



# ‘Urban biocultural diversity’ as a framework for human–nature interactions: reflections from a Brazilian favela

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Accepted: 16 September 2020 / Published online: 9 October 2020  
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## Abstract

Biocultural diversity (BCD), denoting the ‘inextricable link’ between biological and cultural diversity, has traditionally highlighted the coevolution between highly biodiverse regions and the ethnic–linguistic diversity of indigenous communities. Recently, European researchers have relaunched BCD as a conceptual foundation for urban greenspace planning capable of overcoming challenges of the ecosystem services paradigm. However, the methodological foundation for this particular approach to ‘urban BCD’ is still in its infancy, obscuring precisely *how* the framework is an advancement for studying different urban residents’ experience of and connectedness to nature and biodiversity. In this paper, we further develop the urban BCD concept by using the culturally and biologically diverse city of Rio de Janeiro, Brazil as a ‘critical case’. First, we employ qualitative field methods to investigate manifestations of human–nature relationships in the *favela* (informal settlement) of Rocinha and the neighbouring Tijuca Forest. Second, we reflect on how the urban BCD framework and methodology emphasise i) interrelationships, ii) varied group values and iii) participation, and iv) are sensitising and reflexive. Our findings challenge the ‘usual’ narrative about *favelas* as places of environmental degradation and disaster risk, revealing BCD and nature connectedness that are as related to popular culture, fitness ideals and citizen-building, as to traditional livelihoods and spiritual beliefs. Departing from interrelationships, BCD can portray aspects that a narrow focus on ‘services’ and ‘disservices’ cannot, but attention should be paid to how operationalisation risks perpetuating ecosystem services thinking. Nevertheless, we identify promising avenues for its use in highly diverse cities with unequal access to natural areas.

**Keywords** Biocultural diversity · Brazil · Ecosystem services · Favelas · Human–nature connectedness · Informal settlements · Lived biodiversity · Urban greenspace planning

## Introduction

Biocultural diversity (BCD) is a concept used to describe the “inextricable link” between biological and cultural diversity (Maffi 2007 p. 267). Traditionally, it draws on

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**Electronic supplementary material** The online version of this article (<https://doi.org/10.1007/s11252-020-01058-3>) contains supplementary material, which is available to authorized users.

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anthropological and ethnobiological insight into the relationships of indigenous and local knowledge, language and practices with plants, animals, habitats, and ecological functions (Maffi 2007, Cocks 2010, Cocks and Wiersum 2014), in the context of conservation (Maffi and Woodley 2012). However, biocultural approaches are increasingly advocated in both local and global sustainability debates, emphasising co-evolution of humans and nature with the aim to frame interactions from place-based cultural perspectives (Merçon et al. 2019).

One biocultural diversity approach, which we hereinafter refer to as ‘urban BCD’, was recently introduced as an alternative to the ecosystem services (ES) approach to understand *urban* human–environment interactions and support urban greenspace planning (Elands et al. 2015, 2018, Buizer et al. 2016, Vierikko et al. 2016). This responds to concerns that rapid urbanisation, with cities growing both ‘outwards’ through urban sprawl and ‘inwards’ through densification, puts urban green spaces, and thereby city dwellers’ experiences of nature, at the risk of extinction (Soga and Gaston 2016, Botzat et al.

2016). As is extensively shown by the ES literature, urban nature provides key benefits for human health and wellbeing. This includes spaces for social interaction and recreation, air filtration, and protection against climate-related hazards like floods, landslides and heatwaves (Bolund and Hunhammar 1999, Potschin-Young et al. 2018). Moreover, experiences in nature can spur city dwellers' engagement for conservation and sustainability (Beery et al. 2015, Marcus et al. 2016). However, the ES concept and approach, with its near-paradigmatic influence on research and practice, has received criticism for its homogenising and instrumental approach to people's participation and for obscuring the complexity of local values and ecological knowledge (Norgaard 2010, Thorén and Stålhammar 2018). The ES concept frames human–nature relationships in a dichotomous manner with nature as a service-provider (Potschin-Young et al. 2018). BCD is instead advocated as a reflexive concept that can identify people's diverse and heterogeneous motivations and conditions for interacting with urban nature and the reciprocity of such values and interactions (Buizer et al. 2016, Elands et al. 2018, Pauleit et al. 2019, Vierikko et al. 2016).

Nevertheless, the empirical, theoretical and methodological foundation for how to apply BCD in an urban context is still in its infancy, which limits our understanding of precisely *how* the framework is an advancement over ES. This forms part of a more general knowledge deficit on how different groups of urban residents experience, use, and are affected by nature and biodiversity. Particular gaps concern informal green spaces and marginalised groups in the Southern Hemisphere, where cities are expected to grow the most, and at the group or community level, where action and change for sustainability are critical (Botzat et al. 2016, Ives et al. 2017).

In this paper, we aim to test and appraise the *urban* BCD concept (which we see as distinct from the traditional conception of biocultural diversity) by drawing on insight into a highly culturally and biologically diverse urban region as a 'critical case': Rio de Janeiro, Brazil.<sup>1</sup> More specifically, we critically and reflexively apply the proposed urban BCD framework (Vierikko et al. 2016, Elands et al. 2018) to identify human–nature relationships in the *favela* (informal settlement) of Rocinha in Rio de Janeiro. We draw on these experiences to explore how the urban BCD concept can address four methodological challenges and how it can be an advancement over the ES concept. We ask:

- 1 How can human–nature relationships in marginalised communities of Rio de Janeiro be identified and described through the urban BCD framework?

<sup>1</sup> A critical case here means a case purposefully and strategically sampled so that one can assume that the concept of urban BCD should be applicable, and if it is not, we can presume that it is not applicable anywhere (see Flyvbjerg 2011 p. 307).

- 2 Based on these observations, how can the urban BCD framework and methodology emphasise
  - a) interrelationships, b) variation of group values, c) participation, and d) be reflexive and sensitising?

Before answering these questions in Sections 4 and 5, respectively, we introduce the reader to the urban BCD framework and its four central methodological propositions (Section 2) and the qualitative method we developed for applying the framework in our study area (Section 3). Based on the analysis, we conclude in Section 6 by affirming urban BCD as a fruitful research agenda to study highly diverse cities with unequal access to natural areas.

## Urban BCD: History, framework and conceptual propositions

Here, we outline the differences between the traditional BCD concept and the newly launched urban BCD. Rather than a linear advancement, we understand the latter as an adapted version intended for different purposes (Table 1.).

### History and development of urban BCD

Biocultural diversity was popularised following the Declaration of Belém of the 1988 Congress of Ethnobiology in Brazil, which alerted the international community of the simultaneous disappearance of plant and animal species in threatened tropical ecosystems and indigenous cultures around the world (UNESCO 1992). The concept was created to describe the interrelation and overlap between high biodiversity and high cultural (ethnic, religious, and linguistic) diversity in rural, remote, and biodiversity-rich areas (see e.g. Maffi 2005). As a field, the main emphasis of BCD research has been on relations between biodiversity and linguistic diversity and traditional ecological knowledge; threats to and losses of biological, cultural and linguistic diversity; joint approaches to maintaining biocultural diversity; and the development of human rights (Posey 1999, Maffi 2001, 2005, 2007, Harmon 2002, Stepp et al. 2002, Carlson and Maffi 2004). Merçon et al. (2019) identified four fields in which biocultural discourses have been applied: social–ecological systems and sustainability science; civil society organisations and social movements; indigenous rights movements; and international policy arenas. We here refer to all of these four under the umbrella term 'traditional BCD'.

The specific approach of *urban* BCD was largely formulated within the EU-funded GREEN SURGE research project (2013–2017).<sup>2</sup> The purpose was to capture biodiversity

<sup>2</sup> While some alternative applications in urban areas exist, more in line with traditional BCD (see Mendonça 2014, Cocks and Wiersum 2014), by 'urban BCD' we here refer to the GREEN SURGE approach.

perceptions and related practices of different sociological and ethnic groups and thereby emphasise the importance of urban green for quality of life. Elands et al. (2018) describe how the novel concept and framework evolved from the traditional BCD concept through two main developments. First, the traditional focus on ecoregional hotspots shifted to urban areas. Second, the concept shifted from a ‘crisis narrative’, which emphasised the dual loss of biodiversity and indigenous cultures, to a ‘dynamic narrative’, which allows the creation of new forms of co-evolution between people and nature (Elands et al. 2018). In the GREEN SURGE project, the adapted, urban version of the BCD concept thus has an explicit normative focus, which goes beyond safeguarding cultural practices and values; it aims to re-connect people with nature in the face of the ‘extinction of experience’ in cities and to enhance the diversity of nature as part of an urban transformation towards sustainability (Vierikko et al. 2017a).

