Assessing governance challenges of local biodiversity and ecosystem services: barriers identified by the expert community.

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6
7 Abstract
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9 This paper assesses barriers to local biodiversity and ecosystem (BES) governance
10 within cities, drawing on findings from an international expert survey encompassing 45
11 cities in 25 countries. BES is recognised as a key foundation for sustainable cities, yet
12 current literature indicates that more clarity is needed on the factors which may
13 undermine BES initiatives. Survey findings show broad agreement that officials in
14 development sectors have inadequate BES knowledge, budgets for BES are insufficient,
15 and planners in the locality lack knowledge about BES. Respondents not working for
16 local governments were more likely to see policy change with administrations, budget
17 limitations, and lack of expertise as barriers. Respondents for cities in less-developed
18 countries agreed significantly more that there were harmful cultural activities, and were
19 more concerned that inadequate consideration from governments at different scales and
20 poor internal communication were barriers. Based on the findings, we suggest (a) a
21 need to evaluate the effectiveness of collaboration both within government and between
22 sectors; (b) the importance of building capacity within local government staff, both in
23 techno-scientific knowledge and in engaging the policy landscape with this knowledge;
24 and (c) the importance of further considering how BES conservation may relate to
25 culturally meaningful practices.

26
27 Keywords
28

1. Introduction

This paper critically assesses barriers to conservation of biodiversity and ecosystem services (BES) at the local level[1]. Political and societal awareness of the need for urgent action on BES has been stimulated by the high-profile release of the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services' first Global Assessment (IPBES, 2019), which warned of dangerous declines in species and a number of extinction threats. The IPBES assessment reflects a longer history of BES policy and applied research, including the Convention on Biological Diversity (CBD); the Economics of Ecosystems and Biodiversity (TEEB) initiative; and national biodiversity strategies and action plans (see Figure 1). Drivers such as climate change and population increase (with associated demands for food and infrastructure) will increase pressure on BES further (Natural Environment Research Council - Biodiversity and Ecosystem Service Sustainability Programme, 2018). Yet against this backdrop of urgency, it is crucial to systematically establish the factors which prevent effective local BES governance, so that proposed interventions can be responsive to challenges faced in practice.

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[1] There is no universal consensus on the definition of local, city, or urban. In this paper we hence use 'local' as a generic term to refer to BES governance processes taking place at the sub-national level. This includes metropolises, cities, and towns which contain urbanised areas, as well as processes at the landscape and regional levels. The sample of respondents includes people working in jurisdictions which are almost entirely built-up and others working in jurisdictions which contain urbanised areas and significant rural elements.
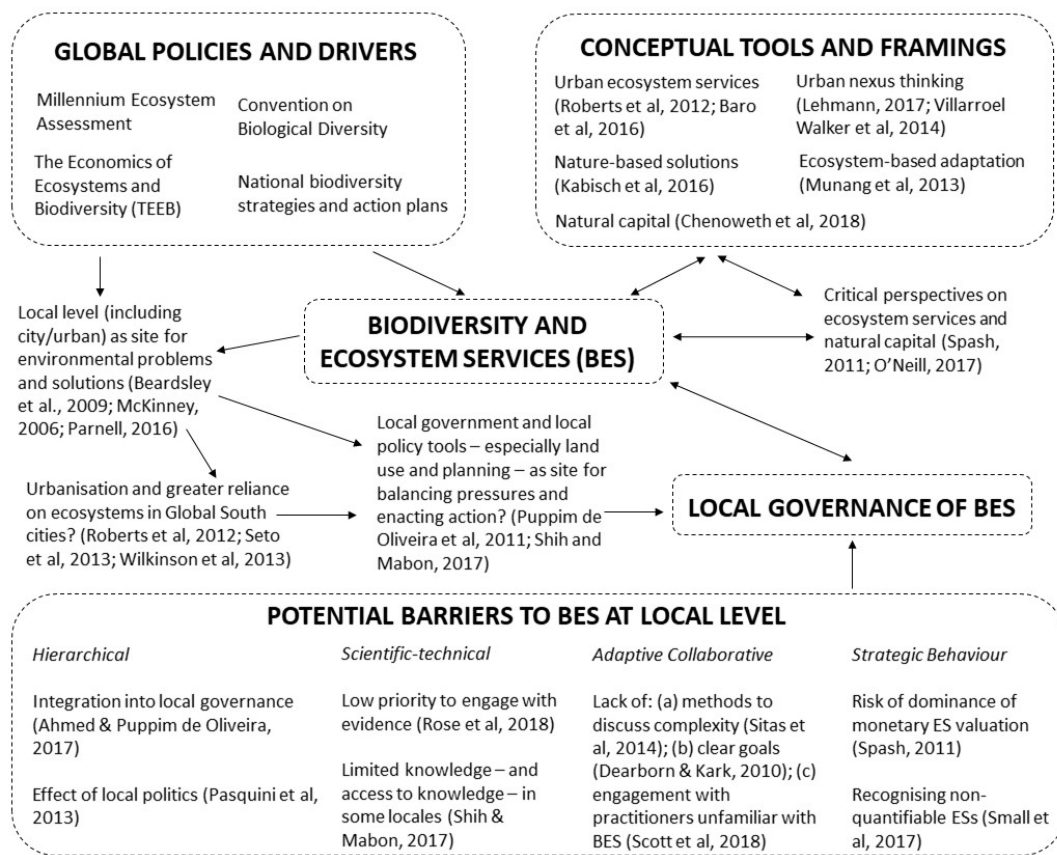
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2 *Figure 1: Relation of local BES governance to policy and conceptual drivers*

3 Figure 1 illustrates how the local level has become a focal point for BES governance,
4 to respond to a number of external drivers and translate conceptual thinking on social-
5 ecological systems into practice. The role of local government in BES gained particular
6 significance after the failure to achieve the 2010 global target on reducing biodiversity
7 loss (Secretariat of the Convention on Biological Diversity, 2010; Puppim de Oliveira
8 et al., 2011). National discourses on benefits of BES conservation arguably did not filter
9 down to local levels, where decision-makers need to balance conservation with social
10 and economic imperatives (Mace et al, 2016). In spite of such rhetoric, the continued
11 prioritisation of economic growth over environmental considerations in national-level
12 policy has also been questioned (Longlands, 2013). Moreover, smaller levels of
13 government allow finer-scale recommendations to be made to promote BES
14 conservation, through processes such as land use planning and open space systems
15 (Puppim de Oliveira et al, 2011; Shih and Mabon, 2017).

16 Understanding and overcoming barriers to BES actions at local government levels is
17 hence important if biodiversity is to be integrated within development process. Indeed,
18 the contribution of ecosystems to people is already deployed as a means of emphasising
19 the value of BES conservation in cities (e.g. Roberts et al, 2012 on Durban; Baro et al,
20 2016 on Barcelona; and the Natural Capital Singapore initiative). Figure 1 illustrates
21 the proliferation of concepts which have emerged in recent years, reflecting the general

idea of human wellbeing through connection of ecological and social systems within cities (Wu, 2014). Common to these is the understanding that people are part of nature and can benefit from the conservation of biodiversity, which underpins a healthy ecosystem and delivers services such as habitat provision, soil formation, food production, water purification, climate regulation, disease control, carbon sequestration, spiritual inspiration, and indeed cultural practice (Berghöfer et al., 2011; Haines-Young, 2009; TEEB, 2012). As such, 'biodiversity and ecosystem services' have come to be considered in combination in both international policy (e.g. the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) and scholarly (e.g. Seto et al., 2013; Wilkinson et al, 2013) arenas.

Local governance of BES is therefore important for addressing global biodiversity loss, adapting to climate change and attaining sustainable urban development. Primmer et al (2015) identify four core aspects of governance which inform the success of BES initiatives. First is *hierarchical governance* – that is, how policies and decisions filter down to lower levels and translate into action. Barriers relating to hierarchical governance for BES identified in existing research include the extent to which BES is integrated into local development, especially for developing countries (Ahmed and Puppim de Oliveira, 2017), and the effect of local politics on successful mainstreaming at the finest spatial scales (Pasquini et al, 2013). Second is *scientific-technical governance* – systematically supporting decision-making with science-based knowledge about the influence of decisions on ecosystems. For BES, Rose et al (2018) argue that although there is good agreement on how to incorporate BES science into policy, low priority means there may not be a drive to ensure decisions are evidence-informed. Moreover, techno-scientific knowledge of ecosystems, and local competence to understand ecosystems, may be limited in some locales – especially in developing country contexts where historical legacies of uneven development (e.g. apartheid and colonisation) may result in different local capacity/priority to create or access knowledge (Wilkinson et al, 2013; Shih and Mabon, 2017). Third is *adaptive collaborative governance*, which concerns how knowledge-producers and decision-makers communicate across sectors and levels with the aim of finding ways to advance shared goals. At smaller spatial scales, the lack of methods to explore the complexity of landscape planning and management may be a barrier to local-level decision-makers utilising ecosystem service science (Sitas et al, 2014). This problem may be compounded by lack of clear goals (Dearborn and Kark, 2010); or limited consideration of the needs of communities or sectors who have to put such knowledge into practice (Shanley and Laird, 2002). The fourth element raised by Primmer et al is *governing strategic behaviour*. This refers to the importance of keeping control over people who are primarily interested in using ecosystems for their own economic benefit. A key challenge for BES here is to avoid monetary valuations of ecosystems dominating governance processes and reproducing potentially harmful market-driven logic (Spash, 2011); and to find meaningful ways to integrate cultural, heritage and aesthetic values associated with ecosystem services which may be harder to quantify (Small et al, 2017).

