

The ecosystem service of sense of place: benefits for human well-being and biodiversity conservation

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SUMMARY

Assessing the cultural benefits provided by non-market ecosystem services can contribute previously unknown information to supplement conservation decision-making. The concept of sense of place embeds all dimensions of peoples' perceptions and interpretations of the environment, such as attachment, identity or symbolic meaning, and has the potential to link social and ecological issues. This review contains: (1) an evaluation of the importance of sense of place as an ecosystem service; and (2) comprehensive discussion as to how incorporating sense of place in an evaluation can uncover potential benefits for both biodiversity conservation and human well-being. Sense of place provides physical and psychological benefits to people, and has neglected economic value. The biodiversity-related experiences are essential components of the service that need to be further explored. A conceptual framework was used to explore how the existing knowledge on sense of place derived from other fields can be used to inform conservation decision-making, but further research is needed to fill existing gaps in knowledge. This review contributes to a better understanding of the role biodiversity plays in human well-being, and should inform the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES).

Keywords: biodiversity conservation planning, cultural service, ecosystem service, Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), sense of place

INTRODUCTION

Globally, habitat transformation is causing unprecedented loss of biodiversity (Butchart *et al.* 2010). In turn, this affects ecosystem functioning and stability, the flow of ecosystem

services and human well-being (Foley *et al.* 2005; Cardinale *et al.* 2012). Conflicts between biodiversity conservation and human development needs, which are driving habitat transformation and biodiversity loss, are difficult to resolve (Chan *et al.* 2007).

In order to identify beneficial solutions for all involved, conservation agendas are focusing on ecosystem services (Balvanera *et al.* 2001; Armsworth *et al.* 2007). Ecosystem services are 'the benefits people obtain from ecosystems' (MA [Millennium Ecosystem Assessment] 2005; p.1), which depend on biodiversity (Mace *et al.* 2012) and sustain human well-being in everyday life (MA 2005). A number of assessments have combined biodiversity conservation and sustainable development objectives (see White *et al.* 2012; Bateman *et al.* 2013). However, studies on the spatial congruence between ecosystem services and biodiversity show that priority areas do not always match (see for example, Chan *et al.* 2006; Anderson *et al.* 2009; Egoh *et al.* 2009; Di Minin *et al.* 2013b). In addition, gaps in ecosystem services science (Carpenter *et al.* 2009), and lack of political support (Chan *et al.* 2007), challenge implementation on the ground (Tallis *et al.* 2008). Consequently, new information is needed to evaluate ecosystem services (Carpenter *et al.* 2009) and assess their contribution to help identify strategies that benefit both biodiversity conservation and human well-being (Chan *et al.* 2007; Norgaard 2010; Saunders 2013).

Ecosystems provide material (for example, water availability, crop diversity, and climate regulation) and non-material (such as cultural, recreational, and spiritual) benefits to people (MA 2005). The evaluation of material services is crucial to inform the society about the importance of natural capital (Costanza & Daly 1992). Importantly, the evaluation of material services provides information that can be used to inform conservation planning (Egoh *et al.* 2007; Tallis *et al.* 2008) and decision-making processes (Daily *et al.* 2009; Bateman *et al.* 2013). However, the evaluation of the intangible benefits of most of the non-material, cultural, services has been largely overlooked (MA 2005).

By bridging the gap between different academic disciplines, the evaluation of cultural services may help inform real-world decision-making (Milcu *et al.* 2013; Saunders 2013). Among cultural services, 'sense of place', which people develop in connection with ecosystems (Russell *et al.* 2013), has been

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indicated as a concept that may potentially bridge existing gaps between ecosystem science and environmental management (Williams & Stuart 1998). By understanding, anticipating, and responding to peoples' relationships with places, managers are better equipped to develop management activities that will avoid conflict and gain public support (Williams & Stuart 1998). Sense of place is, however, one of the most neglected cultural services and information on how to integrate it into conservation decision-making is scarce (MA 2005).

We reviewed the existing literature on sense of place, with an aim to identify the potential contributions of sense of place to both human well-being and biodiversity conservation. We started by defining sense of place in fields outwith conservation science. We reviewed the literature to: (1) clarify the importance (social and economic benefits) of sense of place as an ecosystem service, (2) discuss how sense of place has been accounted for in conservation science, and (3) identify how to further integrate sense of place values into conservation decision-making.