### Conceptual and methodological framework of urban BCD

As a conceptual framework, urban BCD highlights three dimensions of human–nature relationships: materialised BCD, lived BCD, and stewardship of BCD (Vierikko et al. 2017b) (see Fig. 1). Materialised BCD refers to tangible manifestations of BCD interactions, which are both physical (parks, communal gardens, etc.) and conceptual (management plans, ES, etc.). Elands et al. (2018) describe how materialised BCD is mostly concerned with identifying and quantifying the biophysical expressions of BCD of ecological or artificial components of urban green infrastructure. Such identification is based on “the ontological assumption that these discrete objects exist (and are managed) regardless of our perception, and that they can be measured, quantified and monitored” (Elands et al. 2018 p. 4), for instance through “standard measurements of biological, functional and landscape diversity” (Vierikko et al. 2017b p. 27). However, people’s perceptions of the tangible aspects are also considered important.

Lived BCD is described as the heart of the framework and relates to the day-to-day practices and experiences of human–nature interactions. This dimension is concerned with the perceived and experienced qualities, which, mediated by the senses and mind, include values, norms, traditions, knowledge, and sensory perceptions, where both qualitative and quantitative methods can be appropriate for studying these (Elands et al. 2018 p. 4).

Stewardship of BCD is “the active and conscious assemblages of biodiversity” (Elands et al. 2018 p. 5) and includes all forms of active and conscious engagement with green areas. Its analysis overlaps with lived BCD with its focus on values, motivations, and norms, but stewardship also highlights the role of different forms of knowledge in decision processes on human–nature interactions (ibid.). Assessment

can focus on both individual and group processes and, similar to lived BCD, can employ both qualitative and quantitative methods.

### Conceptual propositions for urban BCD

Specifically suggested as an advancement over the ES framework, which has been used for similar objectives in assessing human–nature relationships, the urban BCD framework is said to overcome many of the shortcomings inherent to ES by re-conceptualising human–nature interactions around diversity (Buizer et al. 2016; James 2015). We focus here on four types of work that the urban BCD concept is considered to do (Buizer et al. 2016, Elands et al. 2018).

First, BCD aims to overcome the ideas of human–nature dualisms and one-directional relationships that ES is based on by building on the idea of nature as socially constructed and by seeing biological and cultural diversity as inextricably linked and intertwined (Buizer et al. 2016). It emphasises multiple directions or **interrelationships** rather than one-directional benefits of nature as well as the importance of context and place-based meanings (ibid.). The idea of seeing nature as equipped with inherent ‘services’ is rejected; these qualities are instead seen as relational and emergent through people’s interactions.

Second, BCD is held to consider **variation in group values**, i.e. differences in how cultural groups (described as groups with different ethnic and/or social-economic background) value urban nature. These ‘cultural valuations’ risk not being covered in ES typologies, since they stem from local interactions with the urban landscape and might change over time (Buizer et al. 2016). The dynamic and more comprehensive conceptualisation of culture also recognises that existing or traditional values may not be in line with sustainability, which may require the creation of new cultural models and practices (Elands et al. 2018 p. 3).

Third, BCD is considered an advancement over ES in ‘linking up knowledges’, i.e. transdisciplinary and **participatory approaches**, which implies a stronger focus on stakeholder participation and deliberation. While ES is critiqued for often employing stakeholder participation as an instrumental means to strengthen the legitimacy of a project, BCD strives to include questions of desirability such as “from which cultural worldview it is desirable to quantify ES, or which public goods gain priority over others by a focus on ES” (Buizer et al. 2016 p. 10). BCD is aimed to open up for other types of knowledge, especially with perspectives from the Global South, and by designing research from the perspective of participants rather than pre-determined one-world perspectives.

Fourth, BCD is put forward as a ‘**sensitising**’ concept that allows for ‘**reflexive**’ research (Buizer et al. 2016, Vierikko et al. 2017b, Elands et al. 2018). Here, Buizer et al. (2016 p.

**Table 1** Key differences between traditional BCD and urban BCD

Aspect	BCD	Urban BCD
Origin	Declaration of Belém, First International Congress of Ethnobiology, Brazil (1988)	GREEN SURGE project (2013–2017)
Definition(s)	“Biocultural diversity comprises the diversity of life in all of its manifestations: biological, cultural, and linguistic, which are interrelated (and possibly coevolved) within a complex socio-ecological adaptive system.” (Maffi 2007 p. 269) Cultural diversity is understood as “humankind’s accumulated reserve of learned responses to the environment that make co-existence between man and nature and self-recognition possible” (Cocks and Wiersum 2014, p. 729; cf. Posey, 1999).	Biocultural diversity is “the diversity of life in all its manifestation (biological, cultural, linguistic) and systemic interactions among these. Urban biocultural diversity is a concept emphasizing the links between biological and cultural diversity in cities or city regions.” (GREEN SURGE website) Cultural diversity is “the variety of values, beliefs and ideas, and associated practices of different social groups” (Vierikko et al., 2016, p. 56).
Application	Rural, remote and biodiversity-rich areas, indigenous communities, often developing countries	European cities
Concept use	Descriptive, Normative	Descriptive, Analytical, Normative, Planning and governance framework
Empirical dimensions	Cultural dimensions: Ethnic, religious, linguistic Natural dimensions: Biodiversity etc.	Broader idea of culture (anthropological/ sociological), including practices. Broader idea of nature (than biodiversity) to include green areas in general. BCD dimensions: Materialised, Lived, and Stewardship.
‘Crisis narrative’	Emphasises sustainable practices of indigenous communities – reaction to ‘dual loss’ of biodiversity and indigenous cultures (Elands et al. 2018)	Reaction to ‘the extinction of experience’ in urban settings
Descriptive goal	Describe the link between areas of high biodiversity and high cultural (ethnic, religious and linguistic) diversity	Describe and assess human–nature relations, which is believed to lead to better governance.
Normative goal	Preserve cultural and biological diversity Conserve and sustain traditional practices and traditional ecological knowledge	Re-connect people with nature to increase pro-environmental behaviour and create place-based values of nature. Not only preserve, but also modify relationships and allow creation of new sociocultural patterns that can enhance biodiversity. Preserve biodiversity by recognising non-traditional constellations of urban bio(cultural)diversity (e.g. allotment gardens).
Disciplines/ methodologies included	Anthropological, Ethnobiological	Materialised BCD: Ecological, biophysical, GIS Lived, and Stewardship of BCD: Qualitative and quantitative social sciences and humanities

11) build on the distinction between definite and sensitising concepts put forth by Blumer (1954) to explain how “BCD is less definite [than ES] and more sensitizing because of the focus on diversity [rather than] a productivist line of thought”. BCD is held to challenge and contrast the objectified, standardised and generalised knowledge associated with ES and instead support reflexive, contextualised knowledge creation wherein researchers do not assume neutrality but acknowledge that knowledge is co-produced between themselves and different stakeholders (Buizer et al., 2016) and thereby critically consider implicit values involved in governance and existing concepts such as ‘services’. Our study takes on the task of exploring these four propositions in an operationalisation of BCD, and in doing so, investigating

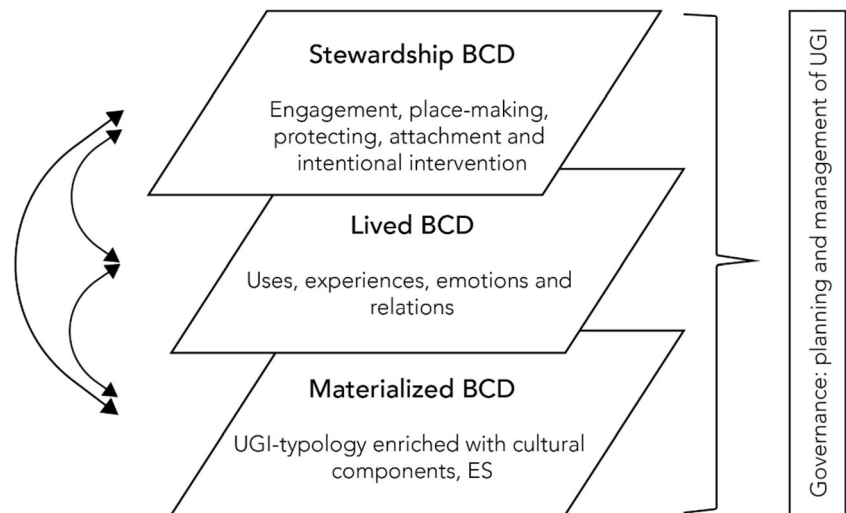
more precisely, e.g. how BCD can be considered a sensitising and reflexive concept.

## Methodology

As researchers in Sustainability Science, an emerging academic field that aims to bridge the social and natural sciences to address the complex sustainability challenges of our time, we embrace methodological pluralism and base our analysis on real-life human–nature interactions while taking into account the influence of ideas and discourses (Mahmoud et al. 2018, Olsson and Jerneck 2018). This section describes the method we developed for exploring BCD in our study area –



**Fig. 1** Illustration of the Biocultural Diversity (BCD) framework and dimensions adapted from Elands et al. 2018 (UGI = urban green infrastructure, ES = ecosystem services)



the *favela* of Rocinha – and why we have chosen this area to represent Rio de Janeiro’s socio-ecological diversity.