1   There is therefore an extensive body of literature into barriers to BES governance. Yet
2   this research arguably tends disproportionately towards the global 'north' (Luederitz et
3   al, 2015; Rose et al, 2018). Although BES actions are advocated within developing
4   country contexts to link environmental protection and poverty alleviation (Seto et al,
5   2013; Wilkinson et al, 2013), developing countries have arguably been
6   underrepresented in research on conservation, environment and climate, and in
7   international fora that shape research agendas (e.g. Doi and Takahara, 2016; Wilson et
8   al, 2016). Against growing awareness of the need to decolonise knowledge – including
9   in BES (e.g. Chilisa, 2017) – it is hence imperative to avoid assumption that the barriers
10   and strategies identified in more Western-centric BES research will be appropriate in
11   other parts of the world. Conversely it is vital not to assume that local BES governance
12   will be somehow 'harder' or less feasible in less developed country contexts (Pasquini
13   et al, 2013). There is, nevertheless, a need for further synthesis across diverse localities
14   and development contexts to build a fuller picture of challenges faced globally (Pullin
15   et al, 2015).

16   This paper hence elaborates barriers to BES conservation as a foundation for
17   developing responsive and appropriate incentives and strategies to promote BES
18   governance. We reflect on findings from the first half of an expert survey into BES
19   governance conducted by United Nations University – Institute for the Advnanced
20   Study of Sustainability (UNU-IAS) in collaboration with International Council for
21   Local Environmental Initiatives - Local Governments for Sustainability (ICLEI).
22   Whilst the survey in question addressed both barriers to and strategies for local BES
23   governance, in light of the complex background outlined above, to allow for adequate
24   depth within the confines of a single paper we focus on identifying common barriers
25   and difference in challenges that may be faced according to the development status of
26   a country. We return to possible interventions in the Discussion.

27

2. Identification of Characteristics Influencing Local Governance of BES

29   We first outline the process through which the survey questions were developed. Areas
30   of questioning were identified through participant observation at two international
31   forums: the expert meeting on Landscape Fragmentation and the City-Region approach,
32   organised by UN-Habitat and the Network of Regional Governments for Sustainable
33   Development in Barcelona in 2012; and the 3rd Meeting on the Implementation of the
34   Plan of Action: including a Meeting of the Global Partnership on Local and Sub-
35   National Action for Biodiversity and its Advisory Committee of Cities, which was
36   organised CBD and ICLEI in Nagoya, Japan on 22-23 March 2011. This allowed the
37   lead author to gain a broad-based overview of key issues being discussed by urban
38   biodiversity practitioners, and formed the basis for the survey questions.

39   Five overarching areas, and areas for sub-questions, were identified: legislation and

1   policy; political; institutional and operational; technical; and communication, education
2   and public awareness. Questions were then refined by reviewing scholarly and practice
3   literature to elaborate factors informing local BES governance.

4   We make two caveats. One is that the themes identified are not intended to be exclusive
5   or exhaustive. Rather, the themes are a heuristic division to further our understanding
6   of where barriers to local BES governance may lie in a complex situation. The second
7   is that this paper only uses the results from the 'barriers' section of the survey, to focus
8   on elaborating common challenges and clarifying differences which may be faced
9   according to the development status of a country. Hence, issues that were categorised
10 in the strategy section of the survey, such as leadership/championship, incentives, land
11 compensation, strategic planning, and payment for ecosystem services, are not reported.

12 *2.1. Legislation and policy*

13 Legislation and policy are the foundation for local BES governance. Legislation, if in
14 place and worded strongly enough, can compel action on BES issues (Melville-Shreeve
15 et al, 2018). Local-level policy allows fine-scale recommendations to be made, to put
16 discourses of environmental protection into practice (Puppim de Oliveira et al, 2011).
17 This is especially so for land use policy, which translates norms and values towards
18 BES into specific practices (Cowling et al, 2008). To mainstream BES thinking there
19 may be particular value in raising understanding of the significance of BES within
20 *planning* sectors (Scott et al, 2018). Indeed, strategic planning of greenspace (Handley
21 et al., 2007; Haines-Young, 2009) and green infrastructure (Hansen and Pauleit, 2014)
22 is argued to be an important part of BES conservation, and by extension human
23 wellbeing in cities. Healthy ecosystems in cities are also gaining wider interest in cities'
24 climate change strategies, through ecosystem-based adaptation measures (Roberts et al,
25 2012). However, particularly in developing country contexts, the ability of urban
26 planning to safeguard environmental quality and remain effective in the face of
27 developer and private sector land development interests has been questioned (e.g.
28 Leducq and Scarwell, 2018). It is also worth assessing the effect of higher levels of
29 government on local BES practice, as legislation and policy from national and/or
30 international levels can mandate (Kronenberg et al, 2016) or hinder (Primmer et al,
31 2015) local-level action. Whilst ecosystem services ideas are not yet common practice
32 in spatial decision-making (Lerouge et al, 2017), an important first area to understand
33 is thus the extent to which legislation and policy for BES at the local level not only
34 exists, but also has sufficient buy-in to be considered effective.

35 *2.2. Political aspects*

36 The enactment and enforcement of environmental policy is mostly influenced by
37 relations between local political and administrative structures (Elander et al, 2005).
38 Political attention to local environmental factors – and hence support for policies related
39 to BES– may vary over time depending on the issues deemed to be of significance to

the electorate (Mabon and Shih, 2018a). Moreover, environmental goals must at times be balanced with social and economic development. Although this is true across development contexts, in low- and middle-income contexts the social and political imperative to address poverty (not just economic growth) can make it even harder for biodiversity conservation to be justified without clear benefit to poverty alleviation (Roberts, 2010). This is why it is important to consider ways to mainstream BES across sectors to give a common purpose. To this end, 'champions' (whether individuals or departments/organisations) who are able to identify times or spaces when policy is changing and ensure they are in a position to influence the decisions being taken; lead brokering between stakeholders; and connect items on the political agenda have been argued to be crucial in sustaining momentum for action and transcending limited political will (Roberts, 2010; Bahadur and Tanner, 2014; Butler et al, 2016). Specific to local BES issues, champions with the nous and skills to shift framings and tap into different funding sources to finance long-term initiatives are important (Dearborn and Kark, 2010; Shih and Mabon, 2017). These 'politics' do not need to be large-scale formalised processes. They may be micro-politics (Macareavy, 2006) and/or informal interpersonal processes (Leck and Roberts, 2015). The second area to question is hence how 'politics' – both formal and informal - may act as a barrier to sustained, coordinated action, versus the competences of BES managers to work within and navigate this complex landscape.

2.3. Institutional and operational capabilities

Here we refer to how local-level organizations 'work', both in terms of external collaboration with other institutions and sectors and also internal relations with different government departments. As Sections 2.1. and 2.2. illustrate, competing socio-political pressures mean there is a need for effective governance – balancing public, private, scientific and civil society perspectives in order to make decisions about the management of the local natural environment (e.g. Young and McPherson, 2013) – to translate BES rhetoric into day-to-day action. Wilkinson et al (2013) argue that the institutional capacity to plan and regulate ecosystem services is among the most frequently cited barriers to ecosystem management in the academic literature.

The mainstreaming of BES issues – "embedding biodiversity considerations into policies, strategies and practices of key public and private actors that impact or rely on biodiversity, so that it is conserved and sustainably used both locally and globally" (Huntley and Redford, 2014: 7) – is seen as key to reinforcing this institutional capacity (e.g. Haines-Young, 2009; Karlsson-Vinkhuyzen et al, 2017). Conventional department-based approaches in governments, which operate or manage interdependent environmental resources through separate departments, can lead to trade-offs between resources and adverse environmental, societal and economic consequences (Bai et al, 2010). Facilitating cross-sector and cross-organisational collaboration towards mainstreaming creates conditions for innovative outcomes by drawing a breadth of perspectives into the decision-making process (Tschakert and Dietrich, 2010; Hurlbert

and Gupta, 2015). Operationalising BES conservation also requires access to financing and resourcing from within local government (Kohsaka, 2010; Kabisch, 2015). BES practice may also be facilitated by the formation of partnerships between the public, private and third sectors. Partnerships can provide the breadth to address the multi-faceted nature of biodiversity threats (Gavin et al, 2018). Yet partnerships may not be effective if they do not incorporate the management needs of local communities, or put results and data in a form accessible to communities making management decisions (Shanley and Laird, 2002). Munthali (2007) adds that to link biodiversity conservation with poverty alleviation, biodiversity partnerships need strong governance mechanisms and to ensure communities feel the benefits of sustainable management. The third area to evaluate is therefore the operational capacity of institutions. This refers to ability to translate legislation, policy and politics into practical BES management.

