

Considering the ways biocultural diversity helps enforce the urban green infrastructure in times of urban transformation

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Traditionally, biocultural diversity (BCD) has been researched in non-western and indigenous societies. Recently, it has also been applied in urbanized and industrialized societies, in particular for the planning and management of urban green infrastructure (UGI). Diversity in human and biological systems is considered to support cities' adaptation capacity. However, diversity might also increase the risk of conflicts. In this paper, we discuss not only how the BCD approach could strengthen studies on human–nature interactions in an urban context, but also the potential pitfalls of applying BCD. By means of two examples of BCD research, that is people in-places and people-making UGI in cities, we argue that BCD as a reflexive concept can strengthen UGI planning and management.

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Introduction

Although more than half of the world's population is already packed into cities, urban areas and populations are still growing fast [1,2]. While cities are expanding and becoming more dense, green spaces (*e.g.* parks, forests, patches of agricultural land, derelict land, water areas, urban gardens and green roofs) or single biodiversity components (*e.g.* large trees) as parts of the urban green infrastructure (UGI)¹⁴ become more important to facilitate human–nature interaction and thereby to support residents' well-being [3–5]. UGI enhances the social–ecological resilience of cities in order to cope with foreseen multiple challenges [6–10]. However, UGI is more than 'just green' providing services for citizens [11,12]. In urban environment, relationships between people and UGI are contingent in space and time, people do not just passively receive and use ecosystem services

¹⁴ Urban green infrastructure (UGI) is understood as an interconnected network of urban green spaces, including multiple types of natural or man-made systems, ranging from large-scale water or terrestrial ecosystems to small-scale pocket parks or green components, such as green walls in cities [8].

provided by UGI [13^{••},14,15^{••},16]. Buizer *et al.* [15^{••}] argue that the commonly adopted ecosystem service (ES) concept fails to identify the diversity and reciprocity of values and interactions, due to epistemological assumptions of a dichotomy between culture and nature. The biocultural diversity (BCD) as a reflexive concept – questioning ones own knowledge and being sensitive to different contexts – aims to recognize these diverse and constantly evolving relationships [13^{••},15^{••},17^{••}, 18,19]. The aim of this article is to discuss opportunities and potential pitfalls of the BCD approach in the urban context with a special focus on diversity. We distinguish between two types of human–nature interaction. First, we discuss human–nature interactions in-places, how people value or use UGI and associated biodiversity. Secondly, we discuss human–nature interactions in place-making and focus in particular on how people co-create UGI and biodiversity through urban farming practices.

BCD approach: opportunities and pitfalls

The BCD concept has especially been used for studying linkages between biodiversity and culture in tropical countries and rural landscapes [20,21]. The idea of biocultural systems – in which biological and cultural dynamics are developed jointly over time – is that diversity in human and biological systems is considered to support the

adaptation capacity to changes in local environmental conditions [21]. Biocultural diversity, captured especially in traditional cultural landscapes, comprises ‘the diversity of life manifested in biology and ecology, as well as cultures, languages and spiritual beliefs’ [22]. Whereas this definition emphasizes historical constellations of BCD, scholars have argued that research should also recognize the continuously changing relationships between cultures and potential challenges related to increasing diversity [14,17^{••},23]. Diversity should be understood as a multidimensional and dynamic phenomenon, instead of a one-dimensional or permissive diversity that is recognized and acknowledged by experts, policy-makers and political decision-makers [24]. The inclusion of cultural dynamics becomes especially relevant in urbanized societies, which have to deal with increasing societal heterogeneity [25,26]. This diversity of cultures or values offers opportunities for the emergence of new forms of engagement and living with biodiversity, also referred to as biocultural creativity [13^{••},27]. At the same time, it should be acknowledged that diversity is not uncontroversial and can be a potential source of disputes and conflicts [28]. On the one hand, BCD acknowledges different ways of valuing and engaging with nature by different cultural groups that consequently should be at least tolerated or even deserve

Figure 1



Illustration of BCD with four examples of relationships between biological and cultural diversity. The connection between biodiversity and culture can vary from unidirectional needs of humans, where cultural diversity can be high, but biodiversity low (upper left). When a green space becomes meaningful, human–nature relationships develop towards a sense of place (upper right). Joint place-making can enhance stewardship towards nature (lower left). Close interrelationships between culture and nature can result in novel biocultural creations where biological and cultural diversity co-evolve (© Kati Vierikko).

protection. On the other hand, these differences might lead to social exclusion, unjust practices and biological deterioration, causing inequalities that need to be combatted [24]. BCD as a reflexive concept provides a sensitive lens on how to look at the complexity of culture and nature and their relationships in different situations and contexts [15**] (Figure 1).