### Rio de Janeiro, a city of ‘extreme’ biocultural diversity, and Rocinha, its largest favela

Characterised by ample biological reserves, stark socio-economic differences, and high diversity in cultural expressions, we see Rio de Janeiro as a case of ‘extreme’ BCD, or a critical case, particularly suited to test and build theory (Flyvbjerg 2011, Yin 2008). The dramatic natural and cultural landscape of the city’s South Zone has earned Rio de Janeiro the nickname *Cidade Maravilhosa* – the Marvellous City – and it was classified by UNESCO as a World Heritage Site in 2012 (Mendonça 2014, Scarano 2014). Another defining characteristic of Rio’s form, culture, and politics is its *favelas*. Also known as informal settlements, squatter settlements, or ‘slums’, they are home to about 22% of the metropolitan region’s 11.8 million inhabitants (IBGE 2011). Against this background, our case study explores BCD in informal settlements (3.1.2) bordering the Tijuca forest (3.1.1), focusing on the *favela* of Rocinha (3.1.3).

#### Biological diversity and the Tijuca Forest

Rio de Janeiro is a biodiversity hotspot and global priority area for conservation. Located in the Atlantic Forest region, it features not just “typical tropical rainforest, but [...] restinga sand bars, mangroves, inselbergs and also lagoon, fluvial and marine associated systems” (Scarano 2014). The almost 900 km<sup>2</sup> of protected land in Rio’s metropolitan area includes the Tijuca National Park: one of the largest urban forests in the world with several endemic and threatened amphibians, birds, mammals, trees orchids, and bromelias (Scarano 2014, Scarano and Ceotto 2015). The forest’s importance for the city has been known for centuries, for example by Emperor

Dom Pedro II who allegedly planted about 72,000 seedlings between 1862 and 1874, mainly to protect the city’s freshwater springs in the mountains, using both indigenous species and exotic fruit trees, such as the jackfruit tree (Mendonça 2014, Scarano 2014). A more recent restoration initiative is the municipal programme Mutirão de Reflorestamento (Joint Reforestation Effort). It began reforesting hillsides and mangroves in 1987, and by 2007, it had restored 25 km<sup>2</sup> in about 100 poor communities (Scarano 2014).

#### Cultural and socio-economic diversity and the forming of favelas

Owing to Brazil’s colonial history, Rio de Janeiro has an ethnically diverse population, most of whom speak Portuguese (Klein and Luna 2009). While most Brazilians still identify as Catholics (65% in the last census in 2010), the religious landscape is diversifying, including a fast-growing evangelical (e.g., Pentecostal) movement, especially strong among poorer population segments (22% of Brazilians in 2010) and various spiritist, vernacular, and syncretised traditions (IBGE 2012, Schmidt 2016). Regarding the latter, people who were trafficked to Brazil as slaves brought with them their religious practices, which blended with Roman Catholicism and resulted in Afro-Brazilian beliefs, such as Candomblé and Umbanda (Lino e Silva and Doherty 2017).

Rio de Janeiro’s spatial development, as well as the origin of *favelas*, largely stems from the industrial expansion in the late nineteenth century when the city attracted a large number of migrants, especially from the poorer Northeast region of Brazil (Speiski et al. 2017). With little affordable housing available, many migrants settled on marginal lands, such as riverbanks or mountain slopes, forming what would become the *favelas*. Today, *favelas* cannot strictly be considered informal settlements since many have been recognised as formal neighbourhoods through the municipal *Favela-Bairro*

programme (1994–2007). However, they still exhibit informal characteristics such as self-built housing, precarious infrastructure, high social vulnerability, disaster risks, and drug-related organised crime (Perlman 2010, Meirelles and Athayde 2014).

### Study area: The favela of Rocinha

We find these conditions exemplified in Rocinha, Rio’s largest *favela*, located on the hillslopes between the high-end neighbourhoods São Conrado and Gávea and the Tijuca Forest. Rocinha is a melting pot of different ethnic, religious, and cultural groups. Its topography, combined with social vulnerability and the high share of self-built housing, puts Rocinha at risk from several natural and climate-related hazards, including heat stress, water scarcity, and recurrent small-scale flooding and landslides during heavy rain. These conditions, well familiar to us before the fieldwork, imply the presence of varied social relations to nature, including young ‘urban’ people, people living at risk from disasters, rural migrants who used to depend on agriculture, and followers of Afro-Brazilian syncretic religions.

### Fieldwork methodology

We constructed qualitative data through three focus groups with residents in the *favela* of Rocinha in January 2018. Our main emphasis was on understanding perceptions concerning the lived experience of human–nature relationships, corresponding to the dimension of lived BCD. Our methodology further encompassed parts of the stewardship dimension through the focus groups, along with six semi-structured informant interviews with community leaders and environmental professionals active in Rocinha and other communities bordering the Tijuca forest (Vale Encantado, Quilombo do Grotão, Tijuca National Park). We also identified significant green structures and aspects of local nature corresponding to materialised BCD (indicators of ‘welcomeness’ and ‘signs of memory carriers’, see Vierikko et al. 2017b, [Supplementary Material](#)) through non-participant field observations, which were triangulated with accounts from the focus groups as well as maps and other documents (newspaper articles, park management plan). During a follow-up visit in February 2020, we presented our results to three additional groups consisting of Rocinha residents and activists, a citizen council of the Tijuca National Park, and Brazilian biology and sustainability researchers, which allowed related discussion and opinions to feed into this article.

### Focus groups and the ‘lifeworld’

We considered focus groups a fruitful methodology to investigate human–nature relationships in Rocinha for several

reasons. First, they respond to the research gap on human–nature connections at the group level (see Ives et al. 2017). Second, with interactions between participants at the core of the method, focus groups can allow the researcher to uncover both individual and group values, observe how normative discourses (‘normal’ or ‘standard’ views) are reproduced – or challenged – in a certain community, and locate tensions between beliefs and practices (Smithson 2000). Third, focus groups produce a different power dynamic, which was useful for our situation as foreign, highly educated white women interviewing *favela* residents. Compared to the individual interview, the group is collectively powerful vis-à-vis the researcher, being able to steer the conversation towards topics relevant to their lives, and having access to shared knowledge to which the researcher is ignorant, which increases the quality of the data and mitigates the risk of the researcher constructing participants as the Other (Smithson 2000).

We used an interpretivist approach and drew on the phenomenological concept of the *lifeworld* (Husserl 1980). The lifeworld consists of everyday experiences that people live and reflect upon which is here represented by residents’ everyday interactions with nature. Inspired by interpretative phenomenology, our focus group design aimed to capture embodied, experiential meanings by seeking detailed descriptions of lived phenomena (Eberle 2014). While the use of focus groups for phenomenological studies is unconventional, group interviews can enrich and clarify phenomenological data (Bradbury-Jones et al. 2009) and make “the phenomenon being researched come[] alive” (Halling et al. 1994 p. 112).

In particular, we used eight sensitising concepts called ‘fractions of the lifeworld’ (Ashworth 2003, 2016; Table 2) to complement and enhance the existing layers and indicators for lived BCD (Vierikko et al. 2017a) and indicate directions that bring experiences into light. To analyse lifeworld

**Table 2** Fractions of the Lifeworld (Ashworth 2003, 2016)

<i>Selfhood</i>	What does the situation mean for social identity, the person’s sense of agency, and their feeling of their own presence and voice in the situation?
<i>Sociality</i>	How does the situation affect relations with others?
<i>Embodiment</i>	How does the situation relate to feelings about their own body, including gender, emotions, and “disabilities”?
<i>Temporality</i>	How is the sense of time, duration, biography affected?
<i>Spatiality</i>	How is their picture of the geography of the places they need to go to and act within affected by the situation?
<i>Project</i>	How does the situation relate to their ability to carry out the activities they are committed to and which they regard as central to their life?
<i>Discourse</i>	What sort of terms – educational, social, commercial, ethical etc. – are employed to describe – and thence to live – the situation?
<i>Moodedness</i>	What is the emotional ‘tone’ or fluctuating mood to the experience?

experiences (following Todres and Holloway 2004), we included questions in the semi-structured focus group protocol that encouraged participants to describe and reflect on concrete events, experiences, or spaces in adjacent nature in detail. The researcher then ‘stayed with’ the participant to encourage more details and avoided making immediate interpretations (Finlay 2013).

### Recruitment and description of participants

Informed by our previous knowledge of the study area (Section 3.1.2), we used purposive sampling, attempting to cover an adequate range of ‘cultural groups’ and informants involved in formal or informal governance of urban nature–culture relationships (see Table 3). This resulted in three focus groups: evangelical Christians (abbreviated as EC), cultural workers (CW), and activists engaged in a local environmental NGO (EA). The interviews lasted between 50 min and one hour, forty minutes and were recorded, transcribed, and translated from Portuguese into English.

Due to time constraints and the exploratory nature of this study, we do not claim to cover the full range of groups, participants, or manifestations of BCD in Rocinha. Moreover, the categories we use to describe different groups (religious affiliation, rural migrants, etc.) are not necessarily

the most salient labels to the participants themselves and should not be seen as mutually exclusive. Nevertheless, our labels were partly validated and confirmed as they were independently used by interviewees to describe how different groups are associated with or associate themselves with nature.