2.4. Technical areas

BES conservation within a locality requires ability to understand, apply and translate ecological concepts and approaches within urban planning processes (Ahern, 2013). Although disciplines associated with urban- and landscape ecology have developed theories and approaches for facilitating ecological/biodiversity planning and management in cities (Wu, 2014), these are not necessarily recognised/prioritised for realisation by cities (Nilon et al, 2017). In Durban, for example, effective BES governance has been influenced by the local government's awareness and knowledge; capability to utilise the underpinning science of BES conservation to inform spatial planning systems; and ability to link BES with addressing local socio-economic challenges (Shih and Mabon, 2017). Attaining such outcomes, however, requires an evidence base of information specific to the locale, and capability to integrate knowledge systems for planning and management (Fratzeskaki et al, 2016). Many cities still face difficulties accessing readily usable and verifiable BES data (Global Biodiversity Information Facility, 2012; Puppim de Oliveira et al, 2014). Ability to access, understand and manage 'knowledge' also increasingly encompasses competence in engaging with local knowledges (CBD, 2018a; IPBES, 2018). A fourth area of assessment is thus the extent to which local BES experts feel they have access to the requisite knowledge to enact scientifically appropriate management strategies – and also the ability to connect technical approaches to BES to the local societal context.

2.5. Communication, education and public awareness

Civil society engagement is often understood in BES as CEPA (communication, education and public awareness) (e.g. CBD, 2018b). 'Communication' is increasingly understood as a multi-way dialogue between different sections of society on what the most appropriate form of BES management is, rather than the one-way flow of information from 'experts' out to society (Mabon and Shih, 2018b). One aspect of evaluating CEPA may thus be the extent to which stakeholders have opportunity to meaningfully participate in decision-making processes (Wesselink et al, 2011). There

is a need to clarify publics people from different socio-economic or cultural backgrounds engage with local biodiversity (Botzat et al, 2016). The question of whether 'active publics,' people who usually participate in environmental consultations, are truly representative of the views of the wider community has also been raised (Harrison and Haklay, 2002). Understanding the cultural significance associated with BES - and by extension the relationship between BES and culturally-meaningful activities - is viewed as an area requiring further research (e.g. Tengberg et al, 2012; Milcu et al, 2013). A fifth area to elaborate is hence the extent to which 'experts' in different contexts consider civil society issues, and how they see their influence on management and governance processes.

The above five themes are all areas which may need to be negotiated as part of considering BES within local environmental governance. The aim of this paper is to assess the relative extent to which these are considered to be areas of concern, through surveying those with expertise and practical experience in BES governance at the local level. In turn, the paper also develops extant thinking on the complexities around governing BES issues, by elaborating where differences in priority may lie between countries.

3. Data and Methods

Expert views on BES strategies within cities were collected via online survey. Responses were received from the countries listed in Figure 2 (the original survey is included as Supplementary Material, and was available in English, Portuguese, Japanese and Korean). To elicit responses from a specialised yet time-poor group of people (Atkinson and Flint 2001), snowball sampling was utilised to disseminate the survey through the international community of researchers and practitioners working on local BES issues. The survey was distributed to member cities of ICLEI participating in the Local Actions for Biodiversity programme, with recipients requested to share the survey with other experienced experts. Additional experts were identified and contacted through searching academic and 'grey' literature and local government websites. Survey information was further disseminated through ICLEI's official website, the representative mailboxes of city governments, the representative emails of research institutes/NGOs, and social media such as Twitter and Facebook.

3.1. Questionnaire design

The questionnaire comprised two sections. The first section assessed the challenges to promoting and implementing BES decisions according to the five thematic areas identified in Section 2. The second evaluated potential strategies to overcome barriers and facilitate BES governance (although this is not discussed in this paper, it is included as Supplementary Material for reference). Respondents were requested to answer the questions based on their practical experiences in specific cities, and to rate the degree of agreement on challenges and strategies from a list of pre-defined problems and/or

answers. A five-point Likert Scale with description was used to measure agreement for both sections. In the first section, options were defined as 1=strongly disagree: not a case or only in rare cases; 2=disagree: only in minor cases; 3=undecided: about half of the cases; 4=agree: in most cases; and 5=strongly agree: almost in all cases. An 'I don't know/not applicable' option was also provided in each question in case respondents were unfamiliar with or did not have experience in a specific area. To collect additional explanatory information, space was provided for open-ended responses in each section. Prior to issue, the questionnaire was piloted, and reviewed by an expert with knowledge and experience working with CBD and ICLEI.

To undertake analysis and discussion in sufficient depth within the confines of a single paper, this paper focuses on the responses to the first part of the survey (perceived challenges to local BES governance and implementation) only.

3.2. Characteristics of respondents and reported cities

80 of 103 questionnaires were completed and are used for analysis. This gives a sample size comparable with other surveys of environmental management experts (e.g. Whitfield et al, 2008; Gattuso et al, 2013). Seven experts responded based on their international experiences rather than issues of a specific city; one respondent reported general problems from German cities; two respondents answered based on their experiences in conservation sites; and one respondents responded based on experiences in two cities. This results in a wide geographical coverage of 45 cities from 25 countries, covering countries from low- to highest-developed status (see Figure 2). Notably, the sample included 6 southern hemisphere countries, helping to address the finding of Luederitz *et al* (2015) that urban ecosystem services research has thus far focused on the northern hemisphere. The sample also included 7 countries from the low- or medium development categories.
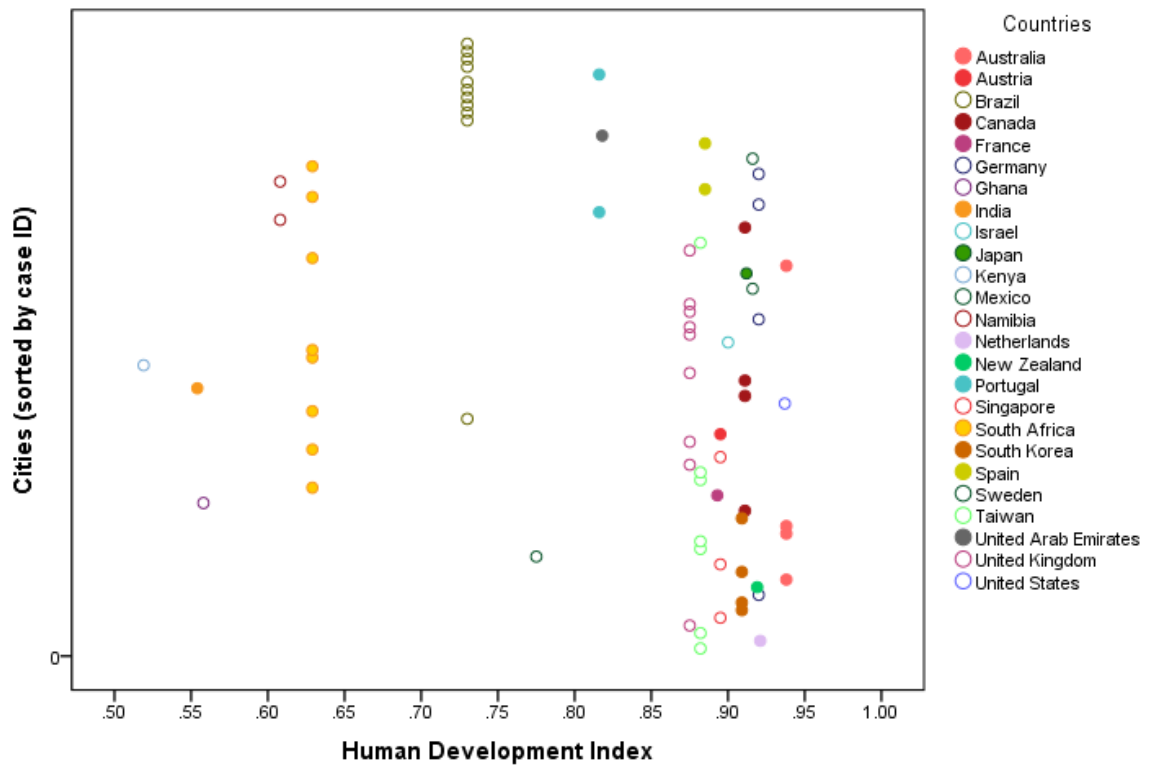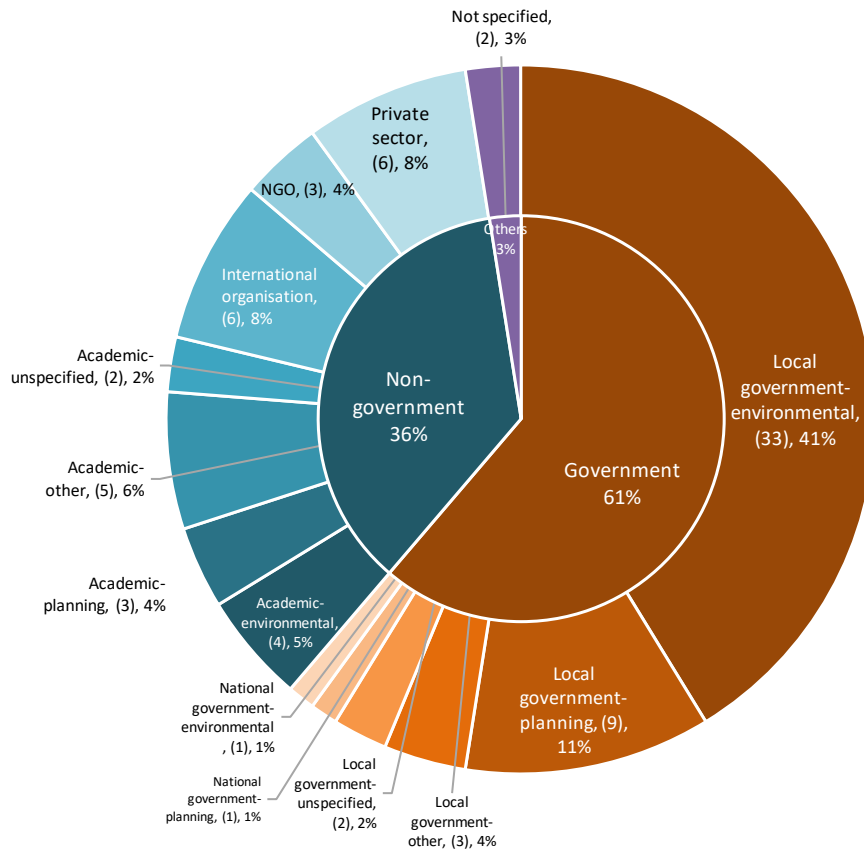
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2 *Figure 2: Distribution of development status of reported cities based on Human*

