design.

Park	Park construction	Park age (years)	Origin / design	Date of neighbourhood	Surrounding matrix
	(year)			urbanization	
Jardim da Estrela	1840s	>100	English design	1800s	Urban
Gulbenkian	1960s	50	Modern Portuguese design	1900s	Urban
Mata Benfica	1910s	>100	Former farms	1900s	Urban
To and Managed India	s 1740s	> 100	English design/ former	1000	Urban
Tapada Necessidades			royal game reserve	1800s	
Mata Alvalade	1950s	50	Former planted woodlands	1940s	Close to other GS
Quinta das Conchas	1900s	> 100	Former planted woodlands	1990s	Close to other GS
Vale Fundão	1970s	50	Former planted woodlands	1960s-1970s	Close to other GS
Vale Silêncio	1950s	60	Former planted woodlands	1940s-1960s	Close to other GS
Parque do Calhau	1940s	70	Planted forest	NA	Green
Keil do Amaral	1940s	70	Planted forest	NA	Green
Montes Claros	1940s	70	Planted forest	NA	Green
São Domingos Benfica	1940s	70	Planted forest	NA	Green



Figure 2.2.3. Jardim da Estrela.



Figure 2.2.4. Mata de Alvalade.

The assessed parks showed to be quite representative of the overall city biodiversity, with high percentages of identified species when compared to the available species lists, except for soil invertebrates for which no previous inventory was made in the city of Lisbon and we were able to identify 84 taxa (78 families, 35 orders). As for the remaining taxa, 36 lichen species were detected in the parks, which represent nearly 86% of the species identified in a study covering the overall city (for detailed information see chapter 2.3). For vascular plants, 223 species were identified which represent 45% of the total number of listed species, but this number is likely to increase as some were only identified at the genus level. As for trees, excluding Botanical gardens, 224 species are reported to occur in Lisbon and 83% of those (n=185) were found in the study parks. Relatively to birds (with census excluding aquatic and nocturnal species), 63 bird species were previously reported to be resident or regularly present during the breeding season in Lisbon's green spaces and 70% (n=44) of these were detected. Contrasting with previous numbers, for butterflies only 44% (14 out of 32 reported species) were inventoried, but sampling is most likely biased due to the unusually windy days during the sampling season.



According to the species-area relationship, larger areas tend to harbour higher number of species. For each taxa individually (Fig. 2.2.5), we observed a positive trend, although not statistically significant, except for vascular plants, between species richness and park area, with larger parks holding higher number of species, as expected according to the above-referred theory. These results are in agreement with the conclusions of the previous chapter, and reinforce the need for integrating large green areas in UGI to support high levels of biodiversity and maximize the provisioning of ecosystem services.

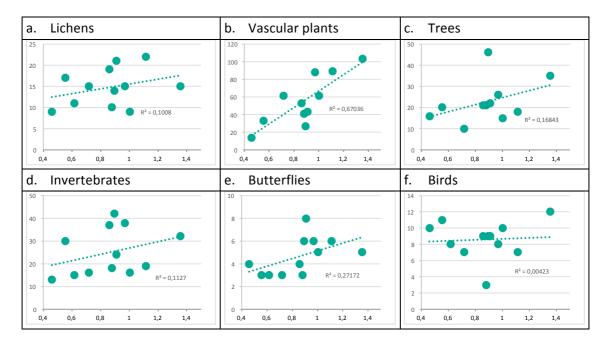


Fig. 2.2.5. Species-area relationship; X axis – log (area) (ha); Y axis – number of species (n).

The same pattern is observed for species diversity, with no evident differences between parks when considering sampled taxa altogether (Fig. 2.2.6), although in each park taxa are not evenly distributed, with different taxa contributing to achieve the same global level of biodiversity.

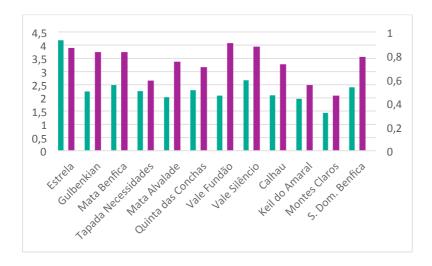


Fig. 2.2.6. Shannon diversity index () and eveness of taxa frequencies () of each urban park.



A simple pairwise comparison (Student's t-test) of taxa abundances between parks showed significant differences between some parks (Table 2.2.2). Most differences were detected between old, designed parks, embedded in the urban matrix and all the others, which proved to be mainly due to the variability in vascular plant species assemblages, but also of soil invertebrates and lichens assemblages, reflecting the long term human intervention in those spaces (data not shown).

Estrela (EST) Gulbenkian (GUL) Grey Mata Benfica (BEN) BEN Tapada Necessidades (NEC) NEC Mata Alvalade (ALV) to GS Quinta das Conchas (CON) CON Vale Fundão (FUN) FUN Vale Silêncio (SIL) Calhau (CAL) Keil do Amaral (KAM) кам Montes Claros (MTC) MTC S. Dom. Benfica (SDB)

Table 2.2.2. Pairwise comparison of taxa in the parks (__ statistically significant differences).

The differences between parks became more perceptible when biodiversity indices are calculated separately for each taxa, with a concordant pattern of trees, grasses, soil invertebrates and butterflies showing higher variability (Fig. 2.2.7). Soil invertebrates showed the highest variability and a clear distinction between parks in the urban matrix and in the forested area, reflecting differences in soil quality but also in management practices, with plant litter, essential for soil invertebrates, being regularly cleaned in the urban matrix parks.

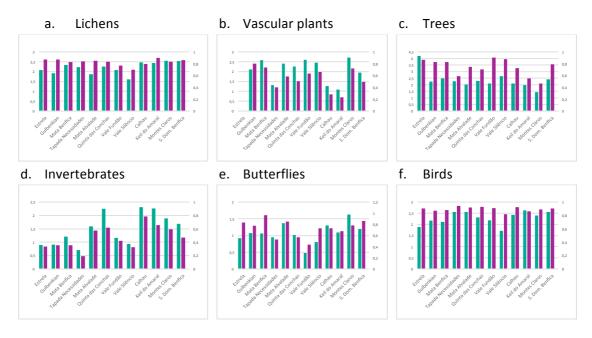


Fig. 2.2.7. Shannon diversity index (__) and eveness of species frequencies (__) of each taxa (a-f).



Despite inter-park differences in both taxa and species diversity, in each park the communities are dominated by a small set of species as depicted in Fig. 2.2.8, with this dominance being particularly evident for plants and soil invertebrates.

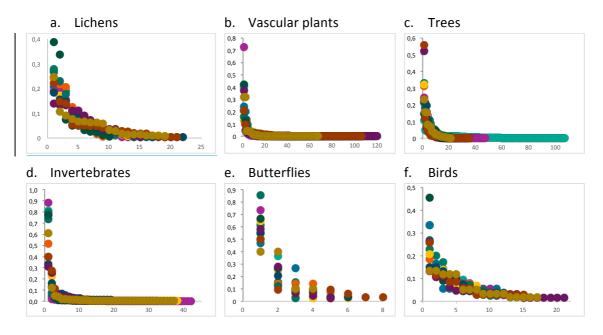


Fig. 2.2.8. Taxa rank abundance curves per urban parks (X axis – number of species; Y axis – relative abundance). The colours indicate the following parks:



Jardim da Estrela's (•) tree community presents the highest evenness reflecting its origin as an English garden style, with a high variety of ornamental species, which is still maintained nowadays. The lower evenness of plant species in the other parks reflect their origin as planted woodlands and farms, and the preference for a small set of plant species that still dominate today.

Although biodiversity of the parks proved to be high when considering known biodiversity at the city level (Santos 2012), when comparing measured and perceived biodiversity as assessed by users (Fig. 2.2.9), we did not find a correlation in any level of analysis, either using species richness or diversity indices, for trees, butterflies and birds altogether (Figs. 2.2.10 and 2.2.11) or per taxa separately (data not shown). This finding contrasts with that of Fuller et al. (2007) who found significant correlations between measured and perceived species richness for each taxon.



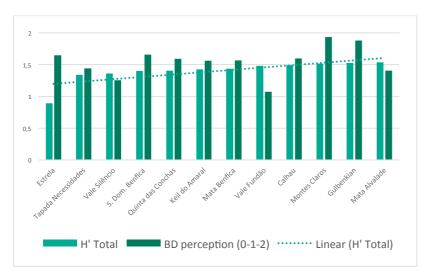


Fig. 2.2.9. Measured biodiversity of trees, butterflies and birds (Shannon index) (_) and perceived diversity (weighted average of attributed score) (_).

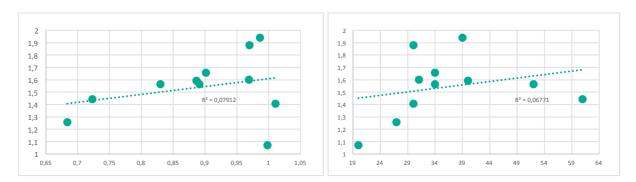


Fig. 2.2.10. Y - Perceived biodiversity x – Shannon index for trees, butterflies and birds.

Fig. 2.2.11. y – Perceived biodiversity x – trees, birds and butterflies species richness.

Biodiversity perceived by users seems to be more related to the quality of the green space than to existing biodiversity as it is inversely proportional to the number of disturbing features in the park as referred by users (Fig. 2.2.12). This agrees with the opinion of Voigt and Wurster (2015) who advocate that lay people use the term 'diversity' to reflect much more than 'biodiversity', 'number of species' or 'quantity of structural elements', but rather the subjective quality of the site that expresses their feeling of well-being and pleasure of being there. This statement is further supported by the observed positive correlation between perceived restorativeness and biodiversity (Fig. 2.2.13), as was also found in a study performed in the UK by Dallimer et al. (2012), who have shown that perceived biodiversity was more related to psychological well-being rather than to actual number of species.



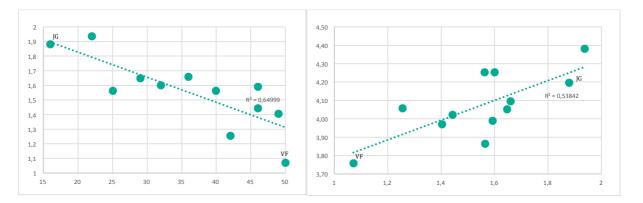


Fig. 2.2.12. y – Perceived biodiversity x – number of referred disturbing features.

Fig. 2.2.13. y – Perceived restorativeness score x – Perceived biodiversity.

This is particularly true if we contrast Estrela or Gulbenkian (JG) parks, highly managed and used by a medium-high socio-economic population strata, with Vale Fundão (VF), a poorly managed park serving an ageing population of lower socio-economic strata, the extreme data points in the above figures.

Box 2.2. Methodological design

The studied parks were chosen according to their location in the city and surrounding matrix. The chosen parks included four park-like areas within Parque Florestal de Monsanto, and therefore fully embedded in UGI, four in the city centre or in neighbourhoods surrounded by dense urban fabric and four in more recentlu built neighbourhoods and within no more than 300 m from other green space (Table 2.2.1). All chosen parks were older than 40 years to ensure a completely developed vegetation structure. The design, characteristics and plant assemblages of the parks reflect their location and the history of the city expansion. Parks in the historical centre, as Jardim da Estrela or Tapada das Necessidades, have the characteristics of romantic English gardens, while those farthest from the city centre represent, to some degree, the remnants of those former woodlands.