### Analysis of focus groups and informant interviews

We used a general inductive approach to analyse interview transcripts (Thomas 2006). For the focus groups, this implied using the ‘fractions of the lifeworld’ (see 3.2.1) and the relevant BCD layers and indicators to interpret participants’ descriptions of interactions with urban nature, resulting in the emerging, ‘hybrid’ themes presented below (4.2). For the informant interviews, we used a similar procedure focused on themes around stewardship.

### Describing manifestations of BCD in Rio de Janeiro, Brazil

In this section, we answer the first research question about human–nature relationships as manifestations of BCD in Rio de Janeiro, with particular focus on lived BCD.

**Table 3** Study participants

Function	Interview code	Description of participants
Resident focus group (Jan 2018)	<b>CW</b>	<b>Cultural workers</b> Focus groups with members of a community-based theatre group working with youth
	<b>EC</b>	<b>Evangelical Christians</b> Focus group with evangelical church members
	<b>EA</b>	<b>Environmental activists</b> Focus group with residents near the forest and active in environmental NGO
Resident informant (Jan 2018)	<b>RI1</b>	Coordinator of community-based cultural museum project in Rocinha
	<b>RI2</b>	Coordinator of ecotourism project in a small community in the Tijuca forest
Non-resident informant (Jan 2018)	<b>I1</b>	Founder and coordinator of community-based environmental NGO in Rocinha
	<b>I2</b>	Environmental analyst and former coordinator of socio-environmental programme at the Tijuca National Park
	<b>I3</b>	Geographer and lawyer defending the land rights of traditional Afro-Brazilian communities (Quilombos)
	<b>I4</b>	Evaluators of 30-year reforestation programme in poor communities bordering the forest
Presentation of preliminary results (Feb 2020)	<b>P1</b>	Rocinha residents and activists
	<b>P2</b>	‘Amigos do Parque’ (friends of the park): Citizen council of the Tijuca National Park
	<b>P3</b>	Brazilian sustainability and biology researchers focused on understanding the relationship between human society and the environment

## Materialised BCD

While detailed biodiversity assessments are beyond the scope of this study, we identified four main types of green structures as key for the case study area and its residents: (1) green structures inside the community of Rocinha, including mountain slopes, single trees, roof gardens, nettles, herbs, and houseplants; (2) the adjacent Tijuca forest and mountains, including its interface with the *favela*, and the natural water spring; (3) other locations outside the *favela* frequented by residents, such as the beach, the Botanical Gardens, or official trails; and (4) the Ecological Park of Rocinha, built for residents by the municipality but largely abandoned by both.

We identified ‘signs of memory carriers and cultural symbols’ as being both biological salient features, such as a well-frequented natural water spring, and cultural artefacts, such as an amphitheatre in the Ecological Park, an educational garden in a school, and a community agroforestry garden established at the site of a landslide that took two women’s lives in 2010. ‘Welcomeness’ is another relevant indicator of materialised BCD and involves the accessibility and inclusivity of the space (Vierikko et al. 2017b, Appendix 2). We observed accessibility as often being severely hampered in the green spaces in and adjacent to the *favela* because of heavy littering, steep stairs or slopes, lack of signalling, or (feared) presence of police and gang members. A telling example is the Ecological Park, which we found to be almost empty except for a dozen heavily armed police officers. Built in 2012 for BRL 24 million (EUR 5.3 million) with the aim to provide a space for leisure activities, environmental education, and to function as a green lung for the community while limiting further urbanisation into the forest (O Globo 2012), the Ecological Park project already shows signs of abandonment, such as broken and unmaintained bathrooms, unfinished/ non-signalised entry, etc. In informal conversations, many residents seemed unaware that the park and its amenities existed.

## Lived BCD (people-in-place)

Participants in the focus groups generally expressed a positive image of their relationship with nature. This included stories, meanings, and uses of nature associated with religious, spiritual, restorative, or recreational uses and values as well as links between nature and fresh air, reduced temperatures and use of material like fruits, as described below. This can be contrasted with previous accounts of residents’ negative perception of natural areas in the *favela* due to problems with garbage, natural hazards, and gang violence (Wamsler et al. 2012). While frequently mentioned, such problems were rather associated with other people in Rocinha. We present these manifestations of lived BCD as linked to eight emerging themes: diversity, nature as life, spatiality, embodiment,

temporality and place memory, degradation, security, and selfhood and sociality.

**Diversity** Participants described the Tijuca forest as rich in plant and animal species, but also recognised diverse plants and related practices inside the *favela*:

Cultural workers [CW] *The Tijuca Forest has all kinds of things, there are orchids, [inaudible] – you can pick them directly – a lot of herbs, fruit-bearing trees. She/it<sup>3</sup> [the forest] is very rich; the soil is very good.*

Another:

[CW] *There are many nettles here, there are herbs, plenty of herbs, and there are a lot of people who grow them, this green roof thing, there is plenty here in the community.*

Participants also described interactions between the forest and the *favela* (environmental activists [EA]): “My mom always used to take black soil from the forest to plant things at home”.

Animals were described in affectionate ways, including monkeys, skunks, and porcupine (CW): “[You can find] porcupine, after I created this garden here, there are three nests up there, a wasp house. I discovered it yesterday, it’s cute, like this size, and different kinds of butterflies and moths, different monkeys”. Participants also referred to popular culture to describe animals in the *favela*, such as this participant’s account of some skunks he saw regularly (CW): “There was one that came into my house. It’s such a cutie. It has a little ear; it looks like Mickey Mouse”.

The diversity of plants in Rocinha was described as directly linked with the cultural diversity of its residents, for instance how migrants from the northeast bring certain practices involving nature (EA): “Rocinha is full of different cultures, there are people from Minas, Paraíba, Ceará. Many people who came from other places brought some things in their luggage”. Followers of Afro-Brazilian religions, such as Candomblé and Umbanda, were described as having a special touch for nature and cultivating herbs:

[CW] *There are many herbs [grown in Rocinha], like “Ninguém pode”, Mother-in-law’s tongue... which people have because of the syncretic religions (...). For instance, if you go there to Mr so-and-so, there are*

<sup>3</sup> The words for ‘forest’ and ‘nature’ in Portuguese (i.e., *floresta*, *natureza*) have similar meanings in English, but since Portuguese nouns use either male or female grammatical gender, they can be interpreted as having a feminine character when used in their definite form (*a floresta*, *a natureza*) or when referred back to (*ela*, meaning “it” but also translating as “she”).



[... mentions different plants], there are various herbs, all of that. Because of the religion that he practices.

However, the evangelical Christians [EC] also made reference to cultivating medicinal herbs, such as *boldo* (*forskohlii*) and lemon balm.

**Nature as life** When discussing why and how nature is important, all groups referred to nature as a provider of life, oxygen, and health, motivating the care for nature. This was more often linked to an abstract conception of nature than to local ecological structures. Some participants referred to nature as “Mother Nature”, as “it/she is life” and as a natural and sometimes vindictive force that might “come for what is hers”. For instance, when asked why nature is important one participant said:

[CW] *Mother Nature responds to our acts. If we destroy that green over there, which we need in order to breathe, Mother Nature will respond. If you build your house in a green space, then there is a flood and the house will come crashing down. Because that is not the right place for constructing.*

Additionally, the group of evangelicals referred to the aliveness of nature:

[EC] *Many people don't understand that nature is not dead. Like he said, it/she is alive. So, when you throw trash, you are slowly killing that live being, just like we are alive.*

An overarching contradiction was the difference in how participants talked about nature, on the one hand, in abstract terms as the foundation for all life, and on the other, how participants viewed local nature. The abstract descriptions of nature tended to be more positive and associated with romanticised language, i.e. “nature is beautiful, nature is life”, describing a nature that is inherently pure, good, and with an agency to respond. Alternatively, participants would describe the link between air quality and the amount of trees *at the city level* by comparing Rio de Janeiro to other cities, stating that “if you live in a place with no trees, the heat increases a thousand times” and referring to trees as “the natural air conditioner” (EC). The descriptions of specific and local nature in the *favela* included more negative associations, e.g. “that bush/forest in the Ecological Park”, reflecting a disconnection between “abstract” (or city-level) nature and “local” nature.

**Spatiality** When it comes to visiting natural areas in the ‘formal’ city, several groups mentioned parks like the Botanical Garden and the Zoo at Quinta da Boa Vista. The Cultural Workers were of the opinion that *favela* residents prefer more challenging and wild experiences, such as hikes, which also

made them feel connected to the city and its famous landmarks:

[CW] – *The Chinese Viewpoint, right, because people want a challenge, they go up and spend the night, see the sunset, from Pedra da Gávea .... you see the entire Rio de Janeiro: the beaches, the lake, and Christ the Redeemer.*

– *A hike is always a challenge. So, I think that's what's attracting people.*

However, they also admitted that the sand of the beach is more culturally accepted among the *favela* residents than the “mud” of the forest (“because they go to the beach, they lay in the sand”). Subsequently, more people have the habit of visiting the beach and caring for the beach, such as participating in beach clean ups, than they do the forest.