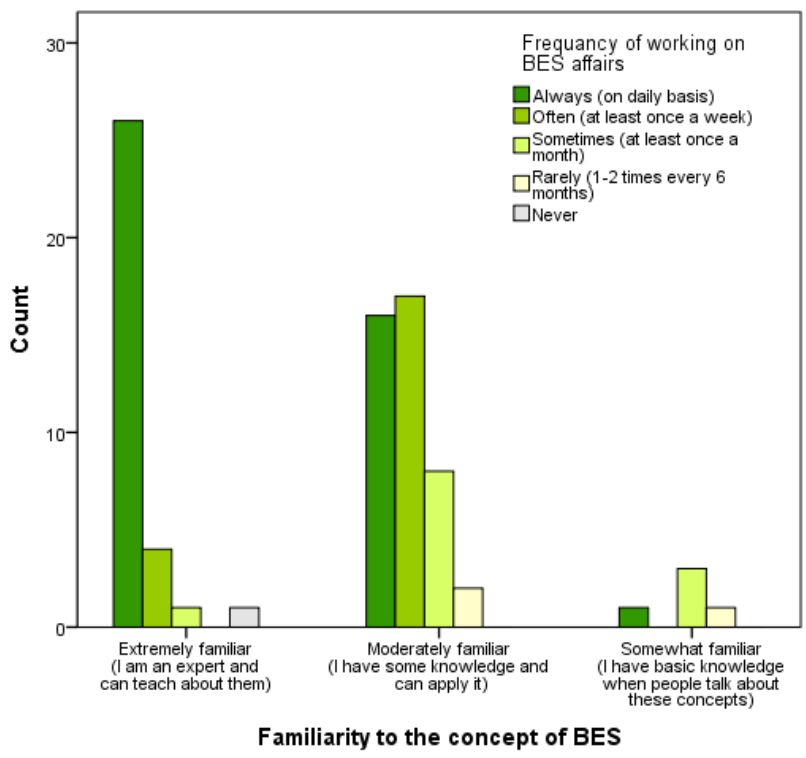3 *Development Index on 2013 UNDP report*
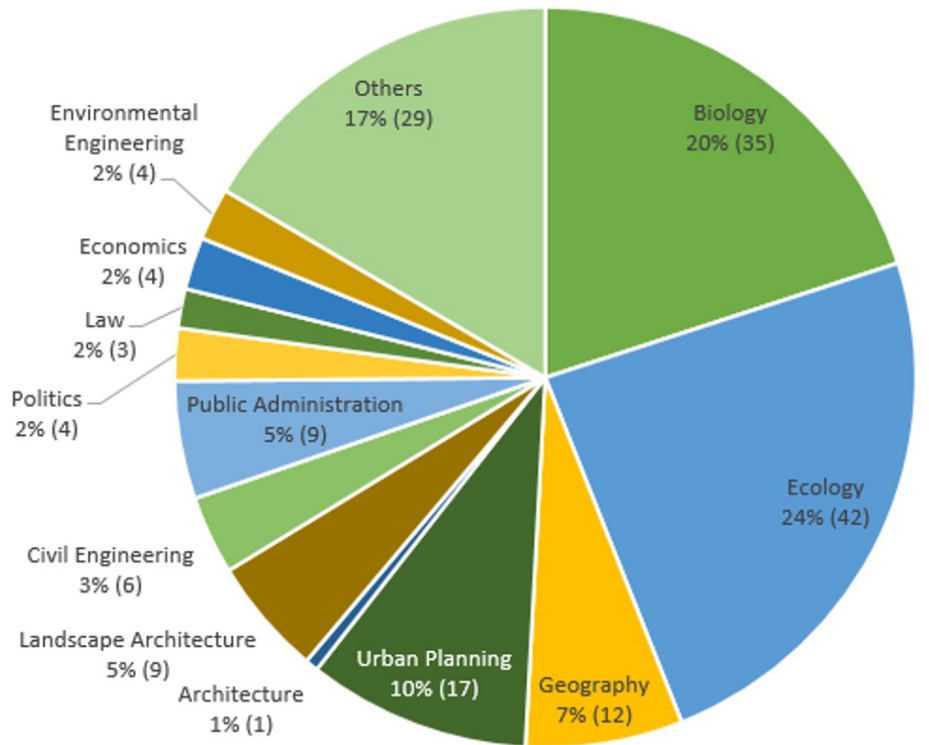
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5 *Figure 3: Professional backgrounds of respondents*

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2   *Figure 4: Current job/role of respondents*

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4   *Figure 5: Respondents' familiarity with and frequency of working on BES issues*

Figures 3, 4 and 5 show the professional backgrounds of respondents, their current job or role, and their familiarity with BES issues respectively. 78.4% of respondents worked weekly or daily on BES and associated issues. A majority regarded themselves as familiar with BES issues (39.2% extremely familiar and 54.1% moderately familiar), whilst 6.7% of respondents showed less familiarity (Figure 4). Over half of respondents had affiliation with governments (58%), followed by 17% with academia and 8% with international organisations. Whilst a large proportion of respondents had a professional background in ecology (24%) or biology (20%), the survey also to an extent captured the views of those with a background in, for example, urban planning (10%), public administration (5%) and landscape architecture (5%). As such, within the survey sample, some voices are represented from sectors of policy-making and academia which may be crucial to turn BES rhetoric into practice, but may lie outside the biodiversity and ecology sectors often foregrounded in mainstreaming research (as argued by Jordan and Russel, 2014; Scott et al, 2018; and others). There are however limitations to our approach, as discussed in Section 3.4.

3.3. Analytical methods

To provide a general overview of the BES governance landscape, descriptive statistics were used to describe all cases against the five thematic areas laid out in Section 2. For analysis, a numerical value of 1 to 5 was assigned to each response, 5 meaning the respondent strongly agreed with the statement in the questionnaire, and 1 meaning the respondent strongly disagreed with the statement. We compared the degree of agreement within each of the thematic areas by four descriptive statistics: overall agreement; median value (Mdn); mode values; and inter-quartile range (IQR). Overall agreement was defined as the percentage of cases showing 'agreed' and 'strongly agreed'. This follows practices for Likert-type data laid out by Harpe (2015). The median and mode values were respectively used to measure the central of tendency in answers, and the most popular answers. Median and mode are appropriate measures of central tendency for ordinal data of the type produced through a Likert-style survey, where the numbers generally represent verbal statements. The arithmetical actions required to calculate means and standard deviations are inappropriate for ordinal data, where the intervals between values cannot be presumed equal (Jamieson, 2004). The IQR, measured by the difference between the first and the third quartile of each question, was applied to observe the variability of agreement. A relatively small IQR indicates a greater consensus of questions, whereas a greater IQR represents more divided opinions.

To assess difference between the opinions of government experts and non-government experts, cases were further divided into government and non-government groups according to the affiliation of respondents. Agreement, median value, inter-quartile range were compared; and asymptotic distribution was compared using the Mann-Whitney U test for each question area between the two groups.

Given the need for greater representation in the scholarly literature of how BES issues

are considered and managed in the Global South (see Sections 1 and 2), responses were further assessed according to development status. The development status of each case was defined by the Human Development Index (HDI) (United Nations Development Programme, 2013). Spearman's rank correlation coefficient was then applied to examine the relationship between the value of HDI and the degree of agreement (on an ordinal scale of 1 to 5) of each challenge area. All statistical analyses were conducted with IBM SPSS Statistics Version 25.