The studied taxa were selected on the basis of two criteria: i) taxon's performance as an ecological indicator and ecosystem services (ES) provider, ii) easy recognition by lay people and therefore a good indicator of perceived biodiversity. Lichens and soil macrofauna, although not recognized by park users, provide information on air and soil quality, respectively. On the other hand, trees, butterflies and birds are appreciated, besides being good indicators of ecosystem functioning and also providing key ES for urban sustainability (e.g., carbon sequestration, pollination, seed dispersion, respectively).

User's biodiversity perception was assessed with face-to-face questionnaires, an approach which enabled assessing biodiversity levels of the urban parks, but also understanding how users perceive and value existing biodiversity, and how these relate to stated well-being and place attachment. Users were asked to score park's diversity of fungi, flowers, trees, butterflies and birds in a scale of 1 (very low) to 5 (very high) for each taxa. Overall biodiversity was scored as low, medium and high and their weighted average calculated to obtain parks' perceived biodiversity. Users were also asked to score from 1 to 5, with a Likert scale, a set of six statements derived from the Perceived Restorativeness Scale (PRS) (Hartig et al. 1997) to evaluate the capacity of these parks to provide psychological restoration and stress relief.

Prior to sampling a geographic information system (GIS) was prepared for each park using



shapefiles provided by the municipality, with each vegetation patch classified in the field per the dominant vegetation structure and species. This GIS formed the basis of the sampling scheme for each taxa.

Lichens were sampled in four trees with medium bark roughness, following the standard European protocol (Asta et al. 2002) further described in chapter 2.3. Vegetation assessment was made using a stratified sampling scheme based on the patch type mapping and its area of occupancy, with at least 5% of each being sampled. Trees, shrubs and grasses were sampled along the same transect using the Point-Centered Quadrat method for trees and the Point-Intercept method for grasses and shrubs (Elzinga et al. 2001). Trees, shrubs and grasses were identified to the species level and their height measured, and for trees DBH (Diameter at Breast Height) was also measured.

For soil invertebrates, soil cores were taken in sampling points chosen according to the proportion of vegetation types (arboreal, flower bed, herbaceous) and dominant tree species in arboreal assemblages in each park (Smith et al. 2006). The soil was collected and kept refrigerated until analysis in the laboratory. Samples were then hand-sorted and all invertebrates (≥ 1 mm length) removed, measured and preserved in 80% ethanol until further identification to the family level.

Butterflies were sampled along fixed transects covering all different biotopes, according to the Manual of Butterfly Monitoring issued by Butterfly Conservation Europe (Van Swaay et al. 2012). All butterflies detected within 2.5 m on either side and 5 m in front of the observer were identified and counted. Bird censuses were carried out during breeding season (April-June), in the first hours after the sunrise, using 10 minutes point counts, in the park centroid and in a number of extra points proportional to the park size (Sutherland and Krebs 1997).

Note 2.2.





Margarida Santos-Reis, University of Lisbon: "Biodiversity (BD) and ecosystem services (ES) are intricately linked and changes in the first impact the provision of the second with consequences on the system's resilience. This is particulary relevant in urban environments were BD is mostly concentrated in the UGI and cities differ in UGI typologies and patchiness within the urban fabric, resulting in different degrees of human exposure to nature and therefore on human well-being. Spatially-explicit knowledge on BD levels in the UGI is therefore of outmost importance to allow ES mapping and quantification. This depends on multi-taxa field surveys that, although resource-demanding, go much beyond the traditional species lists available at the city level. Besides places of social cohesion, UGI components within the city are also the places that citizens search to contact with nature, and their well-being is positively related to perceived BD. However, comparisons between measured and perceived BD show a lack of consistency and this evidence challenges the needed alignment for management and planning purposes. To reduce mismatch between measured and perceived biodiversity, efforts to increase citizens' species identification skills and understanding on ES, as well as engagement in long-term monitoring of BD ("citizen-science"), are much needed. This integrative approach links materialised (e.g. BD levels), lived (e.g. active use of natural elements) and stewardship (e.g. management) diversity in cities.



2.3 Epiphytic lichens in Urban Green Infrastucture (UGI) – indicators of environmental justice

Research phase: Environment

Database: Lichen inventories in the field **BCD indicators:** UGI typology, biodiversity

Contributing authors of this chapter: Joana Vieira, Paula Matos, Pedro Pinho, Margarida Santos-Reis, Cristina Branquinho

- Cities are affected by air pollution and the urban heat island (UHI) effect (higher temperatures
 inside the city than outside), responsible for health, social and economic problems. To increase
 human well-being in urban areas it is important to identify the critical areas affected by these
 problems with high spatial resolution and to evaluate the effectiveness of mitigation measures.
- To monitor the intensity and extent of air pollution and of the UHI effect in urban areas we
 used a typical ecological indicator lichen biodiversity. The epiphytic lichens (living on tree
 trunks) depend exclusively on the atmosphere for their nutrition and hence are indicators of air
 quality and of atmospheric conditions. This work aimed at modelling the effect of size (area)
 and of vegetation density of parks to mitigate air pollution and the urban heat island effect in
 cities.
- With the obtained model we were able to estimate at all parks of Lisbon both air quality and
 the UHI effect that were then superimposed with the age of the population. It was found that
 areas with higher percentage of elderly people were also the areas with lower air quality and a
 more intensive UHI effect. These results signal the areas of the city where efforts should be
 focused on mitigating these problems especially under heat waves and high air pollution
 conditions.
- Using the same model we estimated the contribution of the vegetation to improve air purification and climate regulation ecosystem services in urban areas.

Urban green infrastructure (UGI) provides numerous ecosystem services in urban areas, such as air purification and microclimate regulation (Pinho et al. 2016, Munzi et al. 2014). Detailed information on the provision of ecosystem services and its integration with social-demographic data is an important tool to improve the quality of life of urban inhabitants, as it allows managers to take informed decisions regarding UGI management to optimize the provision of these ecosystem services.

Studying the provision of ecosystem services by UGI requires data with high spatial resolution. This means that we should be able to gather information on air quality and microclimate in many sites within a city. However, as air quality monitoring stations have high operating costs, they are just a few in cities and seldom associated to green infrastructure. A solution to overcome this problem is to use ecological indicators (Llop et al. 2012, Ribeiro et al. 2016). Ecological indicators are components of the ecosystems that can be used to monitor the overall effect of a particular environmental problem, in an easy, reproducible and cost-effective way (Lindenmayer et al. 2015, Nowak et al.



2015). Therefore, using them allows us to assess the effect of green infrastructure characteristics on air pollution reduction and microclimate regulation (Pinho et al. 2016, Munzi et al. 2014).

Lichens are a symbiotic association between a fungus and a green algae and/or cyanobacteria. They have been used since the 19th century as ecological indicators (Branquinho et al. 2015). Contrary to plants, they lack roots or cuticle, and for that reason they take up water and nutrients directly from the atmosphere and are unable to regulate their content. They work similarly to a sponge: if air humidity is low, they are dry and inactive; if air humidity is high they absorb the water and become active. When they become active, all the nutrients deposited in their surface are also absorbed, as are all the pollutants existent in the atmosphere. This means that the different nutrients and pollutants existent in the atmosphere are absorbed in proportion to their concentration in the atmosphere. Nonetheless, different lichen species have distinct sensitivities to atmospheric conditions (to water available in the atmosphere, or to nutrients or pollutants in the atmosphere). For example, some lichen species need to live in places where water is more abundant, while others can tolerate drier conditions. Thus, while some lichen species are sensitive to high levels of pollutants or changes in microclimate, and others are more tolerant, this differential sensitivity can be used to signal local conditions (Pinho et al. 2012, Matos et al. 2015).

Table 2.3.1. Lichen growth forms.

Functional group	Description
Crustose	Firmly and entirely attached to the substrate by the lower surface
Leprose	Like crustose but surface thallus with a granular mass appearance
Squamulose	Composed of small scales
Foliose narrow- lobed	Partly attached to the substrate with a leaf-like form and narrow lobes
Foliose broad- lobed	Same as foliose narrow-lobed but with broad lobes
Fruticose	3D-like structure, attached by one point to the substrate and with the rest of the thallus protruding from the surface of the substrate resembling a shrub

The number of species present in one place is one of the most common metrics used (Branquinho et al. 2015). When air pollution levels are very high, it affects all lichen species and so the number of species present is low (Llop et al. 2012, 2017). Therefore, a decrease in the number of species is seen with an increase in air pollution. The abundance of lichen species is another possible metric to study. However, with abundance as a metric we may not be able to observe some differences between sites, as lichen abundance may increase despite the air pollution (for instance, high levels of nitrogen may cause an increase in the abundance of some species, although it causes a decrease in the total number of species) (Pinho et al. 2012). A way of overcoming this problem is to analyse the different traits of the species that are important to its response to the environment (Matos et al. 2017). When we have considered lichen traits, we can analyse environmental changes (due to their different sensitivity referred above). For instance, in the case of microclimate and air pollution, lichen growth form is an important trait (Munzi et al. 2014). Species with fruticose growth form (like a small shrub)



have more surface area in contact with the atmosphere than crustose ones, and thus are more common in unpolluted areas (Table 2.3.1). Fig. 2.3.1 shows examples of different lichen growth forms. Other important lichen traits in the case of microclimate and pollution are their nutrient and water requirements (Pinho et al. 2012, Matos et al. 2015).



Figure 2.3.1. Different growth forms of lichen: crustose (a), foliose-broad (b), foliose-narrow(c), squamulose (d), fruticose (e), and leprose (f) (Photos by Joana Vieira, Paula Matos and Pedro Pinho).



Box 2.3. Methodological design



Forty parks situating in the UGI in Lisbon were selected in a randomly stratified way with the following criteria: location within the city, type of surrounding land cover and green space size (area). In each UGI epiphytic lichen diversity was surveyed in four suitable trees closest to the centroid of the green park. A grid with five squares, each with 10 x 10 cm, was attached to the trunk of each tree at the four main cardinal points, at 1 m above ground, adapting the sampling procedure of the standard European protocol (see the photo on the left). Lichen species frequency was recorded as the number of grid cells (out of 20 possible) where each species was detected. Lichen species were classified according to three characteristics (response traits): humidity requirements, type of growth form and eutrophication tolerance following Matos et al. (2015, 2017).

Environmental variables at each park were calculated, such as vegetation density as expressed by so-called Normalized Difference Vegetation Index (NDVI) and total park area. The information on Lisbon population at the parish level (age and area of residence of an inhabitant) was retrieved from the last Census in the city (2011).

Spearman correlations between biodiversity metrics and environmental variables were calculated and were considered significant if p < 0.05. A General Linear Model (GLM) with an identity link function was used to calculate lichen richness based on the environmental variables. Comparisons between models with different sets of predictor variables were based on Akaike information criterion (AIC) values, with the goal of obtaining the simplest model that satisfactorily explained lichen richness, allowing its practical use in predicting green spaces air quality. Quality of models were performed by cross-validation. The final model explaining lichen species richness in the study area included Area and NDVI. Demographic population data for each Lisbon parish was related to the estimated average lichen species richness of UGI in the same parishes.