**Embodiment** Participants described embodied and sensory experiences when immersed in nature. Recurrent themes were feeling cleansed, refreshed, or renewed, the feeling of one's soul being cleansed or ‘leaving’ the body, or the body being cleansed from pain and worries. One participant described feelings of being transformed when experiencing the smell from a specific tree:

[CW] *And a smell came, you know that dama da noite ('lady of the night'), the plant, the tree? It's a sweetish smell.(...) Wow, it has such a strong smell, dama da noite. Late afternoon it already starts to emit. It took over the surroundings, you know, that light through the leaves. It's very beautiful. So that transforms you.*

Another participant described his experience as a kind of spiritual immersion and cleansing:

[CW] *I feel good when I'm there. I dive into the waterfall; I stay a little under the water. It seems like I'm talking directly to God. When I come out from nature, all that I was feeling.... pain in my body, worries... it stayed there, and I become another person.*

References to restorative or stimulating ‘energies’ of nature were common, even among the evangelicals:

[EC] – *And I go into that water and I come out like that, with a certain energy.*

– *Yes.*

Participants also mentioned feelings of freedom and of altered states of being when immersed in the forest:

[CW] – *It's inexplicable, you feel very free.*

– *For me, it's like I become an índio (indigenous person). In the middle of nature, [you experience] a different kind of air, you feel the smell of plants.... It leaves us [feeling] renewed/refreshed. (...).*

– *I'll be listening to the birds, the animals, it's a spiritual peace that it gives you. You come from there [the outside world] full of problems; when you get there [in nature] the problems cease.*

The sea and the beach were also described as having therapeutic functions. One participant described an event during a period in his life when he experienced family problems (CW): “And this moment of going to the beach, it seemed like I was talking directly to the sea, repeating, sensing the waves hit, feeling the pure air from the water, and because of this moment, I started to question myself inwardly”.

**Temporality and place memory** Many participants described positive and nostalgic memories associated with surrounding nature, especially involving friends or family or playing as children, such as one participant who described a jackfruit tree:

[EA] *That was like our playground because it was an enormous jackfruit tree; it was one of the most beautiful contacts I had with nature; I think it was the first contact, swinging on that tree.*

Place memories were also linked to vivid sensory experiences, involving sights and smell, as noted here:

[EC] *There in Cachopa, it used to be all green, all trees. So, when it was five o'clock in the afternoon, you could feel a plant, this plant that has a white flower, you could feel the essence!*

There was a general sense of “a before and after”, that nature was being ruined by deforestation, degradation, and sewage, as well as a sense that governmental reforms and management changed the relationships and use of nearby natural areas:

[EC] – *I've been here for thirty years. There were many birds, many trees when I came here. It all ended because of people making houses, making houses. Nature ended.*

– *I want to leave because I lost my love for this place.*

– *Me too.*

– *Over there, in Cachopa, it used to be a paradise. And then the government came (...) to get a lot of votes, they started to call people here and give away pieces of land.*

This narrative of before and after was also articulated with regard to the fresh water reservoir of Labouriaux, located at the top of the *favela*:

[CW] *Since the beginning of my life, I would go there with my friends, a bunch of boys, to enjoy this nature. Because of the forest and the water reservoir, we were in the middle of a waterfall, diving, fishing, etcetera. But there was a day that people started to throw filth, garbage, in the reservoir. This totally killed [degraded] the reservoir.*

The reservoir was described as important for what can be seen as community building/place making:

[EA] *Most of the children here in Labouriaux always played in the forest. We used to walk all the way up to the reservoir, and it was always full. The majority of the children learned to swim in that reservoir.*

This tradition of children playing in the forest seems not to have disappeared. On our way back, we encountered a group of young boys coming out of the forest in Labouriaux. They were playing alongside the freshwater stream and happily showed us their catches of crabs in plastic buckets.

Participants also linked their narratives of place memories with the names of places, such as Rocinha (which literally means “little farm”), which was once a vegetable farm:

[EA] *They grew coffee here.... Around 1880, Rocinha was a vegetable garden (...). Poor people didn't have anywhere to live, so they came here and started dividing the land. This became a rural place, with chickens, cattle, a lot of vegetation that gives alternative medicine. There were many Northeasters; in the old times they always worked with planting stuff.*

**Degradation** Although the focus groups uncovered people's own beneficial uses and experiences of nature, it also became clear how *favela* residents' perception of nature is closely tangled up with the general idea of hazards, sewage, and degradation. These negative aspects are so strongly ingrained in and repeated by people in and outside the community that we can talk about an ‘official’ narrative of environmental degradation, disasters, and drug-related violence linked to *favelas* (see Chisholm 2016). When participants were asked the general question of what nature meant to them, the discussion

quickly turned towards a description of problems related to sanitation and degradation in the nearby nature:

[CW] – *What comes to mind is... life.*

– *Health.*

– *And at the same time, it is about conveying to the people, to have enough basic sanitation, for the people who need to live here in the community (...). You find garbage in the middle of the street, instead of people becoming aware of taking the garbage from their homes and throwing it in the dump. There is a lot lacking with regard to nature, health. To make these people aware, also not to cause floods, due to this track record of throwing paper in the street, PET bottles in the street... it causes tremendous harm owing to the floods that happen here in the community.*

– *Especially now, in the summer, there are these rapid summer rains that come down as it were an entire months' worth of rain in half an hour.*

The problems of natural disasters, including flooding, coupled with the lack of infrastructure for sewage and sanitation in the *favela*, creates an idea here of nature that is associated with degradation. In addition, all groups strongly emphasised (other) people's lack of awareness and environmental behaviour as propelling the harm, through practices such as littering and unlawful vegetation cutting. In fact, when asked if there was something negative about nature in Rocinha, they all insisted that the only negative thing were the people in it.

A common denominator in the personal testimonies about environmental degradation is the identification with trees as symbols of nature and feelings of sadness when they are cut down:

[EA] *Whenever I see someone cutting down trees, I start complaining, I take photos ... I would like to have the power to forbid the construction. Almost every day I hear the axe chopping around here.*

**Security** When asked about natural areas to visit in the *favela*, some participants referred to security issues concerning police and drug-related violence. The Ecological Park was used as an example (EA): "I think that almost no one goes there because of the police... police violence in the *favela* make people afraid to visit". While police violence is part of everyday life in Rio's *favelas*, the statement is likely a reference to the story of bricklayer Amarildo de Souza, who disappeared in 2013 close to the Ecological Park and was later found tortured to

death by police (Watts 2013). The security concern was seconded by the cultural workers:

[CW] *It is not nice for us to access that bush/forest in the Ecological Park. Why, what do we find in that bush? Is it really only monkeys and little birds? Sometimes not, sometimes you encounter something that is not nice.*

(Researcher: *Like what?*)

*Like people who have chosen the wrong life, like right now, Rocinha is at the brink of war, and these entries and exits [of drug soldiers] are through the bush. So, we will not enter the bush.*

Green and bushy areas are thus unsafe and can be seen as "negative space" since they provide hiding spaces and pathways for gang-related violence and crime.

**Selfhood and sociality** Participants expressed what can be considered an emerging cultural norm of identification with a 'middle class' ideal, engaging in hiking and eating sustainable, organic and healthy food. One participant referred to this as the 'fitness' trend:

[CW] *It's in this "fitness" age, a lot of people are adapting to the organic [ideal] due to this, people are doing their own planting, (...) eating what they plant, they make a little vegetable garden at home, without pesticides. I think this is emerging more and more.*

Participants often described the need for other people in the *favela* to change their awareness and behaviour (EA): "Today, people don't value nature; they think that they are owners of the place and they don't see the bad that they are causing." It became particularly evident how the environmental youth constructed their selfhood in relation to other people in the community and by relating to significant life experiences involving nature (EA): "[I spend my time] cleaning out garbage that other residents throw".

[EA] *We took a trail up the mountain, to camp there. For me, it was nature, it was God, it was everything. (...) It was the happiest moment of my life, there in nature, taking a walk in nature, contemplating.*

The group of evangelicals also criticised "other people", including short-term residents.

[EC] *The problem is the people, the majority of people. Because they don't understand that I am nature, you are nature. (...) Many people stay only for a short while in*

*Rocinha, and then they leave. So, they don't have love for the place, they don't take care of it.*

The participant went on to describe how he saw Christianity as contributing to environmental awareness and environmental awareness as a part of citizenship:

[EC] – *We Christians have this thing with caring for life. All of Rocinha's problems with public security... people don't give due value to life anymore. What we see in the day-to-day, like the garbage that should be in the bin, even if the bin is right there and it's empty, they put it on the ground. (everyone agrees).*

– *Yesterday, I argued with a person in the street; I said my love, it's empty, why don't you put this bag there instead of on the ground (...)*

– *It's their responsibility as citizens. People throw trash into the canals, they put the trash bag in the neighbour's door, they are too lazy to take it to the right place.*

## Stewardship of BCD

As seen in the previous section, we identified forms of care and engagement tied to different cultural groups, including Afro-Brazilian religions or the traditional livelihoods of rural migrants. Local stewardship was also seen as emerging through 'new' cultural ideals, including the NGO frequented by the environmental activists (Favela Verde). It promotes awareness raising, garbage clean-ups, community gardens, and the management of nearby trails as well as the training of local guides to eventually launch a community ecotourism business (I1). One of the participants emphasised the importance of the NGO in empowering her to engage in these activities and said that: "I always wanted to do this, but [before the NGO started] I felt like I didn't have the force".