3.4. Limitations

The objective of the survey was to garner a view of the barriers perceived by those working on BES issues globally. The decision to focus on those with knowledge and practical experience of BES issues was taken as: (a) awareness of BES issues in cities is still comparatively low globally (Rose et al, 2018); (b) the Global South is under-represented in existing research into BES issues (Luederitz et al, 2015; Doi and Takahara, 2016); and (c) whilst barriers to BES governance and policy may already be well understood in a 'Western' context, it is not appropriate to assume these challenges (or potential solutions) will be the same in a Global South context (e.g. Castan Broto et al, 2013). Controlling for those already aware of BES issues allowed us to build a baseline of what those with experience in BES issues (not just ecology and biodiversity but in planning as well) saw as barriers across a range of country contexts and sectors, based on their professional experience for what is still an emerging and complex issue (Haines-Young, 2009). Nonetheless, it is important to acknowledge that much BES-related mainstreaming literature has been criticised (e.g. see critiques by Jordan and Russel, 2014; Fish and Saratsti, 2015; Scott et al, 2018) for focusing on those 'in the know' to the detriment of other sectors such as planners, elected local officials and even the wider public who may be able to understand the complexity and value of BES and can offer valuable explanation as to what the barriers are in practice. As such, whilst the findings presented here offer insight across country and development contexts and do encompass views of professional backgrounds beyond ecology/biology, there is a focus in the sample towards those with high awareness and regular professional engagement. Further enquiry, perhaps through more discussion-based methods to give participants time and space to reflect on BES issues, would be valuable to complement this overview of barriers with perspectives from other sectors who also have a role to play in putting BES rhetoric into practice. It would be particularly valuable for further research to explore these issues in-depth in a Global South context, to complement existing work developed in the 'Western' context.

4. Results

This section reports first the general perception of challenges across thematic areas; then differences in perception between government and non-government respondents;

and finally differences according to development status. Where appropriate, the quantitative data (which does not indicate causality) is supported by indicative quotes from the open-ended questions to provide additional explanatory information. To ensure respondents' identities are not made obvious, only the broad regional location and not the specific country/city are reported alongside the quotes.

4.1. General perception across thematic areas

Across all challenges, the problem reaching the highest agreement was "officials in development sectors have inadequate BES knowledge". 83.2% of respondents reported this was a major challenge (Mdn=4, IQR=1) (Table 3). Second highest agreement was "budget is inadequately provided for BES implementation (76.2%, Mdn=4, IQR=1)" and "local government planners have inadequate BES Knowledge at the locality (71.8%, Mdn=4, IQR=1)" (Figure 3; Tables 3 and 4).

4.1.1. Political

Table 1 Barriers associated with political challenges

Political Challenges		N	Agreement (%)	Median	Mode	IQR
P1	National governments do not consider BES issues accurately	77	57.2	4	4	2
P2	Regional (sub-national) governments do not consider BES issues accurately	70	54.3	4	4	1
P3	Local governments do not consider BES issues accurately	76	55.3	4	4	1
P4	BES policies are subject to change when administration change (ex. mayors, city councillors, etc.)	76	63.1	4	4	1
P5	The lobby from city councillors and others for development without BES considerations is thwarting conservation efforts	70	62.9	4	4	1.25

Most respondents agreed that the political challenges raised in the survey were indeed problematic (Table 1). "BES policies are subject to change when administration changes (P4)" and "the lobby from city councillors and others for development (P5)" recorded highest agreement (63.1%, Mdn=4, IQR=1; and 62.9%, Mdn=4, IQR=1.25 respectively). Most respondents reported that BES conservation efforts could be undermined by governments at all levels if BES issues were not appropriately considered (P1, P2, P3). This indicates a difficulty in sustaining BES considerations across time and across political scales. As well as reflecting the political challenges highlighted in the quantitative analysis, the open-ended responses also indicated that leadership could be an important intervention to keep agendas moving forwards in a complex political landscape:

We have a strong environmental lobby from council but are thwarted at state and federal levels (local government, Australasia)

Implementation of BES is very reliant on dynamic individuals in posts to drive the agenda and top down political leadership sympathetic to BES. It helps, immeasurably, if you can relate job creation to BES in a developing country context (local government, southern Africa)

The open-ended responses also gave more specificity on why exactly respondents felt political factors could be a barrier to effective BES actions. Reasons included: electoral cycles and politicians' resulting need for 'success stories' which they could present to the media as working and effective (Brazilian city); the end of the Apartheid system in Southern Africa conversely leading to many politicians reaching power who had not previously had access to the knowledge and skills to make good BES decisions (Southern African city); and local governments being at the mercy of higher levels of government, which were in cases responsible for all aspects of BES implementation outside of land use and planning (Canadian city). The 'political' barriers to BES actions identified in the survey may hence manifest themselves in a number of ways, including (but not limited to) political cycles; historical socio-political legacy; and the presence or absence of champions able to move agendas forwards within legislative or political constraints.

4.1.2. Legislation and policy

Table 2 Barriers associated with legislation and policy challenges

Legislation & Policy Challenges		N	Agreement (%)	Median	Mode	IQR
L1	Local government has little autonomy for determining BES policies	79	35.4	3	2	2
L2	Local government lacks legally binding instruments (regulations and laws with mandatory compliance) for protecting BES	80	48.8	3	4	2
L3	Local government lacks non-legally binding instruments (policies) for promoting sustainable use and management of BES (e.g. Local Biodiversity Strategies)	80	30.0	3	2	2
L4	Legislations and policies favour economic development and generate conflicts to BES conservation	80	67.3	4	4	1
L5	There is a lack of legal instrument to deal with conflicts with property rights (ex. compensation, sanction)	73	39.7	3	3	2

In the legislation and policy field (Table 2), the major problem agreed upon was "legislations and policies favour economic development and generate conflicts to BES conservation" (L4, 67.3%, Mdn=4, IQR=1). Yet only 30% of respondents agreed with L3 that "Local government lacks non-legally binding instruments (policies) for promoting sustainable use and management of BES". In general, respondents were less likely to agree with most problems in this field. Indeed, the open-ended responses illustrate that problems lie not with the presence of policies, but in their implementation:

> *It's one thing to have policy instruments and legislation and quite another to implement them effectively* (local government, Australasia)

> *The problem is not adequate legislation but the enforcement of the legislation.* (local government, southern Africa)

> [names state and municipality] *have a set of laws that allow proper management of BES. However, these laws are decoupled from the rest of the legislation, and even conflicting with it in some respects. Or, at least, it allows divergent interpretations to emerge and virtually nullify the effectiveness of environmental laws. That is, the set of laws is good, but according to the political conjuncture can be, and is effectively, less effective than it should* (academia, South America)

Both quantitative and qualitative responses here indicate that respondents are not concerned with a lack of BES policy *per se* (see, however, the difference between government and non-government respondents in Section 4.2.). Rather, concern is more likely to lie with the effectiveness of these policies in practice. As the next section shows, there is hence need for policy to be backed up with measures to support its implementation.

4.1.3. Institutional and operational

Table 3 Barriers associated with institutional and operational challenges

	Institutional and Operational Challenges	N	Agreement (%)	Median	Mode	IQR
I1	There is a lack of responsible department or unit for coordinating BES issues	80	36.3	3	2	2
I2	Budget is inadequately provided for BES implementation	80	**76.2**	4	4	1
I3	Internal communication among different governmental sectors to discuss BES issues is inadequate	80	70.0	4	4	1.75
I4	External forums involving interdisciplinary experts in decision making is inadequate	76	43.4	3	4	2

		N	Agreement (%)	Median	Mode	IQR
I5	There is opposition to BES conservation from development sectors (e.g. housing, transportation)	78	62.8	4	5	2

For institutional and operational issues (Table 3), most respondents agreed there was budget shortage for BES implementation (I2) (76.2%, Mdn=4, IQR=1). 70% (Mdn=4, IQR=1) and 62.8% (Mdn=4, IQR=2) of respondents respectively agreed that inadequate internal communication among different governmental sectors to discuss BES issues (I3) and opposition from development sectors (I5) were major barriers. Notably, the open-ended responses identify elements where interventions may be targeted in response:

> *Generally development is conflicting with BES, but we now have new systems in place such as biodiversity offsetting where developers are showing an interest* (local government, Europe)

> *Opposition is not the major issue. The major issue is complete lack of understanding and recognition of the benefits ES can bring to other sectors* (consultant, Europe)

Linking back to Section 4.1.2., the implication is that whilst BES policy may be viewed positively, barriers are encountered when it comes to implementing policy actions in practice. Indeed, the open-ended answers suggest there is need for mechanisms to raise awareness and/or link BES conservation with development if these implementation challenges are to be surmounted.