The distribution of lichens varied greatly over the city and according to the park characteristics. Small parks with low vegetation density showed a lower number of lichen species, whereas large parks showed the opposite trend (Fig. 2.3.2). These results of lichen sensitivity to air pollution and microclimate showed us that parks with a higher abundance of species, including the most sensitive ones, have a higher capacity to provide the ecosystem services of air purification and microclimate regulation, than those where they are less abundant and less sensitive species are present. This allowed us to model the number of lichen species for the centroids of Lisbon Parks based on the area of the park and its vegetation density. With this model, we were able to estimate the lichen diversity richness to all parks in Lisbon (a surrogate of air quality and of microclimatic regulation) (Fig. 2.3.3). Results show that lichen species richness is lower in the center-south of the city (Fig. 2.3.3).

We observed that the parks where lichen diversity was lower (and thus, higher air pollution) have simultaneously the highest percentage of elderly population (Fig. 2.3.4). This may result in an increased risk, as this age group has a high susceptibility to respiratory infections and other diseases related to air pollution and heat waves. Projections forecast an increase of heat wave episodes in the future, which may lead to a future increase in social and health problems in city centres. Together, these results reinforce the necessity to mitigate air pollution and UHI effect in city centers.



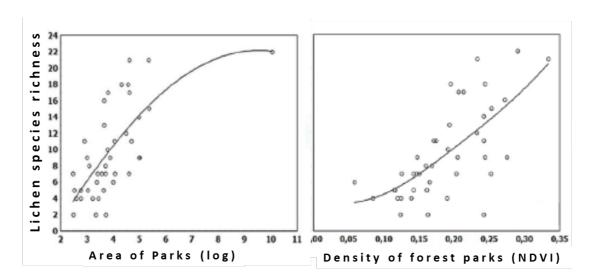


Fig. 2.3.2. Number of lichen species metrics observed in the centroid of 40 Lisbon Parks with the area of parks (Area log m²) and a surrogate of the forest density (NDVI – Normalized Difference Vegetation Index, of the green spaces and a buffer of 100 meter). The line represents the trend.

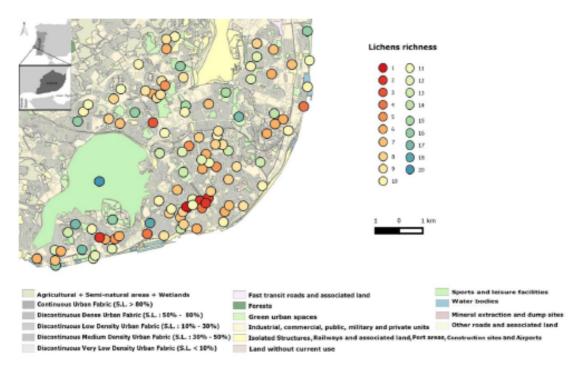


Fig. 2.3.3. Land-use map of Lisbon. Colored circles represent estimated lichen species richness ranging from low (red) to high (dark green / blue) for each green space of the city based on the best model.

This work shows very clearly that vegetation density and size of a park are very important features to improve local microclimate and air quality, highlighting the importance of UGI to mitigate the urban heat island effect and air pollution and improve human well-being. Using lichen diversity as a tool to assess air pollution and the UHI effect and combining it with social-demographic data provides useful information on human-nature interactions in cities and helps to direct management actions in UGI toward increased environmental justice in cities.



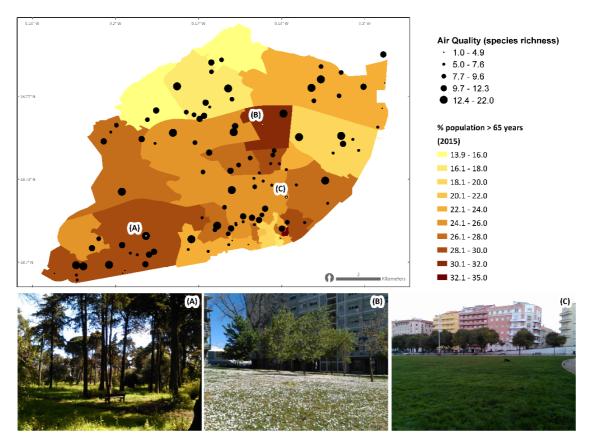


Figure 2.3.4. Map showing sampled species richness across the city of Lisbon and some images of the parks studied (a, b, c). Monsanto (a) is the largest urban park of the city, where the highest diversity of lichens – and thus better air quality, can be found.

Note 2.3. Why should we care about epiphytic lichens in cities?



Epiphytic lichens that grow on the tree trunks in cities are biological entities that go unnoticed to most people. Although they can host or feed many invertebrates, fix atmospheric nitrogen, etc., these functions are not critical in urban environment. The major function of epiphytic lichens for the general population is to act as an early warning signal of the city's environmental conditions. Thus, the presence of high diversity and cover of epiphytic lichen species should be regarded as a sign of good environment. On the other hand, the presence of only a few lichen species can indicate a degree of disturbance. The total absence of species should be seen as a sign of serious problems with air quality. Therefore, lichens should be seen as "nature watchers" that inform population about the environmental quality of our cities and citizens and decision makers can take decisions that reduce the exposure to such risks.



3 LIVED BIOCULTURAL DIVERSITY (BCD) IN EUROPEAN CITIES

Lived BCD refers to personal perceptions, interactions and values, e.g. direct and relational relationships (read more about different relationships in MS22, Vierikko et al. 2017). Emotional involvement with nature will influence an individual's relationship to the natural world (Kollmus and Agyeman 2002). Direct connections are an important factor shaping beliefs, values and attitudes towards the environment, as well as for participating or promoting planning, management and care of a place. Analyzing lived BCD in different spatial or social contexts helps us to identify current direct, relational and shared relationships between culture(s) and nature, and *place-based values* that different groups and individuals assign for UGI and associated biodiversity (Martín-López et al. 2012, Horlings 2014, Chan et al. 2016). Lived BCD refers also to cultural perceptions, interactions and values, e.g. culturally shared relationships. Culturally shared biodiversity components, that are meaningful for different cultural groups, can be called "cultural keystone biodiversity" or bioculturally significant places (Hansen and Rall 2014, Davies et al. 2015, Vierikko et al. 2017).

Explorations of how different social groups interact with, use and value UGI, or specific components of biodiversity (e.g. plant or animal species, decaying wood, ecosystem functions) are an essential ingredient of BCD research (Vierikko et al. 2017). However, these kind of studies do not reveal how socially inclusive different UGI places are (Ernstson 2013, Campbell et al. 2016). Changes in the use or values of UGI, as well as in place-making activities, may lead to shifts in the relationship between culture(s) and nature(s), where some societal groups, individuals or biological features gain while others lose (Buizer and Turnhout 2011). Therefore, place-based and contextualized, transdisciplinary research of lived BCD is necessary (Dempsey and Smith 2014). The chapter presents three examples of how to analyse lived BCD.

3.1 Bioculturally significant Urban Green Infrastructure (UGI) – public value of unique urban nature in Helsinki

Contributing authors: Kati Vierikko, Jari Niemelä, Vesa Yli-Pelkonen

Research phase: Interactions

Database: Internet-based PPGIS survey

BCD indicators: Biodiversity and ecosystem services/ Place memory

- Citizens in Helsinki are more often attached to original urban nature habitats especially forests and open rocks – than to agricultural or horticultural ones. Forests and rocks are most common UGI habitats.
- Citizens strongly appreciate daily contacts with urban nature and they prefer close-to-home small green areas than larger areas further away.
- Forests and rocks have also a strong cultural and social role in Helsinki, and citizens have strong emotions towards these habitats.
- However, citizens living in the dense city centre considered local intensively managed public parks as important places for unique urban nature.



In Helsinki, we studied urban green infrastructue (UGI) that is mostly valued by residents as unique urban nature. We call these places bioculturally significant UGI places. The case study is a good example of how proximity of different green spaces and close-to-home location matter when people give a meaning for UGI. Today, public participation in land-use planning and UGI management processes by using internet-based tools such as Public Participation Geographic Information System (PPGIS), has become common globally (Brown and Kyttä 2014). Collected open access data can be useful for researchers to make their own analyzes. Here we illustrate how data from surveys of public participation can be used when exploring BCD in cities.

We asked the inhabitants of Helsinki about unique urban nature sites as a part of the public participation process related to the new master plan of Helsinki. 1,404 respondents in total marked 4,912 locations of unique urban nature places in a publicly open PPGIS survey. It was possible to complete the PPGIS survey in Finnish, Swedish or English. Most commonly mentioned UGI habitat was forests, which received almost 2,500 locations pointed by 757 respondents and open rocks with 455 respondents and 812 locations (Fig. 3.1.1). Parks was marked by 375 respondents with 709 locations. The number of locations of one respondent varied from 1 to 100. Forests, in particular, received a significant number of locations (>50) by few respondents.

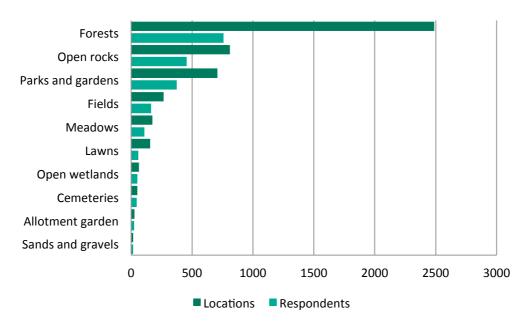


Figure 3.1.1. Number of locations and respondents in 10 different urban habitats in Helsinki.

Respondents were asked to name their home district. We categorized districts into three classes based on their urbanization level (population density and proportion of impervious land) and distance from the city centre: 1) urban, 2) semi-urban and 3) suburban. The amount of different UGI, especially original and agricultural habitats increased from urban to suburban. Horticultural green areas (cemeteries, parks) are most common in denser urban neighbourhoods. We found clear differences in locations between urban and suburban residents: the denser the city structure the less people consider forest as unique urban nature (Fig. 3.1.2). On the contrary, respondents living in the compact centre valued urban parks as a place for unique urban nature more often than respondents living in semi-urban or suburban areas.



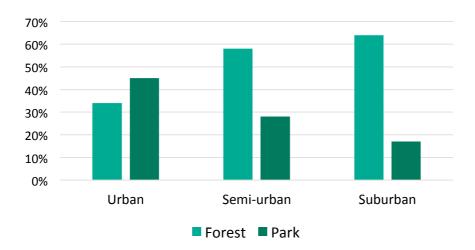


Figure 3.1.2. The proportion (%) of respondents assigning a value of unique urban nature in forests and parks (urban residents n=428, semi-urban residents n=306, suburban residents n=606). Respondent could assign value for both forests and parks, or other UGI types than forests or parks, meaning that a total number of respondents (1,340) considered here is lower than respondents assigning location for unique urban nature (1,404).

Forests were a strongly favoured unique urban habitat among residents in Helsinki (Fig. 3.1.3). This is not surprising, as urban forest network covers the whole city area, and forests are missing only in the city centre (Fig. 2.1.3). Forests have also been a common place for nature-related conflicts between managers, planners and citizens. Politicians and local NGOs have strongly argued for protecting urban forests and associated biodiversity from construction and intensive forest management. Tyrväinen et al. (2007) and Hauru et al. (2015) showed that nearby forests are highly valued by local residents for recreational reasons. Furthermore, biodiversity values of forests are well recorded in Helsinki.