METHODS

To explore the implications of sense of place in biodiversity conservation, we searched existing publications on sense of place, using the Thomson Reuters' Web-of-Science database (accessed 1 September 2014). Since the term 'place attachment' has also been used as an alternative term for sense of place (Brown & Raymond 2007), this was also included in our literature search. We used the phrase 'TOPIC: (('sense of place') OR ('place attachment'))' as a baseline for the search (1441 results). In order to select papers that looked at sense of place in biodiversity conservation, we also included in the search AND 'conservation' as TOPIC (114 results). We subsequently refined the results by using 'biodiversity' (21 results) and 'ecosystem service*' (11 results) and 'management' (57 results). We thus identified a total of 62 unique articles (see Supplementary material for the complete list); those that were most relevant are cited. In each of the studies, we looked at (1) implications for human well-being and biodiversity conservation; and (2) insights addressing gaps in conservation science. Next, we identified gaps in conservation science, and issues related to the integration of sense of place in conservation decision making. The resulting information on gaps was used to develop a conceptual framework (Fig. 1), summarizing insights gained from other disciplines, and emphasizing ways sense of place may be incorporated in conservation decision-making to promote positive benefits for both biodiversity conservation and human well-being.

Sense of place

Sense of place represents all dimensions of human perception and interpretation of the environment in an emotional, spiritual and cognitive way (Tuan 1977; Jorgensen & Stedman 2006). People develop a sense of place as a

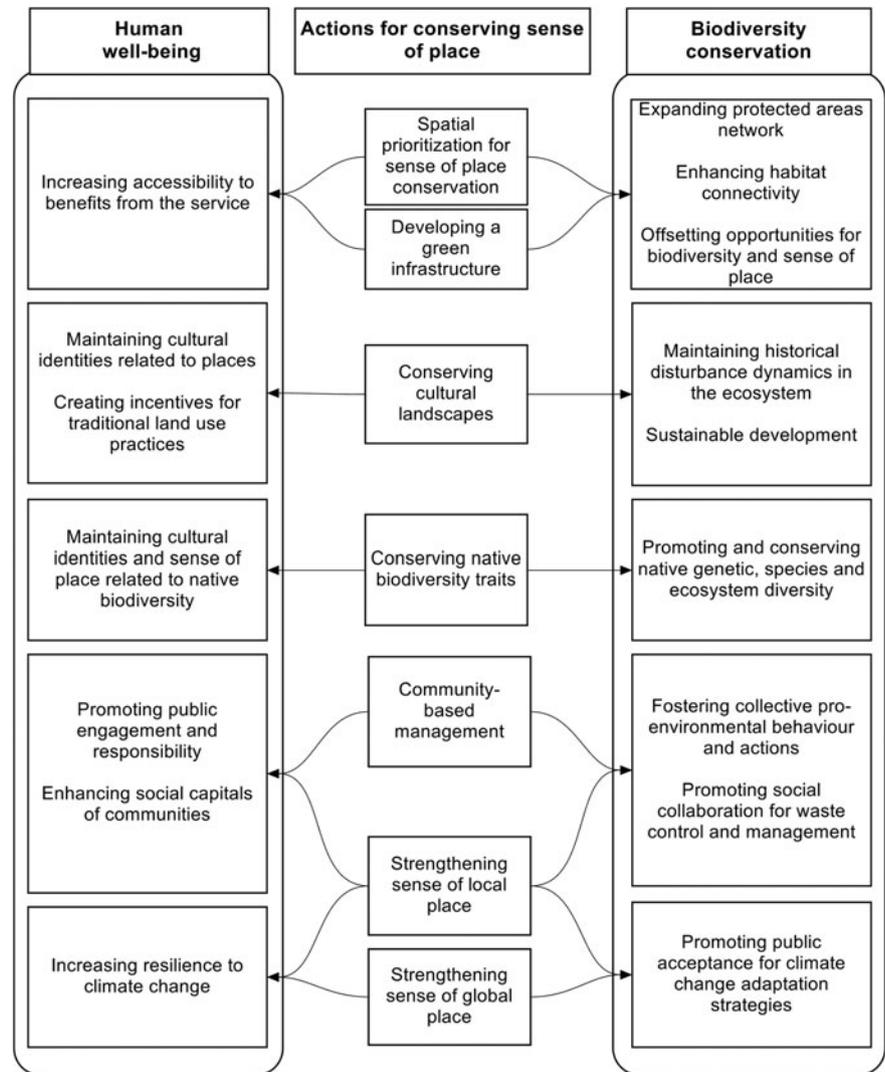
result of biological, individual and sociocultural processes that take place while people experience (namely by interacting, knowing, perceiving, or living; Russell *et al.* 2013) the physical environment (Table 1). In the Millennium Ecosystem Assessment, sense of place was referred to as the relationship between people and ecosystems, this relationship representing a natural condition indispensable for human existence (MA 2005). However, the concept has had a long history of application in multiple disciplines, and has only recently been recognized as an ecosystem service (MA 2005).