4.1.4. Technical

Table 3 Barriers associated with institutional and operational challenges

Technical Challenges		N	Agreement (%)	Median	Mode	IQR
T1	There is insufficient information available indicating what BES are and their condition at the locality	78	61.6	4	4	1.25
T2	Local government planners have inadequate BES knowledge relevant to the locality	78	**71.8**	4	4	1
T3	Officials in the environmental sector have inadequate BES knowledge at the locality	76	39.5	3	4	2
T4	Officials in development sectors (e.g. housing, transportation, economic) have inadequate BES knowledge	77	**83.2**	4	4	1
T5	There is insufficient knowledge regarding how to develop BES strategies for sustainable use and	77	66.2	4	4	1

management					

Other than officials in the environmental sector, inadequate BES knowledge of other governmental sectors has been the leading concern (Table 4). The statement, "officials in development sectors (e.g. housing, transportation, economic) have inadequate BES knowledge", had the greatest support (T4, 83%, Mdn=4, IQR=1). "Local government planners have inadequate BES knowledge relevant to the locality" was another major concern (T2, 71.8%, Mdn=4, IQR=1). This may reflect a view that planners, despite having the potential to balance development and conservation through areas such as land use (see Sections 1 and 2), are rightly or wrongly viewed as not having the knowledge to allow them to realise this (71.8%, Mdn=4, IQR=1). The open-ended responses give extra granularity by illustrating that what is important is not only the presence of knowledge, but also capability to access and apply this knowledge to mainstream BES in other sectors:

> *Inventories of local ES are rare and most of the knowledge is restricted to the scientific community with examples that are from the world at large, but not a local set of ES* (academia, South America)

> *Biodiversity recording is quite good - often prolific - but data is often collected but not always applied, and as different datasets are created it becomes difficult to track change over time (e.g. in quality and extent of key habitats)* (local government, Europe)

> *I think I would disagree with most of the above statements, but then this municipality is well known for its environmental work, so this is definitely not typical of* [names country] *municipalities. Development challenges interfere with conservation and vice versa* (local government, southern Africa)

> *Many of our policy documents mentions ecosystem services explicitly; however, the barrier to using this concept is the fact that there is no methodology that produces reproducible results on the ecological service provided in a given scenario. If you had framed your questions in terms of "biodiversity" strategies, I would have very different answers* (local government, north America)

To some extent, this higher agreement with T4 and T2 reflects the problem regarding opposition from development sectors (I5) identified above and the need to enhance understanding of the benefits of BES conservation among people from non-environmental backgrounds. It is also interesting to note the final comment, which was raised in relation to the distinction between 'biodiversity' and 'ecosystem services,' and the effects this difference may have. We discuss the implications of this slippage in Section 5.1.

1 *4.1.5. Communication, engagement and public awareness*

2 Table 5 Barriers associated with communication, education, & public awareness
3 challenges

Communication, Education, & Public Awareness Challenges		N	Agreement (%)	Median	Mode	IQR
C1	There are inadequate opportunities for public/stakeholder participation	75	44.0	3	4	2
C2	The public perceives BES conservation as an obstacle to development	74	31.1	3	3	2
C3	There are conflicts when people encounter wildlife (e.g. insects, snakes, monkeys)	73	42.4	3	4	2
C4	There are important but unsustainable cultural activities degrading BES	70	41.4	3	2	2

4

5 Compared to other challenge fields, problems associated with communication,
6 education, and public awareness were scored comparatively low, and experts' opinions
7 were more divided (Table 5). No prominent barrier was identified in this field, and the
8 open-ended responses were similarly wide-ranging:

9 *Public comment periods for* [environmental protection and biodiversity
10 conservation] *and other are not long enough or advertised enough* (local
11 government, Australasia)

12 *Of course there are conflicts with wildlife, but there are plenty of instances*
13 *where people exist harmoniously, or actively pursue wildlife in their gardens*
14 (local government, southern Africa)

15 *In general, civil society already realizes the importance of BES, but as long as*
16 *they do not interfere with the supposed progress. Few cultural activities occur*
17 *to me that can be harmful to BES other than hunting and fishing. However, I*
18 *consider that their action is much lower than the impacts produced by the*
19 *alteration of the land use and the decrease of habitats resulting from works of*
20 *built infrastructure and agricultural expansion* (academic, Brazil).

21 Low levels of agreement should hence not be taken to imply respondents do not
22 consider engagement with wider society as a barrier to BES actions. Rather, the
23 diversity of open-ended responses elicited for this question suggest there may be very
24 different types of relationship with nature – and varying expectations for
25 communication and engagement – across cultures and environments, which present
26 context-specific CEPA challenges (see Sections 4.3. and 5.1.).

1   *4.2. Differences between government and non-government respondents*

2   Table 6 Comparison between government and non-government respondents

Challenges		Government				Non-Government				Mann-Whitney U Test		
		N	Agreement (%)	Median	IQR	N	Agreement (%)	Median	IQR	U	Sig.	*r*
Political	P1	38	50	3	1	39	64.1	4	2	648.500	0.329	-
	P2	35	45.7	3	2	35	62.9	4	1	470.000	0.083	-
	P3	38	50	4	2	38	60.5	4	2	611.000	0.235	-
	P4	39	51.3	4	2	37	75.7	4	0	536.500	0.042*	-0.233
	P5	34	55.9	4	2	36	69.4	4	2	521.000	0.265	-
Legislation & Policy	L1	41	36.6	3	2	38	35.4	2.5	2	741.500	0.703	-
	L2	41	56.1	4	1	39	41	3	2	632.500	0.095	-
	L3	41	29.3	3	2	39	30.8	3	2	784.500	0.882	-
	L4	41	63.4	4	1	39	69.2	4	1	754.500	0.646	-
	L5	36	50	3	2	37	29.7	3	1	532.000	0.127	-
Institutional and Operational	I1	41	29.2	2	3	39	43.6	3	2	583.000	0.032*	-0.240
	I2	41	70.7	4	2	39	82	4	1	683.000	0.228	-
	I3	41	68.3	4	1	39	71.8	4	1	626.000	0.076	-
	I4	37	32.4	3	2	39	53.9	3.5	1	523.000	0.031*	-0.247
	I5	40	62.5	4	2	38	63.1	4	2	732.500	0.774	-
Technical	T1	40	57.5	4	2	38	65.8	4	1	646.500	0.218	-
	T2	40	67.5	4	1	38	76.3	4	1	622.000	0.135	-
	T3	39	28.2	3	2	37	51.3	3.5	2	582.500	0.133	-
	T4	40	82.5	4	1	37	83.7	4	1	710.000	0.741	-
	T5	40	62.5	4	2	37	70.2	4	2	622.000	0.194	-
Communication, Education, Public Awareness	C1	38	42.1	3	2	37	45.9	3	2	675.500	0.763	-
	C2	39	30.8	3	2	35	31.5	3	2	641.000	0.637	-
	C3	38	44.7	3	1	35	40	3	2	586.000	0.364	-
	C4	36	38.9	3	2	34	44.1	3	2	593.500	0.823	-

3   * Asymptotic significance at 0.05 levels

We now compare the responses of government versus non-government participants, focusing on challenge areas where the difference in agreement between two groups exceeded 10%, and the median value for both groups reached at least 3 (Table 6). Concern about political factors was more common within non-government experts. All challenge areas received more than ten percent higher agreement from non-government respondents. The difference between government and non-government respondents was particularly distinct in "P4: BES policies are subject to change when administration change". The agreement reached 75.7% within non-government experts (Mdn=4, IQR=0) compared to 51.3% within government experts (Mdn=4, IQR=2). The Mann-Whitney U test also revealed that the distribution of answers was significantly different between two groups (U=536.50, p=0.042, r=-0.23).

This result can be contextualised if we look at the other responses where there was a notable difference. In legislation and policy areas, more government experts agreed with "L2: Local government lacks legally binding instruments for protecting BES" (56.1%, Mdn=4, IQR=1; versus 41%, Mdn=3, IQR=2) and "L5: There is a lack of legal instrument to deal with conflicts with property rights" (50%, Mdn=3, IQR=2; versus 29.7%, Mdn=3, IQR=1). The open-ended responses from local government staff likewise emphasised the lack of legislation as a barrier to BES governance:

> [Names country] *has multiple levels of legislation (both Federal and Provincial) that play a role in BES and conservation - the legislation is contradictory and overlapping in some instances [...] as a result our ability to consider and implement BES is constrained and often reliant on senior orders of government* (local government, north America)

> *In some countries, such as federate governments, local governments have more responsibilities in environmental issues, and, therefore, can make laws that favor BES* (local government, southern America)

By contrast, more non-government experts agreed that "I2: Budget is inadequately provided for BES implementation" (82%, Mdn=4, IQR=1; versus 70.7%; Mdn=4; IQR=2) and "I4: External forums involving interdisciplinary experts in decision making is inadequate". The higher agreement on I4 (53.9%, Mdn=3.5, IQR=1; versus 32.4%, Mdn=3, IQR=2) indicates that many non-government experts still expert more participation opportunities in decision-making processes. Non-government experts generally showed higher agreement on the lack of techno-scientific knowledge for BES implementation. The most prominent gap between government and non-government experts was found on "T3: Officials in the environmental sector have inadequate BES knowledge at the locality". Only 28.2% (Mdn=3, IQR=2)) of respondents within the government group agreed or strongly agreed with this statement, whereas there was 51.3% (Mdn=3.5; IQR=2) of agreement within non-government experts. This is reflected in the open-ended responses from non-governmental responses, which draw out a much broader range of barriers than the legislative focus of governmental

respondents:

The budgets for these management units are usually poor and do not correspond to the most basic management maintenance needs. Most of the time BES management units are isolated from the rest of the administration and treated only as a green showcase or as an inconvenient opposition to progress (IO, southern America)

The major issue is complete lack of understanding and recognition of the benefits ES can bring to other sectors (consultant, Europe)

The environmental laws that concern conservation in [names country] *and in* [names municipality] *are mainly conservationists and make little reference to ecosystem services in the way they are understood in the modern way* (researcher, southern America)

Such qualitative comments cannot give us a direct comparison between the different response groups. It is noteworthy, though, that comments about lack of knowledge and 'appropriate' budget come from respondents with a strong professional interest in biodiversity protection driven by science (e.g. practitioners, researchers), whereas the comments on legislation and legislative complexity as a barrier to BES governance come from the local government officials tasked with putting such actions into practice.