In a PPGIS survey respondents were asked to score whether they prefer small forest patches close to home (score value 100) or large forest areas further away (score value 0). We explored that all respondents favoured nearby small forests (median score value 70.7) over large forest sites further away. Families (households with children) weighted nearby forests slightly more (median score value 75) than other household types (Fig. 3.1.3.). Results revealed that small forest patches nearby homes are important for locals. However, the questionnaire neither defined the size for "small" nor the distance to "the further".



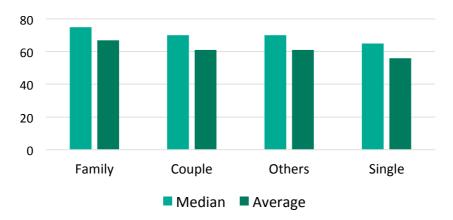


Figure 3.1.3. Median and average scores (0-100) of respondents belonging to different households gave when they were asked if they would prefer small forest patches nearby home (100) or large forest areas further away (0).

We analysed open comments that respondents had attached to places they had located in the survey. Forests received 52 % of all open comments (n=922), which indicated residents' close bond to forests and their concern towards future plans to destroy their favourite forest sites. Very often forests were valued as unique places to relax, enjoy nature, or to feel a real connection to wildlife and offering learning places and playgrounds for children. Vicinity of the sea was also mentioned, and as one respondent expressed: "One of a kind recreational place that absolutely needs to be saved for future generations. Lovely beach, lovely nature, lovely forest and a quiet spot to relax just out of the city".

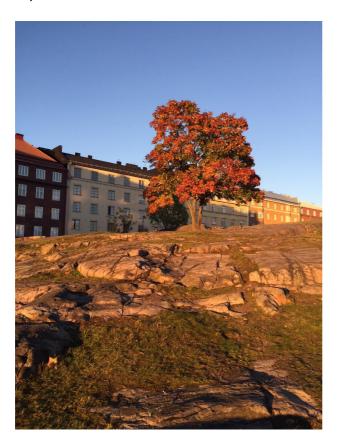




Figure 3.1.4. Helsinki is the rockiest capital in Europe. Vicinity of open rocks in the city center offers places for close nature experience (Photo by Kati Vierikko).

Open rocks was the second most popular UGI habitat that respondent valued as a place for unique urban nature in Helsinki (Fig 3.1.1). They are also the second most common UGI habitat in Helsinki (Fig. 2.1.1). Open rocks are ecologically and socially valuable green areas (Kurtto and Helynranta 1998, Kopomaa 2013). Rocky faces are typical components in urban parks, suburban forests, islands and seashores (Fig. 3.1.4). They offer favorite places for picnic, social gathering, relaxing, enjoying a view or more active use for climbing or wintertime downhill sled ride placed for children. This can also be seen in open comments respondents attached to their favorite rocks. Rocks are an inherent part of the city's cultural identity and they have been historically important places for fortresses and defense systems. Architecturally unique building and the famous tourist site Temppeliaukio church is built inside the rock. Many respondents referred to cultural-historical values as well as wilderness and untouched nature of rocks, as one respondent argued: "Unique green area with rocks, old pines and trees. An important recreational place, great view over the city. The rocky hill is the best local downhill sled riding place for children in wintertime". Plant species composition in rocks is rich and unique in Helsinki compared to surrounding rural areas, indicating shared cultural history with Sweden and Russia as many neophytes grow on urban rocks (Kurtto and Helynranta 1998). There are few biologically rich calcareous rocks in Helsinki. Rocky biotopes are very sensitive for trampling and especially lichens and mosses disappear and annual species in the family Brassicaceae become frequent (Kurtto ja Helynranta 1998).

Public parks were the third most popular green area type in Helsinki. Especially inhabitants living in the city center highly value public parks (Fig. 3.1.3). Parks were also considered socially important meeting points and places for cultural events. Cafes were considered as an essential part of urban parks, and many suggested to add such services to parks they were missing. Many residents expressed that parks represent the "true urban nature" with open lawns, large trees and flower beds, and as one resident commented: "Kaivopuisto park is a great park among other European parks, it is a true English style park, where you can find rocky nature and managed, planted vegetation". Parks in Helsinki differ greatly varying from very orderly and ornamental parks to more wilderness-type parks with sections of meadows or ruderals. Large, treeless and intensively mowed green areas were classified as lawns (see Table 2.1.1). Only few residents considered lawns as places of unique urban nature.

Results from mapping unique urban nature in Helsinki revealed that citizens were more often attached to original urban nature habitats than to agricultural or horticultural ones. Forests and rocks cover almost the entire city area and they are frequently used around the year. They have also a strong cultural and social role in Helsinki and local residents have strong bond to forests and rocks as we showed above. This traditional bond to forests seems to vanish when urbanization increases, and other public places such as parks or market places, and urban services such as cafes and restaurants become more important to citizens than closeness of forests (Tyrväinen et al. 2007). However, bond to urban parks can be emotionally as strong as to original habitats, and they can represent remnants of nature to many citizens. Also, single urban street trees can have multiple values for urban residents. In Helsinki, tree cuttings in urban parks can cause great resistance among residents and



lead to a strong conflict between managers and citizens, as was the case in the Kumpulanpuro environmental conflict in Helsinki (Vierikko and Niemelä 2016).

3.1. Methodological design

We used open access data from an online survey provided by the city authorities. The city of Helsinki conducted a public participation GIS survey to collect views of the city residents for the preparation of the new master plan of the city. The method allowed Helsinki residents to express their thoughts on the city's future. The survey was open between 4 November and 9 December 2013 and it was executed by a private consultant company Mapita Inc. (City of Helsinki 2015). The survey allowed respondents to mark locations on the map to indicate areas with unique urban nature. We compared locations of unique urban nature with UGI to look at what kind of urban habitats are mostly valued by residents (see chapter 2.1). Secondly, we compared areas which received many locations with UGI types (see more in chapter 2.1) to identify UGI habitats (e.g. forests, parks) that are on the one hand highly valued and meaningful to residents, and on the other hand biologically rich. In Helsinki, 1404 respondents in total marked 4,912 locations (respondents could locate multiple places in different UGI types) of unique urban nature places in the PPGIS survey. 76% of respondents were over 30 years old and the largest age group was 30-39 years (36%). About 13% of the respondents used a survey version in English. Unfortunately nationality was not asked in questionnaires. Households without children (67%) were dominating.

3.2 Use diversity of Urban Green Infrastructure (UGI) in five European cities

Contributing authors: Leonie K. Fischer, Ingo Kowarik

Research phase: Interactions

Database: Internet-based survey and field survey with face-to-face and online versions

BCD indicators: User group diversity, interactions

• Our study demonstrates that almost all respondents use both formal and informal urban green spaces in the five studied European cities.

- We detected general patterns at a European scale and as in most cases, urban green infrastructure is used for taking a walk, and nature-related activities (such as experiencing nature) are also prominent.
- The local context matters as there is variation in the ways people of different sociocultural backgrounds and in different cities use green spaces.

We conducted a field survey across five European cities, i.e. the Urban Learning Lab (ULL) cities (Bari, Italy; Berlin, Germany; Edinburgh, United Kingdom, Ljubljana, Slovenia; and Malmö, Sweden). The main aim was to find out how people with various sociocultural backgrounds and in different geographical regions use urban green spaces. For that, on the one hand, we gathered information on the respondents with a questionnaire. For example, we asked them about their age and gender, their educational background and whether they were gardening or not. There were in total 19 sociocultural variables that we assessed. On the other hand, we asked the respondents what they did



most often when visiting an urban green space. In this question, they had different options to choose from, including an option where they could specify an additional activity that was not listed and the option to say that they did not visit a green space at all. We asked this for three different urban green space types: parks, wastelands and forests.

Box 3.2. Methodological design

Within the Urban Learning Labs (ULL) of the five European cities, we performed a field survey on the interaction of urban residents with their green environment (Fischer et al. 2015a, b; see Figure 3.2.1). For that, we conducted interviews at many urban sites (without explicit connection between the questions asked and the places where the interviews were conducted) to find out, which main activities people perform in urban green spaces. We differentiated between urban parks, urban wastelands and urban forests. In total, more than 3,000 respondents gave us information on what they do in urban green spaces most often, together with information on their sociocultural backgrounds. From these data we derived a database that connects information on uses of urban green with sociocultural variables such as the respondents' gender, age, education, occupation, health status, their nature relatedness and migration background. In our field survey we targeted also people that are usually understudied, such as elderly or ill persons or people that do not speak the local language. For the latter, we translated the questionnaire into 10 different languages (those spoken in one of the five cities by at least 1,500 persons), resulting in 19 linguistic comparable versions. In a pretest phase in Berlin, we tested the questionnaire with about 1,000 persons to adjust a final version that was easy to understand also by non-experts (see Fischer et al. 2015b for methodological details).





Figure 3.2.1. Conducting a field survey in Berlin, one study city among the five ULL cities.

The results presented here in the first step describe three main activities that people could indicate for urban parks, wastelands and forests and relate these, in a second step, to the users' diversity. The three activities were chosen from the pool of 10 main activities and are among those that were named most often across the three urban green infrastructure types. More results of the field survey are given in the Deliverables D2.2 (Fischer et al. 2015b: *Interaction of biological and cultural diversity of urban green spaces*) and D3.2 (Braquinho et al. 2016).

Results clearly demonstrate the importance of formal (forests, parks) and informal (wastelands) components of urban green infrastructure for urban people. Of the more than 3,000 respondents, 99% visited urban parks, 97% visited wastelands, and 89% forests in general. Across the five European cities most people went to parks, wastelands or forests to take a walk (see pictures in



Figure 3.2.2). In parks, the second major activity was to relax, whereas people visited wastelands and forests also very often to experience nature. For forests, people also very often mentioned that they passed through them, e.g., on their way home or to work. In parallel, we found out that only 1.4% of the respondents did not find their main activity among the uses listed in our questionnaire for parks, 1.4% for wastelands and 2.4% for forests.



Figure 3.2.2. Getting in touch with nature. Across the five European cities, people often go to parks, wastelands and forests to pass through the green space, e.g., on their way home (top picture), to take a walk (picture in the middle) or to experience nature (picture at the bottom).



The geographic and cultural context

A more detailed look at these data allowed us to detect differences in the diversity of green space use at a European scale, which Figure 3.2.3 illustrates: Three of the most often mentioned activities across the three green space types (to pass through, to take a walk, to experience nature) differ in their frequencies between the five European cities. That is, the geographic and cultural context of the people matters for how they use urban green spaces.



Figure 3.2.3. Use diversity in five European cities and across three green space types. The graph displays how many of the respondents in all five European cities together (panel A) and in each European city (panels B to F) use urban parks, wastelands and forests for the three main activities "to pass" (= pass through), "to take a walk" and "to experience nature", respectively. The three use types were very prominent among the use types, from which the respondents were able to choose (see Fischer et al. 2015a, b for more details on the study design).



For example, people in Bari, Italy, do not use urban green spaces to pass through them on their way as often as people do in other cities. If at all, people in Bari pass through parks and forests, but not wastelands (Figure 3.2.3, panel B). In contrast, people in Ljubljana do quite often pass through forests on their daily way, exceeding by far in the proportion of that activity the other cities. In the cities Bari, Berlin and Edinburgh, people visit nearly all three green space types equally to experience nature (Figure 3.2.3, panels B, C, D) whereas in Malmö especially wastelands and forest are popular for experiencing nature (Figure 3.2.3, panel F), as are wastelands in Ljubljana (Figure 3.2.3, panel E).