However, the case study also revealed conflicts between what can be seen as social versus conservation values, and religious diversity (e.g., use and management of natural spaces considered sacred to different groups) was a key theme (I2, P2). For instance, our interview with the management of Tijuca National Park indicated that Afro-Brazilian religious practices cause environmental degradation through leaving plastic and other non-degradable materials in the forest as offerings. The park had initiated dialogues with religious leaders, who suggested that the custom could be changed so that offerings were removed again after the ceremony (I2). Similarly, the evangelicals described cutting down trees in the Tijuca Forest to make room for their prayer ceremonies on the mountain (EC). Conflicts of interest were also revealed regarding what kind of trees were seen as desirable in the forest (I2, P2). One example is the jackfruit tree, which is an invasive species that the

park management aims to contain and clear, but that the interviewed residents described that they like and use. Previously, reforestation projects have deliberately planted tree species with thorns to keep *favela* residents away (I4).

## Reflections on application: Merits and contradictions of urban BCD

In this section, we answer our second research question by using our empirical work in Rio and perspectives in the literature to analyse the operationalisation of urban BCD and its four conceptual propositions (see Section 2.3). More specifically, we discuss and exemplify how the urban BCD framework can frame human–nature interactions in ways that emphasise a) interrelationships, b) variation of group values, c) participation, and that are d) reflexive and sensitising. We highlight how these aspects can make the urban BCD approach particularly suited for places like Rio, while raising some concerns regarding its application in the Global South.

### Interrelationships

Urban BCD focuses on the dynamic interrelations between biological and cultural diversity, which are seen to co-constitute each other – “they are ‘made’ together and imply each other, they are inextricably linked” (Buizer et al., 2016, p. 9). While practically useful for our study, this idea sparks a number of theoretical questions.

Our Rio study generally benefited from departing from interrelationships, i.e., identifying groups of people and their relationships and practices concerning nature, rather than starting from particular ES provided by green areas. Whereas ES directs focus to benefits associated with particular nature, we find that a BCD perspective may better reflect how people's ideas of nature were tangled up with the community's problems of sewage, health problems, and natural hazards, to the point where it was difficult to separate out 'nature' from these stories. The focus on interrelationships is also favourable since it allows for negative perceptions of nature to be revealed in ways that an ES approach typically does not account for.

We observe, however, that there is little guidance for how to understand the urban BCD framework as interrelational or co-constitutive between natural and social dimensions in an ontological (i.e., related to the nature of existence) and epistemological (i.e., related to the nature of knowing) sense. This may translate into uncertainties regarding operationalisation and knowledge integration, since different methods that potentially draw on conflicting ontologies and epistemologies are to be combined between the three dimensions of materialised, lived and stewardship of BCD. Specifically, we see a challenge for the idea of interrelationships to be realised through the framework when the natural dimension



(materialised BCD) becomes represented by realist and biophysical methods while the social dimension (lived and stewardship BCD) is represented through constructivist or interpretivist methods. For example, we question how our findings representing the lifeworld (i.e., lived BCD) are to be ‘interrelated’ with the dimension of materialised BCD based on e.g. GIS data. There is a risk that qualitative and constructivist interpretations of nature are simply overlaid the quantitative and ecological data, which is considered as the ‘real’ nature. In this case, the claim that the framework recognises nature as ‘socially constructed’ (Buizer et al. 2016 p. 9), will have to be more closely interrogated. An interpretation of the social construction of nature in a material and ontological sense (Demeritt 2002) can come to challenge the conceptualisation of materialised BCD as building on biophysical scientific data. Recognising the social construction of nature in a material sense implies that there can be wildly different ontological perspectives of the same ‘things’ within the framework; that is to say, it encompasses a plurality of worlds, which gives rise to questions of power and inclusion of local knowledge (see Section 4.3).

Traditions such as critical realism (Archer et al. 1998) might offer further guidance for the development of how the three dimensions of urban BCD can be operationalised. Here, the social world is seen to exist independently of our knowledge of it and is driven by causal mechanisms. Additional perspectives from, for example, critical human geography can be seen to resonate with the ambitions of the framework where dualism of humanity and nature are rejected and the starting point is instead inseparability, co-constructedness, and complex entanglements (Castree and Brown 2001, Haraway 2003). It can also be compared to an emerging ‘relational’ view within sustainability research, in which qualitative analysis of the cultural, symbolic, and non-material is to be seen as on ‘equal footing’ with the quantitative and ‘objectivist’ material analysis traditionally favoured for analysing social–ecological systems (West et al. 2020; Lejano 2019).

Problems associated with operationalisation are not unique to this framework (see Thorén and Stålhammar, 2018), but they are perhaps more evident because of the high ambitions and extensive conceptualisation of the three dimensions. Regardless, the framework offers a starting point to further spark interest in and develop epistemologies that can both strive to operationalise co-constitutiveness between natural and social dimensions and accommodate pluralism. Alternatively, it may be more accurate to interpret the wording regarding urban BCD as ‘interrelational’ and ‘co-constitutive’ in terms of *layering* and *linking* dimensions rather than as integrating ontologies and overcoming dichotomies.

### Variation of group values

Urban BCD is considered to highlight *variation* in how cultural groups in specific contexts value and interact with nature

and related changes over time (Vierikko et al. 2017b, Elands et al. 2018). Here, we would like to raise some concerns regarding valuation and the identification of cultural groups, with particular focus on the Global South.

A central assumption regarding how BCD will lead to better governance is the implicit presumption that people value (formal and informal) green spaces positively. While the framework in our case allowed for uncovering both positive and negative views on nature, the way it has been outlined in a European context still has an underlying assumption that nature is ‘good’ and that including a diversity of values through assessment will result in political or public preference for its conservation. However, including more participants from diverse places will not necessarily lead to more positive accounts of nature. This might especially be the case in cities in low and middle income countries, where informal green spaces are often linked to problems associated with waste and sewage, with health impacts, and crime (Adegun 2017). Similarly, place memories might also reflect displacement and violence, and BCD and associated approaches need to be sensitive to these aspects. Even when people express positive perceptions and high values, they may be in conflict with traditional biodiversity conservation, symbolised by the contested jackfruit tree in our case. Different people’s or groups’ values of urban nature are not necessarily in line with conservation goals and targets, and as observed in a parallel study (Stålhammar, 2020), recognising these in traditional conservation management approaches can be challenging. Such conflicts become especially precarious in cities encompassing biodiversity hotspots, where pressing social needs (e.g., for affordable housing) compete with high biodiversity values in green areas regulated by conservation legislation and formal protection (Holmes et al. 2012). Nevertheless, with its focus on different groups, BCD could be used to highlight contested spaces and ways of living in urban nature, including how some groups might benefit from particular green spaces at the expense of others (see Buizer et al. 2016).

The issue of cultural groups and their values also generates an important methodological question, namely, what constitutes a ‘cultural group’ in a place?<sup>4</sup> In our study, we found it beneficial to start from different groups relevant to the study

<sup>4</sup> While urban BCD aims to provide a more comprehensive conceptualisation of culture and cultural diversity than ES (e.g., Elands et al. 2018), described e.g., in terms of demographic, socio-economic, linguistic, and ethnic/national heterogeneity and related interactions (Vierikko et al. 2016), there is little methodological guidance for its application. The empirical studies done within the GREEN SURGE project (Vierikko et al., 2017a, 2016) typically approached their cultural groups through: (1) interviews and observations of users in specific green structures, such as parks or botanical gardens, (2) targeting individuals from diverse socioeconomic groups for a structured questionnaire with photos of hypothetical green spaces, or (3) spatial mapping linking indicators of cultural diversity (such as population density, age dependency ratio or percentage of foreigners) with biological data at the city level.

area and ask about their interactions with nature, rather than to start from a pre-determined ecosystem service or park. This revealed a variety of positive and negative experiences and values associated with diverse urban green structures (from houseplants to hiking paths). Rather than fixed analytical categories, our group labels worked as sampling categories (to ensure different views were included), which also allowed a snowball-type identification of new groups for potential future studies, such as surfers, spiritists, parents/children, and Quilombos (traditional Afro-Brazilian communities of resistance). We hereby see it as positive that BCD's conception of cultural diversity can direct attention both to relatively 'static' categories such as ethnic and religious groups and to other urban 'tribes' and subcultures (surfers, 'fitness' devotees, etc.). However, we raise our concern about a functional focus on cultural diversity and categorisation of cultural groups, which seems particularly unfitting in our study site. A simplistic categorisation of people according to how cultural or ethnic groups use green spaces differently (e.g., "immigrants" for social and food-related activities and "native-born citizens" for sports in Elands et al. 2015, p. 3363) risks de-politicising and de-historicising places and people in cities like Rio de Janeiro. For instance, potential differences in the modern-day use of nature between a (more often) white Brazilian middle class population and a (more often) Afro-Brazilian *favela* population cannot merely be seen as a matter of group preferences, but will inevitably reflect Brazil's almost 400 years of slavery and the existence of *capitões de mato* (bush captains) contracted to hunt down people who fled into the forest. The idea of seeing and comparing cultural diversity side by side with biological diversity could also risk naturalising cultural or socioeconomic categories such as 'favela dwellers', 'evangelicals' or 'urban poor' so that they become perceived as neutral entities that can be compared on the same terms as ecosystems or species. Indeed, to tap into the concept's transformative potential, a challenge for BCD researchers who create cultural categories to highlight diversity *between* them will be to avoid unintended determinism and find ways to support flexible preferences, diversity, and change also *within* groups.