4.3. Difference in perceived challenges according to development status

This section evaluates the influence of development status on the types of challenges perceived by respondents. A Spearman's rank correlation coefficient was used to evaluate the relationship of HDI of each case with the agreement of all challenges (Table 7).

Table 7 Significant challenges for local BES governance by HDI

		Challenge Areas	Correlation Coefficient	Sig. (2-tailed)	N
Political	P1	National governments do not consider BES issues accurately	-.222	.063	71
	P2	Regional (sub-national) governments do not consider BES issues accurately	**-.319***	.010	64
	P3	Local governments do not consider BES issues accurately	**-.256***	.033	70
	P4	BES policies are subject to change when administrations change (ex. mayors, city councillors, etc.)	-.076	.534	70
	P5	The lobby from city councillors and others for development without BES considerations is thwarting conservation efforts	**-.261***	.037	64
Legisl	L1	Local government has little autonomy for determining BES policies	.038	.749	73

ation & Policy	L2	Local government lacks legally binding instruments (regulations and laws with mandatory compliance) for protecting BES	-.190	.105	74
	L3	Local government lacks non-legally binding instruments (policies) for promoting sustainable use and management of BES (e.g. Local Biodiversity Strategies)	-.217	.064	74
	L4	Legislations and policies favour economic development and generate conflicts to BES conservation	.020	.863	74
	L5	There is a lack of legal instrument to deal with conflicts with property rights (ex. compensation, sanction)	-.178	.146	68
Institutional and Operational	I1	There is a lack of responsible department or unit for coordinating BES issues	-.150	.203	74
	I2	Budget is inadequately provided for BES implementation	-.166	.159	74
	I3	Internal communication among different governmental sectors to discuss BES issues is inadequate	**-.261***	.025	74
	I4	External forums involving interdisciplinary experts in decision making is inadequate	.173	.151	70
	I5	There is opposition to BES conservation from development sectors (e.g. housing, transportation)	-.179	.132	72
Technical	T1	There is insufficient information available indicating what BES are and their condition at the locality	-.155	.195	72
	T2	Local government planners have inadequate BES knowledge relevant to the locality	-.197	.098	72
	T3	Officials in the environmental sector have inadequate BES knowledge at the locality	-.094	.441	70
	T4	Officials in development sectors (e.g. housing, transportation, economic) have inadequate BES knowledge	-.019	.874	71
	T5	There is insufficient knowledge regarding how to develop BES strategies for sustainable use and management	-.135	.261	71
Comunication, Education, Public Awareness	C1	There are inadequate opportunities for public/stakeholder participation	-.206	.090	69
	C2	The public perceives BES conservation as an obstacle to development	-.046	.707	68
	C3	There are conflicts when people encounter wildlife (e.g. insects, snakes, monkeys)	-.108	.385	67
	C4	There are important but unsustainable cultural activities degrading BES	**-.348***	5	64

1   * significance at the level of 0.05
2   ** significance at the level of 0.001

3   As shown in Table 7, agreement with P2, P3, and P5 (relating to regional and local
4   governments) decreased slightly with HDI at a 0.05 significance level. Superficially,

this suggests regional and local governments in less developed countries may be less likely to consider BES as an important issue. The open-ended responses, however, explain this reflects the more pronounced challenge of balancing environmental consideration with not only the socio-economic development issues which are prominent in the Global North, but also poverty alleviation (see below):

> *It helps, immeasurably, if you can relate job creation to BES in a developing country context* (local government, southern Africa)

> *The municipality in which I develop my activity have as main economic activities the unplanned exploitation of wood and the beef cattle. The owners of the municipality do not value the forest, and believe that the preservation of the forest and contrary to their economic interests […] local government that dares to take really significant protection measures will pay a high political price* (researcher, south America)

The negative correlation with I3 ("Internal communication among different governmental sectors to discuss BES issues is inadequate") ($r=-.261$, $p=<0.05$) suggests that poor internal communication among different governmental sectors can exacerbate political challenges. This again may reflect the fact that in some contexts, governmental forms and hence relations and priorities between sectors are still emerging – and also that elected officials may, due to historical factors contributing to uneven development, have had fewer opportunities to access knowledge and 'evidence'. The two contrasting cases below show this:

> *A major political challenge in* [names country] *is that it is a new democracy and there are other priorities, e.g. service delivery, poverty alleviation and reducing inequality […] Furthermore many politicians lack knowledge and skills to make good decisions, presumably as a result of the apartheid system* (local government, southern Africa)

> [High HDI European country] *has signed the CBD in 1992 and a lot of job has been done to follow it and we also got the 16 national environmental quality objectives and the environmental code in 1999-2000* (local government, Europe)

The most significant correlation overall was found with C4 ($r=-0.348$, $p<0.01$), suggesting less developed countries were more likely to have important but unsustainable cultural activities. Responses indicate this could reflect greater connectedness to – and hence greater cultural significance of – local natural environments in lower HDI contexts:

> *The concepts of relationship with nature and other non-human organisms are strongly rooted in culture […] Few cultural activities occur to me that can be harmful to BES other than hunting and fishing* (academic, southern America)

Today there was an article in the local newspaper about a wolf that was observed here the other day. It is very rare to observe wolf here in our agricultural landscape (local government, Europe)

The correlation found here and associated open-ended responses both reflect the context-specific ways biodiversity and environmental quality are perceived according to culture and environment. As discussed in Section 5.1., this reflects the importance of sensitivity to local context in assessing the propriety or otherwise of local BES initiatives, and of avoiding assumption that barriers encountered in one local context will be relevant elsewhere.

5. Discussion

5.1. Conceptual implications

We draw out three conceptual implications from our findings. First, our results reflect a need for continued scholarly attention on how 'biodiversity and ecosystem services' is understood within a local context. The wider literature has identified lack of agreement on what constitutes BES and related concepts as a major barrier to attaining practical action within localities (e.g. Garmendia et al, 2015; Matthews et al, 2015; Gippoliti and Battisti, 2017). The open-ended responses in the survey too note that 'biodiversity' and 'ecosystem services' are considered separately within local government mandates, and that their respective understanding and priority may differ. In general, biodiversity (i.e. habitat protection and conservation) was reported as being more established, whereas ecosystem services knowledge was viewed as being less prominent and not connected to biodiversity conservation. This is partially a limitation of the research in that the survey asked for views on 'local governance on biodiversity and ecosystem services' as a single entity (see Section 5.3). Nevertheless, following Dearborn and Kark (2010), this slippage between 'biodiversity' and 'ecosystem services' draws attention to the need for clarity on what precisely is being protected and enhanced, to what purpose, and what effects this may have in terms of responsibilities and priorities. This is something that the survey did not touch on, but as in common practice 'biodiversity and ecosystem services' are often taken together, there is perhaps need to find ways for opinion shapers (international organisations, think tanks, practice-focused academics) to make this distinction clearer when talking to practitioners working to implement BES measures within a city context. Such clarity becomes even more important as IPBES – which takes biodiversity and ecosystem services together in its title - gains high-profile attention following the publication of its global assessment report (IPBES, 2019). Even accepting a BES approach is challenging (Scott et al, 2018), but consensus at initial stages may help to avoid problems from slippages later.

Second, our responses serve as a reminder that BES policy and governance is inevitably influenced by the local socio-political context, and that barriers identified in one

location will not necessarily be barriers elsewhere. Survey responses show that BES governance is informed by how different layers of government are structured within a country; by decision-makers' ability to access to education, knowledge and evidence; by national pressures for socio-economic development; and even by the presence or otherwise of champions to drive specific agendas forwards. It is well understood that land use policies are not value-neutral and can serve – and be informed by – local social, cultural and political goals (e.g. Mitchell, 2004; Shih and Chang, 2016). Our findings likewise show that even in areas such as BES conservation where there is a drive for evidence-based governance (Svancara et al, 2005), there is a need to pay attention to the social processes informing how BES is defined, by whom and to what effect (Orenstein, 2013); and the strength of policy wording to allow effective BES governance to happen (Melville-Shreeve et al, 2018). Keeping in mind this understanding of what works (and what does not) in specific contexts and why is even more important when one considers ecosystem services in the context of climate change adaptation, where there is major international drive for knowledge-sharing and international collaboration to foster innovation (Bai et al, 2018).