The sociocultural context

Regarding the sociocultural backgrounds of the respondents, our results point to some differences in who is using urban green spaces in which way (Tables 3.2.1 - 3.2.3). As shown in some local studies (Sang et al. 2016, Palliwoda et al. 2017), female park visitors were generally more active than male visitors. People who mainly use wastelands for taking a walk were on average younger (38 years) than those walking on woodlands (39 years) and parks (42 years) (Table 3.2.1). The proportion of females reported to take a walk in wastelands (64%) was slightly higher than in forests (60%) and parks (59%). This indicates that the wild, or informal, character of wastelands was not more associated with feelings of unsafety than in conventional green spaces like forests or parks. Over 80% of the respondents reported to be at good health when they predominantly go for a walk in any of the green space types in question.

Table 3.2.1. Sociocultural background variables of people that most often take a walk when they visit an urban park, wasteland or forest. Included are the answers on the activity "to take a walk" of 980 respondents in parks, 195 respondents in wastelands and of 435 respondents in forests. Numbers show the proportion in each of the categories, except for the variable "age" (mean). Numbers may be below 100% as proportions of NA are not displayed.

		Park	Wasteland	Forest
Age	mean	41.7	38.1	39.8
Gender	male	40	35	40
	female	59	64	60
Walking a dog	yes	10	8	8
	no	88	89	90
Gardening	yes	58	56	61
	no	41	43	38
Health	good	82	82	83
	bad	14	14	15

People that reported that their main outdoor activity is to pass through green spaces (Table 3.2.2), had an average age of 36 years in the green space type wasteland and 42 years in the green space types park and forest, respectively. Passing through forests was especially prominent for female respondents (62%). About 13% of our respondents were dog walkers that used wastelands for passing through. Up to 85% of people that reported to use green spaces to pass through indicated a good health status.



Table 3.2.2. Sociocultural background variables of people that most often go to an urban park, wasteland or forest to pass through them on their way to work, home etc. Included are the answers on the activity "to pass through" of 257 respondents in parks, 126 respondents in wastelands and of 37 respondents in forests. Numbers show the proportion in each of the categories, except for the variable "age" (mean). Numbers may undergo 100% as proportions of NA are not displayed.

		Park	Wasteland	Forest
Age	mean	42.0	36.1	42.1
Gender	male	42	42	38
	female	57	56	62
Dog walk	yes	8	13	8
	no	91	87	92
Gardening	yes	64	61	65
	no	35	38	35
Health	good	79	85	76
	bad	17	13	16

People that go to green spaces to experience nature were on average between 42 and 43 years old (Table 3.2.3). While for male respondents forests were the most interesting green spaces for experiencing nature, urban parks were most attractive for women: up to 66% were female that reported to go to parks especially for experiencing nature. Very few people that reported to walk a dog regularly went to wastelands for experiencing nature (7%). Similarly to the other two use categories, about 80% of the green space users that went outdoors for experiencing nature indicated to be at good health. This indicates that providing access to urban green spaces – and associated health benefits – is a vital challenge for urban green development.

Table 3.2.3. Sociocultural background variables of people that most often go to an urban park, wasteland or forest to experience nature. Included are the answers on the activity "to experience nature" of 406 respondents in parks, 136 respondents in wastelands and of 204 respondents in forests. Numbers show the proportion in each of the categories, except for the variable "age" (mean). Numbers may undergo 100% as proportions of NA are not displayed.

		Park	Wasteland	Forest
Age	mean	43.0	42.7	41.9
Gender	male	33	40	42
	female	66	60	58
Dog walk	yes	12	7	15
	no	86	92	82
Gardening	yes	68	68	69
	no	31	32	30
Health	good	82	83	81
	bad	14	12	15



The main insights from this study are:

- Our findings show on a broad European basis that different urban green space types are used by a variety of people and for a diverse range of activities. Only few people do not go outside for specific recreational activities. This demonstrates the important role that natural settings play for people that live in the European cities studied.
- A closer look at the ways how people with different demographic or cultural background use
 different types of urban green spaces reveals clear differences, e.g. in relation to gender or
 health status. The key conclusion thus is, that a range of different green space types is
 needed to meet the demands of different groups of users.
- Obvious differences in use patterns between people with good or bad health status indicate
 the challenge of providing access to green spaces also for people with health problems. The
 variation of use patterns among cities hightlights the need for considering the regional or
 local scale when linking supply and demand factors in urban green development
 (Hegetschweiler et al. 2017)
- Urban wastelands, which are informal green spaces, are approached by urban residents for partially similar reasons as are parks and forests. This is a surprising result as there is controversy about the value of urban wastelands for urban residents (e.g., Krekel et al. 2016, Brun et al. 2017). Wastelands are often associated with negative valuations, but may offer manifold opportunities for approaching urban nature (Kowarik 2017). Our study evidenced that wastelands do support a broad range of uses by urban residents. This points to unexploited opportunities to enhance liveable cities by integrating wastelands into the urban green infrastructure either permanently or as part of an interim use strategy.
- Unsurprisingly, urban green spaces are mainly used for taking a walk. Yet, different from our expectation, experiencing nature is also a highly relevant motivation for using urban green spaces. This holds not only for forests or wastelands as "wild" urban ecosystems, but also for parks. This adds a stong social argument to existing ecological arguments for supporting a biodiversity-friendly management of urban greenspaces. Since the opportunities to contact nature are strongly decreasing, mostly in young people (Soga & Gaston 2016), urban greenspaces thus offer opportunities to counteract this trend if adequately managed.
- Our field survey on the valuation and perception of urban biodiversity (Fischer et al. 2015b)
 as well as on how people use urban green infrastructure (Fischer et al. 2015b, Branquinho et
 al. 2016, this report) demonstrate positive attitudes of urban people towards biodiversity in
 urban green spaces.

In all, our study manifests that parks, forests and wastelands are key components of urban living for all sociocultural groups. With that, our evidence, based on a large European sample, show that green spaces are places, where people of different attitudes, and of different socioeconomic, demographic and cultural backgrounds have the possibility to meet, interact, and experience nature, on a common basis. Urban green spaces are thus places for BCD that support both liveable and biodiverse cities.



Note 3.2.

Assessing the human-nature intersection in cities



Dr. Leonie K. Fischer and Prof. Dr. Ingo Kowarik: "It was very exciting to assess data from so many people and from five different cities across Europe. To design this field survey and to gather the field data took us quite a while but our study is now really filling several knowledge gaps. For example, we can now describe differences in people's interaction with nature on a very detailed level, e.g., who are the people that want to experience nature in cities? What do young or old, ill or healthy people do most often? How about people that walk a dog regularly, do they have other needs? Beyond the information on who uses green spaces for what, we can also search for differences between the five geographical settings. For us, it was important to exceed on the knowledge on traditional green spaces such as parks, and to include also informal green spaces such as the wastelands studied. Especially in times of increasing diversity among urban dwellers, information on the geographic and cultural context of interactions in green spaces is crucial to develop urban green as shared environments."

3.3 Cultural diversity and social cohesion of public parks in three European capitals

Contributing authors: Kati Vierikko, Jasmina Lindgren, Mari Pieniniemi, Mia Puttonen, Paula Gonçalves, Dagmar Haase, Cristian Ioja

Research phase: Interactions

Database: Face-to-face interviews in the field

BCD indicators: Interaction with other users / user groups and socio-demographic and economic characterization of neighbourhood

- We explored visitors' perceptions of cultural diversity of urban parks in four European capitals.
 We conducted face-to-face interviews of over 1400 park visitors. We revealed that experiences and perceptions of cultural diversity differed between European capitals, but even more between parks in the same city.
- Some parks seem to support social cohesion while others have an insignificant role in supporting cohesion. Parks reflect the social identity of their neighbourhood and weak social capital or a negative perception of the area can decline the cohesion of park.

UGI should deliver multiple benefits and ecosystem services, support sustainability and resilience of cities. In addition, green spaces, especially public parks, should be inclusive and provide equal opportunities for residents. Present dynamics in cultural diversification is a great challenge in many European cities. It also raises new challenges for planning, designing and managing UGI. Cultural diversification can happen through the influx of migrants with different cultural orientations on the use of UGI (Jay et al. 2012, Kloek et al. 2013, Leikkilä et al. 2013), or among different sociodemographic groups or through differentiation in urban lifestyles (trends). Increasing cultural diversity will have an effect on meanings, values or perceptions assigned to UGI, which can cause



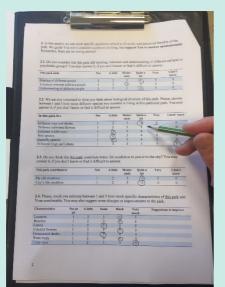
conflicts and inequity of use/access/values related to UGI. Some groups can be stronger or more empowered than others and notions of equal access, environmental justice and power issues become important. How well urban parks fill these multiple demands by the society and diversifying citizens and how we can measure social cohesion of parks? In this chapter we present our results on how culturally diverse and socially cohesive public parks are, by studying perceptions of park visitors on cultural diversity and community cohesion of parks in three European capitals: Berlin, Bucharest and Helsinki.

Social cohesion includes three components: social inclusion, social capital and community cohesion. Social inclusion refers to belonging of an individual to wider society and equal opportunity for all and access by all to goods and services essential to enable full functioning as a citizen (McDowell 2006). Social capital pertains to connections between individuals, i.e. social networks and the norm of reciprocity and trustworthiness that arise from them and the levels of trust people have in others (Putnam 2000, Kearns 2004). Community cohesion is distinguished as sense of belonging to the community, tolerance towards and respect for difference, appreciation of diversity and development of strong and positive relationships between people from different backgrounds (Forrest and Kearns 2001, Commission on Integration and Cohesion 2007). In this chapter the focus is on community cohesion of urban parks.

Box 3.3. Methodological design

Study of cultural diversity and social cohesion is a part of the research of biocultural diversity (BCD) in parks developed by the University of Helsinki (UH) and the University of Lisbon (FFCUL). The aim was to study biological and cultural diversity in parks by using several methods (mixed-method approach). The study included multi-taxa assessment of biodiversity values (chapter 2.2), observations of park users and use, and a short face-to-face survey (7-10 minutes) in the

park (i.e. on-site study).



The survey started with interviews. Visitors were asked about their motivations to arrive, duration of stay, visit frequency, if he/she arrived alone or with someone, if the park is special and why, enjoyed and disturbing things, does the person visit other green spaces, does s/he have special places (incl. non-green places) in the city, and perceptions of biological and cultural diversity. The second part of the survey was a questionnaire completed by the respondents. It included closed questions (Likert-scaling) where the respondents were asked to score different components of community cohesion, biological diversity and structural diversity of the park, and if the park contributes to personal and societal well-being. The third part covered a wide range of background questions: gender, age, education level, current occupation, birth country, mother tongue, marital

status, home address, illness and self-reported health and life conditions. In Helsinki and Lisbon, park visitors were observed in each 12 studied park. There were 10 different observation periods during weekdays and weekends. Observers recorded what each park visitor was doing and grouped the park visitors based on their gender, age, identified ethnicity and disability. 11 different groups and 19 different activities were identified.