The terminology surrounding sense of place varies across different disciplines (Table 2). For example, in environmental psychology and sociological studies, sense of place is referred to as peoples' attachment to, identification with, and dependence on places, and has been used to describe connections with, and perceptions of, environments affecting human behaviour (Stedman 2002). In human geography, sense of place entails all the meanings that people assign to places, which define the perceived value of their attributes and appearance (Tuan 1990). In health sciences, peoples' connection with the natural environment has been described as a biologically-based condition, essential for human health (such as mental health and recovery; Maller *et al.* 2006). In ecosystem management, sense of place refers to public attitudes toward the environment and its management (for example in urban planning, natural resource management, and land-use planning), and has been used to assess social impacts of specific management decisions (Bauer *et al.* 2009). Finally, sense of place plays a key role in tourism development, and has been studied to understand its contribution to tourists' perceived value of experience, expectations, and satisfaction in relation to a specific destination (Kil *et al.* 2012).

Health benefits

Contact with nature promotes physical, mental and psychological well-being, enhancing peoples' assessment of quality of life in ways that cannot be satisfied by alternative means (Abraham *et al.* 2010; Maller *et al.* 2006; Russell *et al.* 2013). For instance, exposure to nature has been shown to promote recovery from surgery (Ulrich 1984) and lower blood pressure (Lohr & Pearson-Mims 2006); relieve stress (Leather *et al.* 1998); increase positive mood (Maller *et al.* 2006); reduce mental fatigue (Staats *et al.* 2003); reduce crime and the tendency for aggressive behaviour (Kuo & Sullivan 2001); promote social integration (Kweon *et al.* 1998); and contribute to the integrity of a personal or community identity (Horwitz *et al.* 2001; Maller *et al.* 2006). These benefits are received by people everywhere, by interacting with nature in a variety of environments, from urban areas (such as public gardens and parks; Tzoulas *et al.* 2007), to countryside (for example cultural landscapes; Phillips 1998) and natural environments (or wilderness; Fredrickson & Anderson 1999). For example, experiencing solitude in wilderness areas enhances self-perception, personal fulfilment and promotes emotional, physical and intellectual

Figure 1 Conceptual framework incorporating sense of place in conservation decision-making; pathways outline potential ways to mitigate threats to biodiversity conservation.



improvements (Fredrickson & Anderson 1999). Experiencing wilderness has been used as a therapy for rehabilitating adolescents with emotional and behavioural problems (such as impulsivity, suicidal thoughts, and drug and alcohol use; Harper *et al.* 2007). Conversely, urban environments seem to be associated with a number of negative effects on human health. Being born and raised in an urban environment, for example, increases individual risk for anxiety, and depressive and psychotic disorders (Pedersen & Mortensen 2001; Weich *et al.* 2006).

Moreover, people obtain benefits by contact with nature either directly, for example having indoor plants at the workplace (Larsen *et al.* 1998), a view from a window (Ulrich 1984; Leather *et al.* 1998), and/or actively experiencing nature through recreation, or indirectly by knowing its existence in the world (Russell *et al.* 2013). In particular, understanding sense of place as self-perception in a global environment has been suggested as critical for further studies, as it amplifies the importance of sense of place benefits from a local to a global scale (Devine-Wright 2013).

Economic benefits

In economics, ecosystems are referred to as 'natural capital' and are evaluated according to the goods and services they provide to individuals and societies (Costanza & Daly 1992). The economic values of sense of place have not yet been assessed, resulting in an incomplete evaluation of the natural capital (MA 2005). The economic value of sense of place, as for other cultural services (Chan *et al.* 2012), has been overlooked due to the difficulties related to its quantitative assessment (Williams & Stewart 1998).

Cultural services have been mainly evaluated for their recreational and aesthetic services (see Chan *et al.* 2006; Bateman *et al.* 2013), neglecting the sense of place value (MA 2005). For example, the aesthetic perception of ecosystem is influenced by components of attachment and emotions (Ulrich 1983), which might be related to observers' expressions of its sense of place. Moreover, sense of place has been shown to drive tourists' preferences for the choice of destination (Um & Crompton 1990), and the intention to revisit (Kil *et al.* 2012). However, there is no empirical evidence about the ability of

Table 1 Components of the development of sense of place and attributes of each component affecting peoples' perspectives.