Third and related, we reiterate a key argument of our paper. Whilst it may ultimately be true that the challenges to BES faced in developing countries are the same as for 'Western' contexts, underlying issues relating to access to knowledge and the nature of governance systems formed under various historical-societal background may be different. This is borne out in some of the quantitative findings, most notably the indication of cultural aspects as a barrier to BES conservation in developing country contexts (C4); and the low agreement and high diversity in views on whether local environmental officials lack adequate BES knowledge (T3) (Tables 4 and 6). The narrative responses demonstrate this point especially well, and are hence worth including in the discussion:

> *For historical reasons of the environmental movement itself and of biodiversity conservation, especially approaches focused on endangered species and protected areas with exclusion of populations, biodiversity can even be seen as a strategy of domination of foreign countries or ruling classes* (academic, South America)

> *Furthermore many politicians lack knowledge and skills to make good decisions, presumably as a result of the Apartheid system. This is a strong factor* (local government, southern Africa)

In Global South contexts, historical and contextual factors can inform particular attitudes to BES and explain why certain barriers exist in the present. In keeping with emerging thought into 'epistemologies of the South' (de Sousa Santos, 2014) and the decolonisation of knowledge (Chilisa, 2017), it is crucial not to assume that barriers to and strategies of BES conservation that may have been well-established in more Western-centric literature will be relevant elsewhere – or that the underpinning social

1   dynamics will be the same.

2   *5.2. Practical/policy implications*

3   Beside the conceptual implications, we identify four practical implications of our
4   findings for future local BES policy and governance.

5   First is the difference in perception of knowledge, and perception of participation and
6   engagement. reported between 'government' and 'non-government' respondents. As
7   per Section 4.2., non-government respondents were more likely to report knowledge
8   limitations as a problem, and also to view opportunities for participation as inadequate.
9   This illustrates the importance – even in local government contexts where fora for
10   expert/public engagement are available – of careful evaluation of and reflection on
11   whether engagement is actually effective (Silvia, 2017). Indeed, in the context of cross-
12   sectoral partnerships, this supports Cockburn et al's (2016) view that partnerships are
13   only effective if supported by opportunities for collaborative learning and underpinning
14   evaluation. Local-level BES management thus ought to include regular and structured
15   opportunities for formal evaluation of knowledge and engagement processes. Such
16   evaluation may enhance the effectiveness of collaboration between government sectors
17   and also with different external sectors (e.g. academia, developers, civil society). More
18   importantly, the assessment of effectiveness of participation should consider not only
19   whether there is formal structure for engagement, but also how opinions from
20   participants are considered and addressed in subsequent decision-making. There is also
21   value in specifically evaluating partnerships, as an interface between government and
22   non-government actors, to assessing whether members perceive additional value from
23   these bodies. Such actions, however, require relatively long timeframes and more
24   resources for forming consensus and delivering policies.

25   Second, many of the barriers identified – especially but not exclusively in lower HDI
26   contexts – relate to difficulties in building support for BES actions across sectors and
27   levels of governments. This relates to the value of achieving broad-based support
28   through and for BES mainstreaming. What warrants further exploration, however, is
29   the specific value in lower HDI contexts of land use planning as a platform for
30   facilitating this mainstreaming, and as a system for linking the competing environment
31   and development pressures identified in our survey (Handley et al, 2007; Hurlimann
32   and March, 2012). Doing so requires deeper consideration of what the barriers to
33   mainstreaming are in practice, through more systematic engagement with sectors such
34   as planning who are arguably crucial to implementation but have not been so explicitly
35   considered in research to date. Our findings (especially Section 4.1.3.) also indicate a
36   need to evaluate how incentives such as payments for ecosystem services and habitat
37   banking can help make planning policies and tools more effective in developing
38   countries, where land can otherwise come under pressure for socio-economic
39   development.

Third, in the survey responses, a shortage of BES-related knowledge was broadly agreed upon by respondents. However, there was no significant difference in response according to HDI. Indeed, cases considered to be successful examples of BES practice informed by knowledge are diverse, such as Durban, South Africa (Shih and Mabon, 2017); Stockholm, Sweden (Andersson et al, 2014); and Curitiba, Brazil (Mittermeier et al, 2005). Regardless of national development status, ability to navigate local social, political and cultural factors (and having individuals and units with the right knowledge and skills) can all influence the effectiveness or otherwise of BES governance. 'BES-related knowledge' may thus encompass knowledge of policy and funding landscapes, strategies for communicating with different internal departments and external sectors, and local cultural relations to BES, as well as the technical and scientific properties of the local natural environment. Any intervention aimed at enhancing BES knowledge in a locale hence ought to (a) begin with consideration of what specific knowledge is lacking, and how it may be enhanced; and (b) avoid attempting to replicate 'success stories' or best practices from elsewhere without careful scrutiny of how local conditions may differ from the original context.

Our fourth and final practical implication relates to the finding that cultural aspects harming BES was perceived to be a significantly bigger issue in lower HDI contexts. Activities with negative effects for ecosystem health have been demonstrated in cases to nonetheless have cultural and social significance (e.g. Randrianandrianina et al (2010) on urban hunting in Madagascar; Mabon et al (2018) on fishing and crab hunting in coastal Vietnam). Such activities can maintain good social relations and may be important in making communities resilient to subsequent environmental change, especially in lower HDI contexts where vulnerability can be higher. Our survey findings reinforce the argument of Botzat et al (2016) and suggest there is a need for local authorities to work to better understand the role that cultural activities play in building and sustaining resilient communities. As part of this, it is important to consider how the social capital benefits that may arise from culturally meaningful activities may be traded off against the environmental benefits that come with BES conservation. This links back to Primmer et al (2015) and their interest in adaptive-collaborative governance and also governing strategic behaviour. Our findings indicate that cultural practices related to ecosystems can have a significant bearing on BES managers' practice, and also that the way in which communities derive benefit from interaction with ecosystems may run up against more technical assessments of ecosystem services. Following some of the more critical takes on biodiversity and ecosystem services as promoting a narrow understanding of the relations between social and ecological systems (Spash, 2013; O'Neill, 2017), this finding hence (a) illustrates the importance of making attempts to understand and integrate cultural ecosystem services (and disservices) within more technically-driven governance processes; and (b) considering who stands to benefit or lose from BES management in a locale.

6. Conclusion and looking forward

This paper provides a broad overview of BES challenges, which are not necessarily generalisable to all conditions. In keeping with Section 5.1. and the importance of local context in driving understandings of BES, consideration should be given to local institutional structures, historical and cultural factors and development context while developing locally-appropriate strategies. Moreover, the study respondents may to an extent be a self-selecting and informed sample, given some people were recruited through existing participation in BES associated networks (e.g. engagement in ICLEI or other city networks). While a higher proportion of people with educational backgrounds in biology and/or ecology is to be expected in a survey of BES experts, further engagement with people and contexts less aware or engaged could uncover additional barriers and opportunities. Lastly, as noted in Section 5.1, understandings of biodiversity and ecosystem services vary across cities and respondents, yet this paper takes 'biodiversity and ecosystem services' as a single entity. Further research to clarify how exactly different local governments understand biodiversity versus ecosystem services (and also the relationship between them) may help to explain why BES governance can succeed in some contexts but not others.

To conclude, we return to the four types of barrier to BES governance identified by Primmer et al (2015) and discuss how these may be surmounted. First is hierarchical governance, which BES research to date has considered in relation to integration into local governance and effects of local politics. These factors emerged in our study as well. One positive factor reported both in our responses and elsewhere was the value of 'champions' able to work across sectors and government levels in the absence of clear legislation (e.g. Leck and Roberts, 2015). Second is scientific-technical governance, with concern in BES research that despite good knowledge in many locales, there is low priority among decision-makers to engage with relevant evidence. Our findings add to this the desire from many non-governmental respondents for more participation, but also frustration even within governments over communication. As such, going beyond one-way information provision and instead creating spaces for discussion on available evidence (Fish and Saratsti, 2015) may be a pathway to overcoming scientific-technical barriers. Third is adaptive collaborative practice. This has been considered widely in BES work to date, in relation to issues such as a lack of methods for understanding complexity, lack of clear goals, and limited engagement with wider governmental departments beyond environmental protection. Our findings indicate, through the differences in perception between governmental and non-governmental respondents, that opinions of what constitutes 'successful' BES governance may vary across sectors. In this regard, outcome- and place-based approaches (e.g. Luers, 2005; Reed et al, 2017) may help to build consensus on what 'success' looks like. Lastly, when it comes to governing strategic behaviour, our findings show that cultural practices can be significant in some contexts, even if they may harm BES. The value of these practices to communities may be difficult to measure or quantify. Given this complex landscape, our findings also indicate a need for BES managers themselves to adopt strategic action (after Chu et al, 2017). This means looking for opportunities and situations which can allow different interest groups to agree that the conservation of

1   BES is important to serve their otherwise diverse strategic interests.

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