In Berlin, Helsinki and Bucharest cultural diversity and community cohesion were studied with two separate questions. First, respondents were asked if they felt that the park is culturally diverse without giving any definition of "cultural diversity". If the respondent said YES (or NO), (s)he was asked to shortly explain why, allowing the respondent to express in his/her own words what he/she understands by cultural diversity. Key words of expressions (e.g. cultural events, different user groups, old people using the park) mentioned by a respondent were documented. The open answers were coded and grouped into seven components: 1) different groups (including ethnic, age, gender, tourist, immigrants, subcultures), 2) cultural events, 3) cultural history, 4) recreational activities, 5) design, 6) atmosphere, and 7) buildings and services of the park. Second, respondents were asked to score how much the park contributes to different aspects of community cohesion by asking if the park contributes to: (a) meeting other people: 1 (none) ---- 5 (very much), (b) tolerance towards others: 1 (none) ---- 5 (very much), and (c) understanding different people: 1 (none) ---- 5 (very much).

People's perception of cultural diversity (CD)

In all three cities the majority of the interviewed visitors considered that parks are culturally diverse, in Helsinki even two-third of interviewed visitors (Fig. 3.3.1). Variation between parks within cities was small in Berlin and largest in Bucharest. Only 10% of visitors considered that a park is culturally diverse in two parks in Bucharest. Both parks are located in the periphery of the city and situated in poor neighbourhoods. In Berlin, all three parks are located in relatively rich neighbourhoods. In Helsinki, the proportion of visitors feeling parks as culturally diverse varied between 30-86%, being lowest in parks were the neighbourhood is relatively homogeneous with few immigrants.

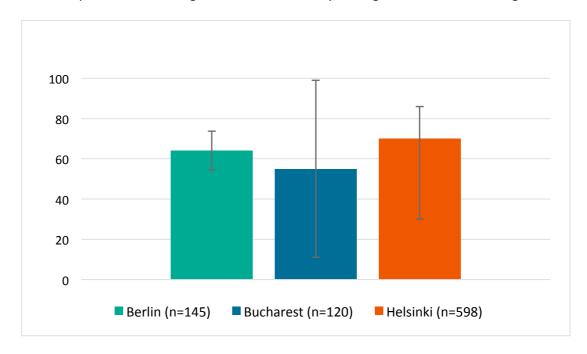


Figure 3.3.1. Proportion (%) of respondents who considered that the park they visited is culturally diverse. Bars in columns indicate variation in proportions between parks within a city. In Berlin variation was lowest and in Bucharest highest.



Having a closer look at how people interpreted cultural diversity (CD) in their own words revealed interesting differences between cities (Fig. 3.3.2). In Bucharest, people in general identified only few components (5) manifesting CD and the most commonly mentioned thing was cultural events. Only 10% of visitors mentioned different groups (e.g. foreign, ethnic) as reflecting cultural diversity, and in parks Brâncuşi and Motodrom by none. Very often visitors of parks in Bucharest could not give any definition why they consider parks are culturally diverse.

In Berlin, park visitors mentioned 11 different things in total when they interpreted CD. Almost half of the interviewed visitors interpreted cultural diversity as different groups, many referred especially to ethnic and foreign people. The design of a park and opportunity to do different activities were mentioned only in Berlin, and especially by visitors in the recently established park Gleisdreieck that is well-known for its unique park design. In Helsinki, a majority interpreted CD as different groups. Cultural history of the park and cultural events were considered as indicators of CD by more than 20% of visitors and atmosphere of the park – not mentioned by Berliner or people in Bucharest – manifested cultural diversity for 10% of visitors. In addition, few visitors considered nature as an important part of CD, but only in Finland. Buildings and local café or restaurant services were considered as a core component of CD by a minority of visitors in Helsinki (13%), Berlin (5%) and Bucharest (3%) (Fig. 3.3.2). Results, however, need to be interpreted with caution as some respondents did not feel parks as culturally diverse, despite that they mentioned diversity of users (for instance: "park is not really culturally diverse, but many groups use the park"). In Helsinki, visitors mentioned atmosphere as an important component for CD by meaning the park itself ("Everyone is welcome to this park") or the park could reflect the atmosphere of the neighbourhood.

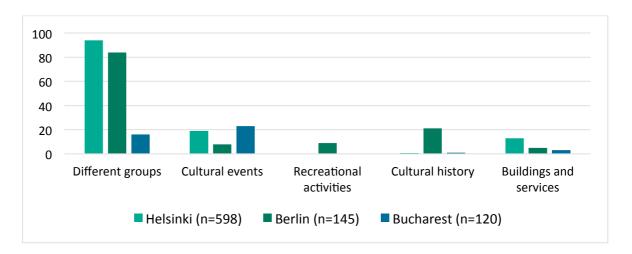


Figure 3.3.2. Five most commonly mentioned components reflecting cultural diversity (CD). Different groups include different socio-economic, ethnic, foreign, and age groups, as well as gender and tourists. The value in y-axis describes the proportion (%) of interviewees who mentioned the component. The same person could mention several components.

Park visitors' perceptions of community cohesion and social interaction of the park they visit was studied by asking them if they felt the park contributes to meeting, tolerance or understanding of others (Box 3.3, Fig. 3.3.3). Questions were not easy ones, and understanding received most "I don't know" answers, especially in Bucharest.



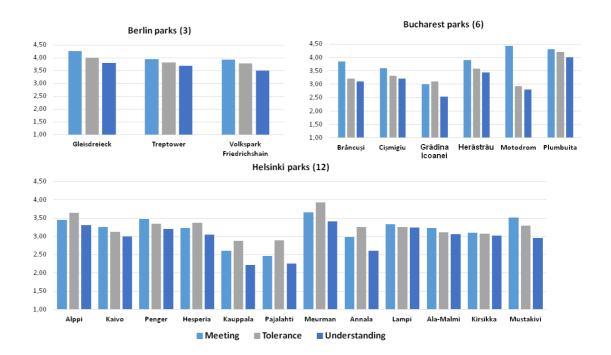


Figure 3.3.3. Average Likert-scale scores (1-5) for community cohesion given by interviewed visitors in parks in Berlin, Bucharest and Helsinki. On average, people scored lower values in Helsinki, but especially tolerance received higher scores than meeting or understanding in six parks in Helsinki.

In Berlin, people gave highest scores for all three components of community cohesion and the scores were lowest in Helsinki. Parks in Berlin are located in neighborhoods with relatively good socioeconomic status, whereas in Helsinki the studied parks were chosen to represent city districts with different socio-economic status and proportion of immigrants. Interestingly, in six parks in Helsinki, people scored tolerance higher than meeting or understanding others. This can be explained by the use motivations of park visitors in Helsinki, where many arrived at the park to spend time alone, and they were not interested in meeting other people (results not presented in this report). Despite people spent their time in parks alone, they were open and tolerant towards others. On the contrary, in Berlin and Bucharest, park visitors gave higher scores for meeting than for tolerance and understanding, except in the park Grădina Icoanei in Bucharest, which is located in a rich neighbourhood in the city center and where the respondents gave higher values for tolerance. Park visitors in Berlin and Bucharest arrived more often with someone and the reasons for arrival were more social (picnic with, walking with or meeting someone) than in Helsinki, which could explain high scores of meeting others.

Social cohesion in Helsinki parks

What factors influence the perceived cohesion? We analysed answers from the parks in Helsinki more closely. We wanted to see if location, user diversity (observations of different groups) or perceived CD (people's perceptions of cultural diversity of a park) correlate with scored cohesion. Our preliminary results revealed that visitors' perceptions of CD as different groups correlated with scores of cohesion, especially with meeting and tolerance, despite the correlation coefficient being rather low (Fig. 3.3.4). On the contrary, observed user diversity did not seem to support community



cohesion of parks. Interestingly, there was a weak negative, but not significant, correlation between tolerance and amount of immigrants living in the neighborhood.

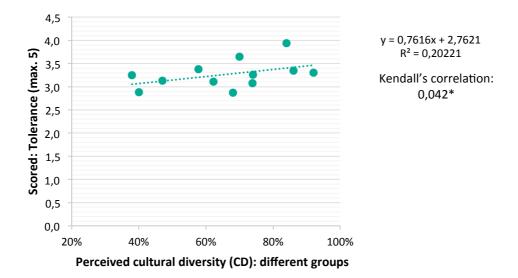


Figure 3.3.4. Correlation between proportion (%) of people who considered a park as culturally diverse due to different groups and scored tolerance (0-5).

Our results remind us that urban parks are not intrinsically social meeting places increasing social cohesion, but several other factors influence social cohesion of UGI. Kazmierczak (2010) studied social cohesion of parks in the UK and she revealed that park users' motivation and the socioeconomic reputation of the neighbourhood can either support or weaken perceived social cohesion (p. 275-280). Our results from Helsinki seem to support her findings on social cohesion. The cohesion was scored highest in Meurman park in Helsinki, which is located in a neighbourhood with strong social identity (Fig. 3.3.5). The park manifests community cohesion of the neigbourhood and community identity of residents. A small cafe plays a central role in building social cohesion in the park. Ecological characteristics of the park (park size, vegetation) play a minor role in this process. Indifferent relationship between people and nature in parks were also identified when analysing visitors' experiences – these small pocket parks can contribute to social relations, but are most likely too small for rich nature experiences and supporting biodiversity.





Figure 3.3.5. Café in Meurman park in Helsinki is an important component for supporting social cohesion of the park and entire neighbourhood (Photo by Kati Vierikko).

Note 3.3.

Why do we need onsite BCD studies of UGI?



Dr. Kati Vierikko, University of Helsinki: "Today public participation for UGI planning and management has become very common in European cities. Main tools for participation are Internet- and GIS -based surveys and workshops. Unfortunately, empowered and educated citizens often dominate participation, despite that web-based surveys are easy to fill at home. In addition, online surveys do not provide realistic information about the actual user and use dynamics of different green spaces. Ethnographic research (real-life field observations and interviews) has been common in North America, and recently in Europe. I favor the onsite approach, as it can give a detailed picture of social dynamics in parks or other green spaces. Observers can identify how, when and by whom green spaces are used. Are there, for instance, women, different ethnic groups or just one group dominating? Quick (<10 min) onsite interviews allow collecting larger datasets and covering a wider range of visitors than long in-depth interviews. Combined questionnaires with open and closed questions (e.g. Likert-scaling) allow visitors to express in multiple ways why and how they use green spaces, what they enjoy, dislike, etc. in parks. Asking these things with open and closed questions can help in identifying salient differences with challenging issues such as social cohesion in different green spaces. Lack of resources, short interviews and attitude of an interviewee towards an interviewer can influence the results and researchers need to be sensitive when interpreting results, not making too general conclusions. Placing interview results in a larger context, such as neighborhood, city district, or city, or comparing results in a European scale, can provide deeper understanding of other local, regional or global factors, such as ecological, economic, social and cultural beyond the local UGI. This can have a great impact on uses, values or importance of UGI for citizens."



4 STEWARDSHIP BIOCULTURAL DIVERSITY (BCD) IN EUROPEAN CITIES

Stewardship is the third aspect of the BCD concept. A growing body of literature on different forms of stewardship and engagement in nature or sustainability issues clearly show how people engage actively in shaping biodiversity to align with ideas about what is 'desirable' or 'valuable'. This desire to manage, improve or promote certain aspects of the natural world we live in is constantly changing both nature and biodiversity itself and how we understand and make meaning of it. Novelty, the break from business as usual, either through the arrival of new perspectives or new ecological features may provide windows for re-evaluation and opening up new fields of meaningful BCD. However, BCD is not only created by the intentional interaction between engaged stewards and a local ecology. Various human interests and pursuits come with indirect, if often profound, consequences. Land transformations or sheer human presence influence ecological processes and dynamics, as well as species communities. Thus, actively or passively, directly or indirectly, we coproduce and are influenced by the nature we are embedded in. The third dimension of the BCD concept tries to capture this inherent agency and some of the complex factors that shape humannature relationships over time. This includes the various activities aimed at maintaining or promoting biodiversity as well as those altering biophysical conditions for other reasons. Stewardship can emerge from three social contexts: institutional/public (municipality, government, research institution taking care of nature), communal (group of people, NGOs, organizations taking care of nature) and private (individuals or entrepreneur taking care of nature). We give an example how communal stewardship of BCD can be analysed.