BCD from a people in-place perspective

In general, people value UGI positively. This applies also to biodiversity at the species or community level, especially those components of biodiversity that are aesthetically appealing (colour of flowers), generally known or appreciated for other reasons (edibility, smell) [29,30]. Such biodiversity elements tend to be more actively promoted [29,31]. Therefore, 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 component of BCD research [19,30]. Earlier studies have shown that people often value high biodiversity, especially if the place is familiar and they feel comfortable about the environment [32]. Fischer *et al.* [33] studied people's ($n = 3800$) perception, valuation, and uses of UGI and biodiversity levels in five European cities (Bari, Berlin, Edinburgh, Ljubljana and Malmö) within the EU FP7 GREEN SURGE project (www.greensurge.eu). Despite the fact that citizens value forests and other green spaces (parks, wastelands and street greens) positively, valuations of different levels of plant diversity vary significantly between cities, suggesting that the regional context and, moreover, cultural factors, matter in the relationships between people and urban nature [33].

Because residents, in general, share positive values about UGI irrespective of their cultural differences, green spaces are potential places facilitating social cohesion [34]. However, UGI places are not socio-politically neutral places, as people have unequal access or opportunity to engage with nature [14,35,36,37]. Cultural diversification and impact of the in-flux of migrants into cities will increase challenges related to communication, equity and justice issues [25,26]. 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. For example, the acceptance of novel wild nature in urban brownfields has conspicuously increased during the last decades and facilitated the integration of such novel wilderness areas into the urban green infrastructure [38]. Today a considerable proportion of urban residents assign values also to wild growing plants ('weeds') in streetscapes [39]. Studies on people's perceptions or valuations of UGI or specific biodiversity components, however, do not reveal how socially and ecologically inclusive UGI is. Therefore,

more contextualized, transdisciplinary research into BCD place-making and place-keeping activities is necessary [40].

BCD from a people making-place perspective

People actively 'make places', either through using, managing or giving meaning to a place [41,42]. Interdependence between culture and nature may change or disappear due to declining local involvement with place. Moreover, this might cause a decline in the existence of social-ecological memory carriers¹⁵ that contribute to the long-term resilience in a rapidly changing urban landscape [43]. Studying BCD in place-making enables us to reveal memory carriers that are of critical importance for citizen's belonging to nature, ecosystem stewardship and social cohesion [44–46]. Innovative UGI governance practices were studied in-depth via 18 cases in European cities as part of the GREEN SURGE project [47]. The six studied cases present examples of urban farming¹⁶ that were established recently on derelict land by either local people (Edinburgh and Ljubljana), communities (Szeged), or municipalities (Malmö and Lisbon) or have a longer history as traditional allotment gardens (Stockholm) (Table 1). BCD assessments of case narratives and documents were carried out. The aim was to identify to what extent BCD is being manifested in urban farming practices. Cultural diversity (CD) was assessed by means of investigating (i) the heterogeneity of involved societal¹⁷ groups, (ii) the knowledge exchange between groups, and (iii) whether a socially shared bonding to the place has evolved [15**,48]. Instead of enumerating nature using biological indicators, we appraised biodiversity (BD) by investigating how it is expressed and acknowledged by the actors in each case. BD was assessed through (i) the way it was articulated, (ii) the extent to which BD was acknowledged and (iii) whether a strong bonding with nature has evolved, that is living *together with* biodiversity.

Involvement of different groups varied between cases. The highest group diversity (in terms of socio-economic characteristics, age, ethnicity) was found in the Edinburgh, Lisbon and Stockholm cases. Increasing multiculturalism were regarded by some participants as a threat to the involvement of autochthonous residents in the Edinburgh case [47]. Knowledge exchange appeared to be important in all cases to share and maintain social

¹⁵ Biodiversity is the foundation for ecological memory carriers and a carrier can be, for example gene pool of soil. Social memory carriers guide human practices and they are repositories and transmitters of experiences, knowledge and meaning [43].

¹⁶ Urban farming is broadly interpreted in this article and includes a variety of practices, such as allotment gardening, bee and chicken keeping, urban farms, balcony gardens, peri-urban farms and inner-city community gardens, food production and food education [47].

¹⁷ Societal groups can be separated from each other based on demographic, socio-economic and linguistic differences, ethnicity or nationality. The same person can belong to several social groups.