### Participation and inclusion of marginalised knowledge

Urban BCD is considered to have a stronger focus on inclusion of knowledge through participatory approaches than ES, with the aim to "open up" for other types of knowledge and to start from the perspective of participants rather than pre-determined perspectives (Buizer et al. 2016, Vierikko et al. 2017a). However, with its largely descriptive focus on depicting and assessing human–nature interaction, we ask how the framework could be inclusive and/or empowering in a place like Rocinha.

Our first question concerns BCD as inclusive of local knowledge. While the framework is claimed to integrate (or 'link up') various knowledges of nature, there is a risk that it simply portrays these as being additional, overlaying the cultural over the natural, rather than seeing them as inherently interrelational, as discussed above (Section 5.1). How nature is viewed here, and whose version of nature counts, can have important political and methodological implications with regard to the inclusion of knowledge. The crucial question is whether the framework will allow for local people's ideas of nature to *challenge* the authority of scientific knowledge, or whether people's knowledges will simply be subsumed and overridden by biophysical scientific data. Researchers should pay attention to 'silences and incompatibilities' between datasets produced by different methodologies, since these can yield rich insights and reveal the partiality of different types of knowledge (Nightingale 2003, Johansson and Abdi 2019).

Another central idea is that urban BCD assessments can inform and attract policy interest to maintain and protect the kind of nature and practices that people care about (Vierikko et al. 2017a) (see the discussion on values and governance in Section 5.2). Here, one might critically ask what power marginalised groups' perceptions actually have to inform and change policy and formal institutions or mobilise interest in conservation in this way. The idea of including underrepresented groups of people in natural resource management will be superficial if broader social and institutional structures do not also change to support inclusivity (Cooke and Kothari 2001, Agrawal 2002). This latter idea of knowledge inclusion resonates with the large and varied literature on participatory approaches that claim to be 'empowering' or 'emancipatory' (Freire, 1970; Glassman and Erdem, 2014; Mertens, 2007). Moreover, placing the focus on individuals' (underrepresented or not) practices and preferences fails to recognise the broader societal and institutional landscape that supports unsustainable development. For example, while Latin American governments have (sometimes violently) fought informal settlements and related environmental degradation, many land invasions have also been sanctioned since they have allowed employees to subsist on lower wages in the city; such settlements thus function as a subsidy to capital and to labour (Eckstein 2001). Moreover, dogmatic discussions about nature conservation versus *favelas* rarely acknowledge that both nature and the urban poor are given a low priority under the dominant elite-oriented planning model, which aims to 'sell' the city as merchandise on an international market by favouring high-end services and infrastructure (see Vainer 2000). If BCD is to be emancipatory and empowering, it may need to move beyond its descriptiveness and engage with further theoretical perspectives, such as migration and critical urbanism, to understand how, why, and in which context particular practices harmful to citizens and nature exist. With its focus on explaining the (sometimes unobservable) causal

mechanisms of social phenomena, the philosophical perspective of critical realism could provide insight into how emancipation can be approached by revealing underlying structures that affect people's situation negatively, including how the cultural and the natural co-shape each other (Fletcher, 2017, Isgren and Harnesk 2019). With regard to the 'lifeworld', methodology on emotion and subjectivity in participatory resource management (Morales and Harris 2014) can offer a foundation of how participatory work can be attentive to the individual experience and at the same time examine broader contextual factors and power dynamics.

Even as a descriptive approach, however, we see how BCD could challenge or 'disrupt' the dominant narrative of *favela* residents as environmental villains. The urban BCD framework can highlight people's positive engagement and relationships with nature beyond the ES framework's simple focus on the benefits of nature. By enhancing positive perceptions and care of nature, an alternative image can emerge alongside the dominant one of violence and degradation that is often depicted in the media. This may have implications at both the political and personal level. Firstly, whereas informal settlements are currently often put in opposition to conservation, *favela* residents' ecological claims or actions can help give validity to – and discover new allies for – their ongoing social struggles, similarly to social movements in Europe (Islar and Irgil 2018). In fact, there are examples of *favela* activists employing environmental actions to create legitimacy and counteract evictions on environmental or conservation grounds (Rio on Watch 2017). Here, there may be important synergies with dweller's claims regarding risks and losses from climate hazards such as floods and heat, not least in the emerging discussion on climate attribution (James et al. 2019). Secondly, making such environmental engagement visible has the potential to strengthen people's identity in relation to the formal city. Our findings demonstrate how *favela* dwellers themselves subscribe to the official narrative that "poor people destroy nature", for example in describing other dwellers as the main negative aspect of nature. The pervasiveness of this narrative cannot be overstated, as became evident when we reported back our findings to residents and activists in 2020. While we tried to highlight the positive environmental engagements that showed up in the (more exploratory and interactive) focus groups in 2018, the "garbage problem" quickly took over the discussion in 2020. At the same time, we observed how citizen-building and identity formation processes continuously took shape in discussions of the environment.

Finally, we see that through a purposeful focus on different groups, the framework has the potential to reveal marginalised or contrasting views. As the suggested BCD indicators (Vierikko et al. 2017b) include physical accessibility (under materialised BCD), safety, conflict and inclusiveness (under lived BCD), and land tenure and property rights (under stewardship), there is potential for the individual researcher to

highlight related environmental justice issues. The framework also directs attention to 'place-making', i.e. how people co-create green spaces through practices and discourses. Based on our case, we suggest that this research needs to include more nuanced perspectives with questions of access amongst different groups and for whom existing (formal) green spaces have been established. As suggested by Vierikko et al. (2017a p. 54), by scaling up the focus of analysis, one can gain a deeper understanding of socio-political and economic factors beyond the local green structure.

### Sensitising and reflexive

Urban BCD is advocated as a sensitising (rather than definite) concept that allows for reflexive research (Vierikko et al. 2017b, Elands et al. 2018). We here sketch a working definition of what sensitising and reflexive can mean and discuss related choices for our study.

The idea of urban BCD as a sensitising concept is explained by Buizer et al. (2016), quoting Blumer (1954 p. 7), as "[w]hereas definitive concepts provide prescriptions of what to see, sensitising concepts merely suggest directions along which to look". Sensitising concepts lack specified attributes or "fixed bench marks" and instead give a general sense of reference and guidance in empirical inquiry (Blumer 1954 p. 7). We find it useful to understand sensitising concepts as "a place to *start* inquiry, not to *end* it" (Charmaz 2014 p. 30). When designing our methodology, we applied selected BCD indicators (Vierikko et al., 2017b), which helped us inquire about and pay attention to participants' perceptions of welcomeness, diversity, security/conflict, and place memory (while we deemed indicators focusing on, e.g. species inventory, local economy, land tenure, and network structure of governance as outside our scope). To enhance the perspective of lived biodiversity, we combined these indicators with the fractions of the lifeworld (see 3.2.1) as "directions of where to look" and "a place to start inquiry", which led to the inductive identification of eight 'hybrid' categories of manifestations in the focus group material (see Section 4.2). More generally, we find that the overall conceptualisation of BCD, and specifically of culture as dynamic, leaves room for a more open interpretation of human–nature interactions and knowledges, including constructivist methodologies and understandings. Whether it is more sensitising than ES, however, relies on the specific methodology and analytical concepts applied in each case (including the techniques mentioned in this section). Our 'sensitising' methodology might indeed be adaptable to an ES study, but the analysis would be more focused on looking for categories of services, and combining a techno-scientific term like ES with, e.g. the concept of the lifeworld, might be met with resistance.