4.1 Engagement with nature – allotment gardeners in Berlin, Leipzig and Lisbon

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Research phase: Interaction

Database: Face-to-face interviews

BCD indicators: UGS typology, UGS origin and evolution, socio-demographic characterization, well-being, local ecological knowledge, local ecological knowledge exchange, property-rights regime, specific rules and norms, engagement

- We analysed and compared characteristics of urban agriculture and gardeners in three European cities, two in central Europe (Berlin and Leipzig in Germany), and one in the Mediterranean region (Lisbon in Portugal) by interviewing gardeners and municipality staff
- While in Lisbon urban gardeners still have their roots in rural origin, this urban-rural connection seems to vanish among Central-European urban farmers, and they learn their practices through social media or with a help of initiators (city officials, experts)
- The study underpins the importance of allotment gardens as green spaces in cities as they –
 regardless which country studied provide a broad contact to urban nature, they are a social
 carrier of soil management practices and help to save species in cities (Lovell 2010).



Allotment gardens are an important element of UGI in almost all European cities, once installed for local food production and as a kind of outdoor health support for industrial workers, today as a mean to ensure the well-being of city dwellers, provide ecosystem services, help to learn about nature by growing own food and, to a certain extent, preserve urban biodiversity (Gómez-Baggethun and Barton 2013, Bell et al. 2016). The rise of urban allotment gardens (UAG) was driven by the increased industrialization in the XIX century, being a well-established practice in many countries in northern Europe, having reached its peak in the WWII period for food supply but also temporary housing reasons (for war refugees and bombed out). After a decline of importance and interest in allotment gardens in the 1990ies, along with the societal changes in large parts of eastern and southeastern Europe but also with an increase in labour-driven migration in whole Europe, nowadays, initiatives to implement UAG are expanding again (Bell et al. 2016) especially for their recreational component, providing opportunities for social cohesion, communication and community development (Kurtz 2001, Firth et al. 2011). The rising doubts in agro-industrially produced mass food and the interest in healthy food (vegetables, fruits, herbs) additionally has led to a certain revival of urban gardening in general (CoDyre et al. 2015).

History of allotment gardens in Berlin, Leipzig and Lisbon

Berlin was the European capital of UAG in the 1920s with 6,239 hectares and 165,000 lots used for gardening. Around 100 years later, only 2,992 hectares remained divided in 918 allotment garden colonies and 73,075 lots. Still, and despite this decline in numbers, Berlin is one of the most allotment-rich cities in Germany. UAG were first used to compensate supply shortfalls after WWI and WWII, but also to feed eastern Berlin during socialist times with fresh fruits and vegetables. In western Berlin, in comparison, UAG were more places for recreation in a green environment located in a limited area with island-situation of "the west" in the city of Berlin, situated in the GDR. These historical legacies are still visible in the activities and cultivation behaviour of east and west German urban gardeners in the city (Figure 4.1.1 A, A1 and A2, Tables 4.1.1 and 4.1.2).

Leipzig, the second "capital" of UAG in Germany, has 278 UAG colonies with about 39,000 lots occupying an area of 1,240 hectares. These UAG make up some 24 % of the green spaces (GS) in the city, a considerable share next to urban forests and classical parks (Figure 4.1.1 B, Tables 4.1.1 and 4.1.2). Leipzig is the city where the famous type of the "Schreber allotment garden" was established for the very first time and is still a historical site for the worldwide garden movement. The distribution of the UAG in the city is comparatively spread however with a clear urban-rural gradient. UA gardening became unpopular – as already mentioned in the introduction text – after the political turn in Germany in 1990, where many people left the city and unemployment increased dramatically. Today, UA gardening became popular again, also among young people, and thus vacancies within the UAG colonies cline. As the city of Leipzig is re-growing again since 2005, some of the inner urban UAG colonies are now under pressure to be replaced by more profitable new residential buildings (Haase et al. 2017).

In Portugal, agriculture has always played a major role in the development of rural areas and cities. In the XX century, the rural exodus to urban areas, especially to Lisbon, lead to a rapid growth of the city, with no concert for UGI planning, including urban agriculture. It was only very recently, that the



municipality included GS in its policies and practices. In the last decade, an increasing number of disperse and informal allotment gardens (IAG) emerged, especially after the beginning of the economic crisis of 2008 affecting Portugal (and Europe in general). To satisfy the local population's clear interest for urban agriculture, the municipality recognized the need for the creation of organised spaces where gardeners could have the opportunity and conditions to grow food products. Initiated in 2007, the development of a strategy for urban agriculture that includes, since 2011, the creation of several horticultural parks (HP) (Figure 4.1.1 B, B1 and B2, Tables 4.1.1 and 4.1.2).

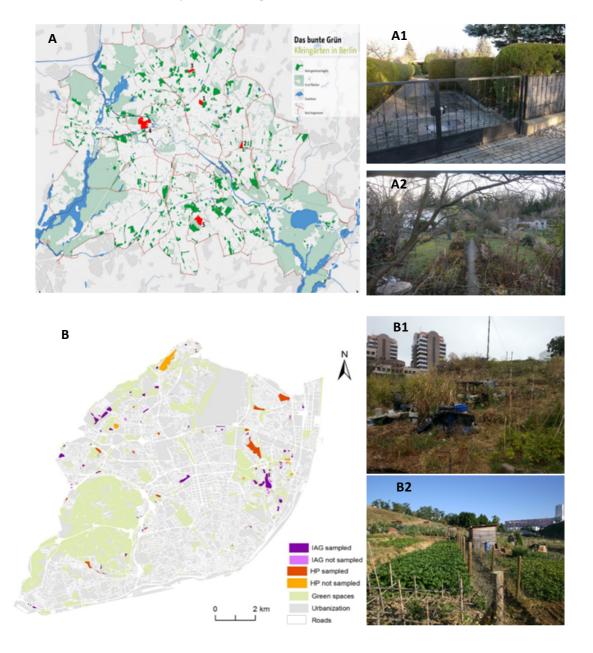


Figure 4.1.1. The UAG network of Berlin (A) and Lisbon (B). In Berlin, UAG are represented in dark green, and those analysed are in red: 1=UAG "eu Hoffnungstal and Heinersdorf", 2=UAG "Alwin Bielefeld"; 3=UAG "Daheim II"; 4=UAG "Charlottenburg Nord"; 5=UAG "Marienfelder Weg, Windmühle and Goldregen"; in Lisbon, sampled HP are in red and those not sampled in orange;



sampled IAG are in dark purple and those not sampled in light purple. The images "B1" (IAG) and "B2" (HP) illustrate UAGs where interviews were performed.

Table 4.1.1. City area, area and percentage of UAG (of the city surface area), number of UAG colonies, area of GS, % of GS (of the city surface area) and percentage of UAG in GS per each city.

City	Area (ha)	Area of UAG (ha)	% of UAG	UAG colonies (n)	GS area (ha)	% of GS	% of UAG within GS
Berlin	89200	2992	3.0	918	6400	46.7	none
Leipzig	28900	1240	4.3	278	5150	24.1	+/-30
Lisbon	8545	114 (c), 140 (p)	1,3 (c), 1,6 (p)		2354	27.5	4,8 (c), 6 (p)
IAG		77	0.9	482			
НР		36 (c)	0,4 (c)	15			
		63 (p)	0,7 (p)	21			

Indicators of governance & stewardship	Berlin	Leipzig	Lisbon - IAG	Lisbon - HP
Initiative	Created by citizen initiatives in the late 19 th and early 20 th centuries; supported by the city which bought land	Created by citizen initiatives in the late 19 th and early 20 th centuries; supported by the city which bought land	Created by citizens Lack of planning and mismanagement Not regulated/ supported by the municipality	Municipal (long waiting list)
Property-right regime	Municipal land managed by the AG associations	Municipal land managed by the AG associations	Municipal or private derelict land	Municipal land Many times, HP are areas with high concentration of IAG that were converted
Rules & norms	AG regulations	AG regulations	No rules or norms	Plots attributed per home proximity, Obligation to practice organic farming Payment of an annual rent
Management & engagement	Fenced and with proper sanitary and water supply facilities	Fenced and with proper sanitary and water supply facilities	Improvised fences and locks Poor sanitary conditions Precarious aspect	Provision of fences, shelters, water for irrigation, training and technical support
Plots			Single to multiple Size: 4 - 2800m ²	Multiple Size: ≈80 - ≈200m ²

Box 4.1. Methodological design

We performed semi-structured interviews in the cities of Berlin, Leipzig and Lisbon. The total area of urban allotment gardens (UAG) was calculated for each case study, as well as the area of green spaces (GS) and proportion of UAG in the green spaces (table 4.1.1.). Aiming to analyse both informal allotment gardens (IAG) and HP (horticultural parks) of UAG existing in Lisbon, we used information provided by the municipality and satellite imagery to understand the location of both types of UAG, having later confirmed if they were active or abandoned through field observations and satellite imagery. A total of 263 questionnaires were performed: 50 in 5 colonies of UAG Berlin, 110 in 8 colonies in Leipzig and 103 in Lisbon - 60 questionnaires in IAG and 43 in 14 HP. We conducted the inquiries to a single gardener per UAG, during winter and



summer, on weekdays and weekends, to include gardeners with different routines and characteristics.

Our goal was to characterise urban gardeners' socio-demographic and economic profile, as well as motivations, agriculture practices, perceived benefits and challenges faced while gardening. To accomplish this objective, the inquiry, constituted by close questions, was previously divided in six groups, each one with a specific goal: group A - The place you grow fruits and vegetables; group B - Cultivation; group C - Capacity; knowledge, motivation; group D - Costs; group E -Biodiversity; group F - Personal information. The first group consisted of questions regarding the UAG itself: purpose of the UAG, if the gardeners used it on their own or with other people, the renting price, size, the amount of time spend there, the products cultivated; the group B was related with the type of agriculture practiced, the regularity of use, fertilizers used, origin of seeds, seedlings and water for irrigation, and the main challenges faced while having an UAG; the group C was related to the way gardeners learned to cultivate; the group D focused on the expenditures of having an UAG and possible economic compensation; the group E was related with perception of biodiversity; in the final group we asked a wide range of personal information, with questions such as the distance from home to garden, household constitution, gardener's income, shopping habits (farmers, market, supermarket), gender, age, education level, work status, nationality and if the gardeners had a rural or city background. The inquiries were later analysed and answers compared between cities.

The interviews showed that gardening is an activity that is extremely important for gardeners' well-being. According to those interviewed, two factors were highlighted as well-being instigators, both mentally and physically, while gardening: i) the sense of entertainment, that occupies their minds allowing them to forget their concerns and problems, and ii) the opportunity of being outdoors, interacting with nature and socializing with other gardeners.