Table 1

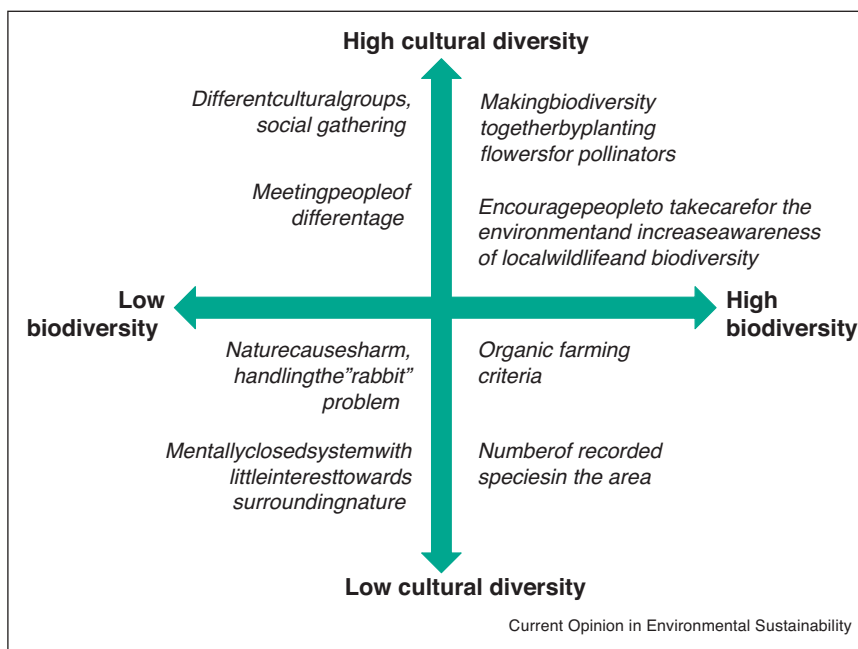
Six urban farming places/practices throughout Europe [47]

Location	Description of urban farming
Edinburgh, Great Britain	Granton Community Gardeners (GCG) was a grassroots community gardening initiative in a socially deprived north Edinburgh neighborhood. It was initiated by local people living in flats without a garden out of a desire to grow their own vegetables near home in 2010
Lisbon, Portugal	The municipality started the initiative in 2007. The first organized municipal gardens opened in 2011. The idea was to integrate urban farming into the existing UGI. Besides the allotments, the municipality provides fences, shelters for the storage of tools, water for irrigation, training and technical support for all the users
Ljubljana, Slovenia	The Beyond the Construction Site (BCS) was a civil initiative aimed at using abandoned land in the city to practice a facilitated inclusion of local residents in governing the city space. The initiative started in 2010 and was supported by the city. Facilitators were high-educated people who had skills to start initiative with creative ground
Malmö, Sweden	This case was part of a larger urban farming project called 'Stadsbruk'. The project was initiated by a company that works with social innovations. The company, together with the City of Malmö and the Swedish University of Agricultural Sciences (SLU), are the main partners in the project
Stockholm, Sweden	Igelbäcken is an official allotment garden established by the municipality in 1978. Gardeners pay a fee to the municipality and are obliged to follow strict rules. The allotment has a board elected from the people using the garden. Today the majority of users are immigrants to Sweden. Gardeners organize events and frequently use their plots for social gatherings
Szeged, Hungary	This very first community garden in Szeged started in 2014. It was created as part of a larger initiative: the development of the community center 'The Sky Above Tarján—Stopping-place' (in Hungarian Megálló, Tarján felett az ég). The center is located in the northeastern outskirts area of Szeged city. The initiator was an NGO

memories and practices, being especially relevant for newcomers and subsequent generations [43]. Sometimes external facilitators (government actors, institutions or organizations) have a focal role to play in offering solutions for internal cultural or ecological problems [49].

Initiators and established boards organized events for strengthening the dialogue between gardeners and other actors. Those cases that were initiated by local people showed strong bonding, especially in Edinburgh and Ljubljana. Joint place-making increases social bonds

Figure 2



Some examples of BCD manifestations in the six urban farming cases based on cultural diversity and biodiversity assessments. Manifestations can shift towards high cultural diversity without linkage with biodiversity (upper left) or vice versa (lower right). Manifestations with low biological and cultural diversity indicate (lower left) dichotomy between culture and nature. Expressions of making biodiversity together and taking care of nature imply a strong bond between people and nature (upper right).

among participants and strengthens community identity [48,50]. Although our analysis did not reveal to what extent the cases were open for heterogeneous societal groups, it is important to mention that in cases of a homogeneous group composition, which often coincides with a high sense of community, there is a potential pitfall because the social cohesion of the green space decreases, because the community becomes protective of the place [51].

Biodiversity in urban farming is shaped by initiators and gardeners, and controlled by shared rules and norms. Management activities and norms (e.g. organic farming) can increase or decrease species, biotope or functional diversity. Participants in the urban farming cases (Edinburgh and Ljubljana), for which the aim was to diversify derelict land by creating gardens for both people and nature, embodied strong bonding with nature; they perceived themselves as living within nature and, because of that, they feel they needed to respect biodiversity. In cases that show strong manifestations of both cultural and biological diversity, urban farming was inclusive, the place was made together, learning from each other and respecting biodiversity. ‘Social gathering, learning, engagement with nature, sense of ownership’ were common BCD manifestations in these cases. In cases where manifestations shifted towards low biological and cultural diversity there were no indications of mutual interactions between two diversities (Figure 2).

Conclusions

We illustrated 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. High BCD diversity illustrated in Figure 2 should not be considered as fixed or ideal state to achieve, but merely contextual investigation of BCD manifestations. UGI represents a constantly evolving biocultural system. As urban farming can be a new biocultural creation at one location, so can rewilding of cities in another location. Changes in 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 [15**,17**]. 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 [52].

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