Closely related to urban BCD as sensitising is the idea that it should support reflexive knowledge production. Reflexivity

in BCD is explained as a general call for more qualitative and ‘context-sensitive’ approaches (Elands et al. 2018), offering an alternative to the top-down standardised and generalised knowledge associated with ES (Buizer et al. 2016). The focus here is also on contextualising one’s own knowledge and recognising the social nature of research practice. In other words, researchers should not assume ‘neutrality’ but recognise the co-production of knowledge and the inherent values of methodologies (see Vatn 2005, Buizer et al. 2016). There is, however, little methodological guidance as to how to ‘do’ reflexivity in practice. In descriptive phenomenology, a key methodological device for reflexivity is ‘bracketing’, which entails researchers deliberately putting aside their preconceptions and knowledge about the studied phenomena by using strategies such as delaying literature review until after data collection and analysis, asking open-ended questions, returning results to participants, or keeping a reflexive diary through the research process (Chan et al., 2013). In contrast, *interpretative (hermeneutic) phenomenology*, which we adhere to, does not see it as possible nor desirable to fully set aside or ‘bracket’ researchers’ experiences and understandings. For us, the phenomenological approach is characterised by an intersubjective interconnectedness between researcher and the researched (Finlay 2009), which means that we assume our own subjectivity from the outset and try to distinguish what ideas belong to us rather than the researched. In our study, we were for example cautious about overemphasising connectedness and relationships to nature and the forest that one might associate with traditional or indigenous spiritual beliefs. By explicitly paying attention to ‘romanticised’ descriptions, we found that these were also associated with, e.g., popular or contemporary culture. We also examined our preconceived idea that participants would mostly see local nature in negative terms; conversely, participants rejected the idea that nature could be or do ‘wrong’. The latter may, however, also be related to focus group design, where questions about people’s general or abstract view of nature (“What does the word nature mean to you?”) preceded those about particular nature (“What green spaces do you visit?”, “What types of animals or plants are found here?”).

Another aspect is how the BCD framework, or related research findings, can be translated into urban policy and planning in a reflexive way. Policy makers may be more likely to pick up tangible, material, easily quantifiable, and generalisable aspects of human–nature interactions. While recognising context-specific relationships is in line with current conceptualisations of Nature’s Contributions to People (Díaz et al. 2018), fundamental questions remain about how to integrate such context-specific and qualitative knowledge in general planning and decision-making frameworks. In other words, in what form can qualitative and context-specific data be presented alongside other indicators in a way that does not reduce or subsume local ways of knowing? BCD’s

contribution to ‘governing cities reflexively’ (Buizer et al. 2016) through planning guidelines or assessments depends therefore not only on what research methods are used but how results are interpreted, placing importance on the institutional setting as well as the participation of researchers who can explain the uncertainties and limitations of their findings.

## Concluding remarks

In this paper, we have critically and reflexively applied the biocultural diversity (BCD) concept as it has been reimagined for the urban context. We have advanced urban BCD (as framed by the GREEN SURGE project) by placing it in a highly diverse Brazilian setting, developing a qualitative BCD method using focus groups, and exploring four central methodological challenges.

In response to our first research question, we found BCD to be manifested in Rocinha in a variety of ways, and participants explicitly brought up the link between cultural diversity and the diversity of plants and herbs inside the *favela*. Three key observations can be made about the empirical results: First, a positive image emerged of *favela* residents’ own relation to nature alongside the existing “general” view of nature as linked to problems of garbage, disasters, and gangs. Second, we have shown how in this rapidly urbanising context, “local” perceptions and ecological knowledge do not only mean traditional or indigenous but are as much infused with nature romanticism, popular culture, and ‘hiking’ and ‘fitness’ ideals. Third, we found that focus group discussions about local nature became an arena for citizens to articulate how they perceived their identities in relation to the *favela*, and the group discussions can therefore be seen as a type of deliberation on local values of nature and ‘citizen-building’.

In response to our second research question, we see several ways in which our case study benefited from a BCD approach. With the starting point in interrelationships and diversity of values, BCD may be more suitable to study human–nature relations in contested places like Rocinha since it can portray both negative and abstract positive aspects of nature that generally do not fit into a narrow focus on ‘services’. Highlighting positive biocultural engagements and relationships with nature allowed alternative images to emerge alongside dominant narratives of violence and degradation, which may serve to imagine alternative futures as well as to strengthen citizens’ identity in relation to the formal city.

However, we raise a few concerns regarding the urban BCD framework and approach. A key question is whether BCD – as it has been used in GREEN SURGE – actually necessitates *biodiversity*, or could the word biodiversity be replaced with ‘nature’? In fact, it seems like cultural diversity or a diversity of *perspectives* (often found in cities) is more important for the approach to generate interesting findings. Its



application may be less efficient or even contra-productive for traditional biodiversity conservation efforts.

We have another concern regarding co-constitution and integration of knowledge. While the aim of the framework is to go beyond the dichotomised thinking associated with ES, it spurs questions concerning potentially conflicting perspectives, ontologies, and epistemologies that are to be combined during the operationalisation of assessment methods for the three dimensions within the framework. With its ambition to combine a realist understanding of materialised BCD with a qualitative understanding of experience and use, there is a risk that the framework merely perpetuates the ES framing by portraying natural environments as mechanistic components of ‘green infrastructure’ which provide a stable and ‘objective’ foundation of green over which people overlay (rather than integrate) meaning and interpretation. It is therefore important not to overemphasise the ‘co-constitutiveness’ of the framework itself but to strive to be attentive to and investigate how different applications and methods operationalised within the framework are partial, complement each other, and are subject to positionality.

This study also demonstrates some of the limits of what a conceptual framework can do. The ambition to create holistic and comprehensive frameworks with various perspectives of human–nature interactions is at odds with the fact that partial representations often are what makes frameworks useful to begin with (Mitchell, 2009). The appropriateness of a framework then depends on what the purpose of the representation is and what type of intervention is called for. The BCD framework developed in GREEN SURGE will not automatically emphasise interrelationships, variation of group values, participation and knowledge inclusion, and be reflexive and sensitising – this will depend on its application. We believe that some criteria should be formulated to guide and ensure the merits of the framework in operationalisation. These criteria should address aspects such as problem formulation (e.g., what is the purpose of the assessment? How is ‘culture’, ‘interactions’, and ‘biodiversity’ defined?), data elicitation (e.g., how can categories for data collection represent diversity and change?), and knowledge integration (e.g., using a mixed methods perspective, how do different BCD dimensions and related qualitative and quantitative methods support, complement, silence, or unsettle each other throughout the process?). We welcome a plurality of research perspectives; epistemologies such as critical realism can help uncover underlying mechanisms and feminist epistemology can reveal the power dynamics and politics of attempts to incorporate situated knowledges in scientific frameworks, but these epistemologies are certainly not the only way.

We remain critical of the appropriation of the term ‘biocultural diversity’. Since the aims of the framework we call ‘urban BCD’ deviate from traditional BCD approaches, it

can seem unnecessary to adopt a term associated with already manifested scholarly traditions. In particular, it might create tensions if urban BCD is seen to imperialise conceptual territory. However, the emerging ‘paradigm’ of BCD research (Merçon et al. 2019) signals an opportunity to leverage the commonalities amongst diverse BCD approaches that focus on local human–nature relationships and situate these alongside each other to target what type of BCD lens is most appropriate for what purpose. We hereby align with scholars who have expressed the need to study biodiversity interactions beyond a limiting and deterministic view of ‘indigenous people who are connected to nature’ (Cocks and Wiersum 2014) – in both rural and urban places.

We conclude that urban BCD implies a conceptual advancement in considering local human–nature relationships in cities, also for the Global South. Compared with the ES concept, it allows for a more inclusive and comprehensive understanding of the relationships between urban nature and people’s quality of life. Moreover, it allows for a diverse application of methodologies, especially with regard to the qualitative social sciences. Importantly, the success of the approach hinges on the fact that its focus on interrelationships, diversity of values, inclusiveness, and reflexivity is maintained when the framework is integrated into policy and decision-making. In relation to this, it is crucial to further consider how and in what form qualitative BCD data on, e.g., emotions and the lived experience can be usefully presented to planners and conservation managers in a way that does not risk being quantified or reinterpreted as ES. The openness of the BCD framework may work well for being a ‘container’ for diverse approaches in research. If it is to be used for planning, however, it needs to match the demands of institutions of being clear and straightforward. That said, institutions also need to adapt to be receptive to context-specific perspectives, which calls for further engagement with developing BCD at the science–policy interface.

**Acknowledgments** The research benefitted from funding from the Lund University Centre of Excellence for Integration of Social and Natural Dimensions of Sustainability (LUCID) funded by the Swedish Research Council Formas (Linneaus Centre LUCID; grant 259-2008-1718) and from the Swedish Research Council VR (“Where the Favela meets the Forest”, grant number 2019-00498). We are grateful to the reviewers and the following people for their invaluable input and support during the research process: Eja Pedersen, Anne Jerneck, Gabriel Voto, Agni Hevea dos Santos, Chad Boda, Guilherme de Mendonça, and most of all, the anonymous research participants.

**Author’s contributions** Both authors contributed equally to the literature review, study design, analysis of empirical material and writing. SS took the lead on the theoretical framing and discussion of conceptual implications. EB led the field work in Rio de Janeiro.

**Funding** Open access funding provided by Lund University.

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