Regarding the type of agriculture practiced, we found that integrated agriculture – avoiding the use of pesticides and artificial fertilizers - and organic agriculture – no use of artificial fertilizers, pesticides or genetically modified seeds – seem to be the most frequent across the three cities (Fig. 4.1.2). In the IAG of Lisbon, 65% of gardeners still use some type of mineral fertilizer or chemical to increase production or to cope with pests. In the HP, as explained, in spite of being mandatory to practice organic agriculture, 19% of gardeners still use chemicals, even if it is only in small amounts. Overall, in urban agriculture, organic/alternative types of fertilizers seem to be dominant when compared to mineral ones, showing that UAG are not that "non-bio" or old-fashioned as often portrayed.

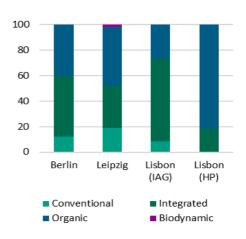


Figure 4.1.2. Relative proportions (%) of agriculture types practiced by gardeners in Berlin, Leipzig and Lisbon.

The main difference between UAG in Lisbon and Berlin relates to irrigation. Due to the appropriation of derelict land in the IAG, in most cases (70%), Lisbon gardeners can only rely on precipitation, facing lack of water during summer. This is due to the climatic conditions of the Mediterranean region, with wet and cold winters and dry and hot summers, which obliges many gardeners to cease their activity



during hot months. In HP, on the other hand, water is provided all year round, allowing production at all seasons.

The way that gardeners learned to cultivate seems to be an important parameter differentiating gardeners in the three cities. Two clear groups of urban gardeners were identified: those who learned through personal relationships, and those who learned from indirect sources (Fig. 4.1.3). Personal learning refers to learning with family members, friends or other gardeners, whereas indirect learning means learning through school or university, seminars or media. Overall, the "personal way" was more frequently referred than the "indirect way". However, we could understand that the

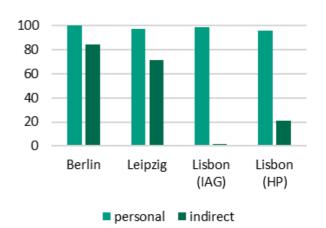


Figure 4.1.3. The way gardeners learned how to cultivate Berlin, Leipzig and Lisbon, in percentage.

number of urban gardeners that learned how to cultivate through indirect sources, differ: in central Europe, the indirect sources of learning seem to be much more popular than in the Mediterranean. In fact, in both German cities, learning how to cultivate through media sources is common among users (82% in Berlin and 67% in Leipzig). In Lisbon, learning with family members, particularly with parents, was the most common process (88% in IAG and 74% in HP). These gardeners usually are from rural origin, having moved to the capital in the 1960s – 1970s, and this suggests tradition and social cohesion as the most important factors in the learning process in Portugal. In HP, however, we could see that 16% of users where trained to cultivate by the Municipality and this was done prior to plots' attribution. These users are usually Lisbon-originated or moved from other big cities, having in most cases acquired an interest in agriculture due to curiosity and for wanting to experience something new, and not due to tradition.

In all cities, gardeners represented a variety of socio-demographic, economic and ethnic backgrounds (Fig. 4.1.4). But in all, most gardeners were more than 60 years old and no longer professionally active, having therefore more time to spend gardening. In addition, this activity is practiced by both men and women, except in Lisbon's IAG, where male gardeners were in the majority.

It is important to also highlight differences found in the governance and stewardship related issues among UAG types in Lisbon. Many gardeners in horticultural parks first had an informal allotment garden, and acknowledged the fact that access to water all year round gives them the possibility for permanent gardening and growing food. Most gardeners referred that the annual rent is not expensive, but those with less income mentioned difficulties in paying for that recreational activity. In addition, many of the interviewed in the IAG referred that they would like to rent a plot in an HP, however, due to the home proximity factor, many times, they prevented for being considered suitable candidates by the municipality.

Overall, UAG can provide strong recreational, social and many times educational inputs, fostering relationships between neighbors and cultural groups. This activity seems to be particularly important to people that are no longer professionally active, but also to young people to get/keep better



contact to nature in cities to learn and to experience flora and fauna (Steel 2013). Last but not least, allotment gardens as well as community gardens contribute to the food supply of and in cities (Kortright and Wakefield 2011) although they remain a niche in urban food security.

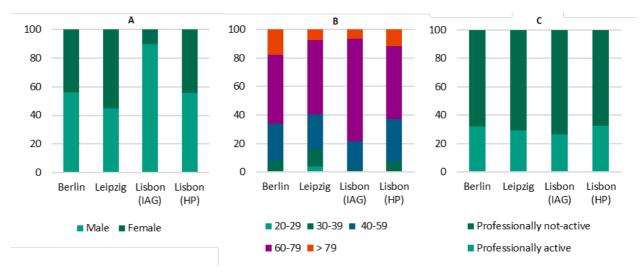


Figure 4.1.4. Socio-demographic characteristics of gardeners in the three cities, in percentage: A – gender; B – age; C – work status.

Note 4.1.

How can UAG contribute to the BCD framework in urban environments?



Dagmar Haase, Humboldt University of Berlin: "Allotment gardens in cities are unique examples of quite old prevailing green structures that supply a full range of ecosystem services to urban dwellers on the one hand but are also places of social cohesion, personal communication, learning about nature and where city dwellers can learn and practice food production for themselves in an increasingly industrialised and service-driven urban world. UAG contribute to the BCD framework as they are melting points of both nature and garden biodiversity and people. In UAG, gardeners often cultivate old species of apples, strawberries, tomatoes or different types of berries or even potatoes that urban citizens cannot anymore buy in local supermarkets due to the homogenization in agro-industry and, what is more, are often very expensive in organic stores. Thus, grown in the UAG these species contribute to a typical 'garden BCD' as they link species with actions and activities by the gardener as well as knowledge about the way of cultivating them. UAG are also places where many bird species in cities live benefiting from the multilayer structure of the green in gardens providing multiple habitats and places for breeding. Thus, UAG link materialised, lived and stewardship diversity in cities."



5 CONCLUSIONS - BIOCULTURAL DIVERSITY (BCD) IS SENSITIVE FOR LOCAL DIVERSITY

Contributing authors: Kati Vierikko, Vesa Yli-Pelkonen

5.1 Cities differ in their Urban Green Infrastructure (UGI)

Urban Green Infrastructure (UGI) is different and unique in every city due to geography, climate, land-use history, past and present human-nature relationship and management decisions. Consequently, biological diversity also differs among cities. For instance, the share of different UGI types, such as original, agricultural, horticultural and spontaneous and the associated habitat types strongly determine what kind of flora and fauna can found in each city (chapter 2.1). Although it is possible to find a rather similar share of typical UGI habitats in many cities across Europe, the distribution of habitats within the cities may differ a lot, for instance if UGI habitats are spread rather evenly across a city or if they are situated mainly in the outskirts of a city. UGI of a city is often determined largely by fragmentation history of so-called natural UGI habitats, which may have over time resulted in small patches of e.g. remnant forests across the city or only a couple larger contiguous remnant forest areas (perhaps now functioning as designated larger recreation areas) within the city borders. In addition, some of the remnants of "original" nature areas may have been modified to formal parks and new parks or other green areas (such as green roofs) may have been constructed to various places in a city, which together with "wilder" urban nature areas form the heterogeneous and unique mosaic of urban green infrastructure. Moreover, the heterogeneity of habitat types in the urban landscape often results in higher biodiversity in a city. Closeness of water areas brings an extra dimension to UGI as for instance in Helsinki numerous islands within the city area contribute to UGI network of the city as important, but often less readily accessible, recreation areas for the inhabitants of the city. On the contrary, in Berlin, for instance, the UGI in the urban landscape does not have this element of sea present.

UGI is often constantly under threat due to new development plans and construction of housing and other grey infrastructure, that may result in losing parts of green areas and UGI network. This may also modify the UGI in the future as cities expand and become denser and it very much depends on city planners and decision-makers how well UGI in each city is considered in the face of development. Increasing population in certain parts of cities, for instance where a new housing area is built, often creates increasing use pressure to certain UGI types (such as remnant forests) close to such newly-developed areas, which may, due to trampling and wear, risk the ecological and aesthetic quality, as well as biological diversity, of those habitats. In all, UGI in each city or urban area is in constant interaction with and under the influence of the surrounding human population, which makes it necessary to look at UGI in the context of both social and ecological dimensions.

5.2 Different relationships between cultures and nature shape Urban Green Infrastructure (UGI) differently in each city

As UGI is unique in every city, so are their inhabitants. We are facing a fast urban transformation, where some cities are growing and the others are shrinking. Urban population is becoming culturally



more diverse and immigrants from countryside, other countries or continents carry along their own experiences, values and perceptions of humanity, urbanity and nature. However, while studying human-nature interactions by using multiple methods in GREEN SURGE's WP2, we found interesting differences between and within cities on how people experience biological or cultural diversity, and how their engagement with nature develops (Fischer et al. 2015b, Vierikko et al. 2016, Vierikko et al. 2017). Cultural diversification and the impact of in-flux of migrants into cities will increase challenges related to communication, equity and justice issues (Vierikko et al. 2016). Moreover, due to the emergence of new urban values regarding biodiversity, simultaneously with the phenomenon of extinction of nature experiences, shifts in values and meanings regarding UGI and biodiversity may occur as well.

Urban residents share positive values about UGI irrespective of their cultural differences (Fischer et al. 2015b), and that different UGI types (e.g. forests, parks and wasteland) are used by a variety of people and for a diverse range of activities. Therefore, green areas are potential places facilitating social cohesion. However, UGI places are not socio-politically neutral places as people have unequal access or opportunity to engage with nature (Byrne and Wolch 2009, Peters et al. 2010). Our results remind us that urban parks are not intrinsically social meeting places increasing social cohesion, but several other factors influence social cohesion of UGI. A park manifests community cohesion of the neighbourhood and community identity of residents, while ecological characteristics of the park (e.g. park size and vegetation) may play a minor role in this process. Indifferent relationship between people and nature in parks were also identified when analyzing visitors' experiences. For instance, small pocket parks can contribute to social relations, but are most likely too small for rich nature experiences and supporting biodiversity.

Our stewardship BCD studies showed that urban allotment gardens are places for engagement and place-making. They are places for social-ecological memory carriers that contribute to the long-term resilience in a rapidly changing urban landscape. However, changes in use or values of UGI, as well as in stewardships, may lead to shifts in the relationship between culture(s) and nature(s), where some societal groups, individuals or biological features gain while others lose (Vierikko et al. 2016). Our case study revealed that urban gardeners, who learned how to cultivate through indirect sources, differ: in central Europe, the indirect sources of learning seem to be much more popular than in the Mediterranean. In Lisbon, learning with family members, particularly with parents, is still common, suggesting that memory carriers are still heritage, and continuum has not yet disappeared. This suggests tradition and social cohesion as the most important factors in the learning process in Portugal.

In this report (D2.3) the aim was illustrate how the BCD concept can enforce researchers, practitioners and planners to widen their epistemological thinking from a culture-nature dichotomy and to be sensitive towards diversity of relationships between culture and nature. We presented four key challenges related to urban transformations in the sense of a co-evolution between biodiversity and cultural diversity in the Milestone 22 (Vierikko et al. 2017). Being a reflexive concept and taking contextual situations into account, BCD can be a useful tool when planning, designing and managing for socially inclusive and ecologically sound UGI.



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