<i>Component</i>	<i>Attribute</i>	<i>Definition</i>	<i>Evidence in literature</i>	<i>Reference</i>
People	Biological / evolutionary	Psycho-evolutionary theories explaining peoples' preferences for certain types of natural landscapes as the result of evolutionary processes that still drive the selection of places providing restoration and refuge	People's preference for natural over built landscapes, regardless of people's cultural origin; preferences for savannah-like environments	Kaplan and Kaplan 1989; Kellert 1995; Grinde and Patil 2009
	Personal experience	Personal, intimate experiences at different dimensions (namely living within, knowing, perceiving, and interacting)	The longer the experience of a place, the higher is the level of attachment to it (by accumulating and deepening personal meanings, memories and feelings)	Tuan 1977; Low and Altman 1992; Schroeder 1996; Russell <i>et al.</i> 2013
	Socio-cultural context	Different people share meanings and symbols of a place as a consequence of interpersonal interactions with the particular cultural group they belong to	Heterogeneity in preferences and attachment to places according to cultural origin, ethnic and religious association, education and occupation	van den Berg <i>et al.</i> 1998; Urquhart and Acott 2014
Ecosystem	Physical attributes and features	Physical attributes/ features of a place influences the symbolic meanings of the landscape which are in turn associated with evaluations and attachments	Preferences for park-like natural-looking landscapes that include canopy trees or water features; allow views out across the landscape	van den Berg <i>et al.</i> 1998; Stedman 2003;
	Ecosystem appearance/ ecological condition	Ecological qualities and aesthetic aspect of the environments (such as complexity, coherence, disturbance), influencing people's landscape preferences and attachment	Preference for 'healthy' looking landscapes; perceived concerns about environmental degradation	Ulrich 1983; Kaltenborn 1998; Brehm <i>et al.</i> 2013;

aesthetic and recreational values to act as surrogates of sense of place in the assessment of the natural capital. In other words, the use of these values to assess the economic importance of ecosystems may overlook other aspects that sense of place in turn entails.

Sense of place includes other aspects of economic benefits, which are not confined to recreational and aesthetic values. For example, contact with nature at the workplace increases work productivity (Leather *et al.* 1998) and reduces health care costs by preventing mental illness (Dewa *et al.* 2004). Moreover, the improvement of social connections (Fredrickson & Anderson 1999), as a result of sense of place development, enhances the value of social capital (namely social collaborations that encourage collective and productive activities; Lewicka 2005), by encouraging interpersonal bonds between people in groups

and communities (Pretty & Ward 2001). This strengthens peoples' commitment to places, enhancing pro-environmental behaviour, responsible use of resources and waste reduction (Pretty & Ward 2001; Ramkissoon *et al.* 2012).

Use in biodiversity conservation and management

Sense of place plays a key role in predicting and promoting public support for conservation in diverse socioecological contexts (Garcia-Llorente *et al.* 2012; Lokhorst *et al.* 2014). In conservation science, sense of place has been explored as part of attitudes toward accepting conservation policies (for example, conservation easements in private lands; Farmer *et al.* 2011), and supporting environmental conservation (Garcia-Llorente *et al.* 2012; Lokhorst *et al.* 2014). Connection

Table 2 Concepts related to sense of place that have been used in different disciplines to describe various aspects of the human relationship with the natural environment.

<i>Discipline</i>	<i>Concept</i>	<i>Description</i>	<i>Context</i>	<i>References</i>
Ecosystem service	Sense of place	The provisioning of opportunities for people to develop a sense of connectedness and self-fulfilment	Providing benefits to people	MA 2005
Environmental psychology, sociology	Sense of belonging; sense of identity; sense of community	Respectively: positive and affective bonds with places; beliefs about the relationship between self-definition and places; degree to which a place is perceived to sustain a specific behaviour/activity	Exploring dimensions of people-place relationship. Reduction of, and recovery from, stress; psychological integrity and preventing mental illnesses	Kaplan and Kaplan 1989; Low and Altman 1992; Cuba and Hummon 1993; Stedman 2002; Gosling and Williams 2010; Lopez-Mosquera and Sanchez 2012; van Riper and Kyle 2014
Human geography, philosophy and religion	Topophilia; sense of meanings	What a place symbolizes to people, even just from knowing that the place exists	Relation between preferences, beliefs and perception of place-related values	Tuan 1977; Tuan 1990; Kaltenborn 1998; Brown and Raymond 2007; Brehm <i>et al.</i> 2013;
Health sciences	Biophilia	Innate love and desire of contact with nature	Contact with nature in recovery from diseases and staying healthy	Ulrich 1984; Kellert 1995; Maller <i>et al.</i> 2006; Grinde and Patil 2009; Abraham <i>et al.</i> 2010
Environmental resource management	Sense of commitment; Sense of ownership	Judgments of the perceiving quality of an environment and its management	Policy making; conflict avoidance	Bauer <i>et al.</i> 2009; Buijs <i>et al.</i> 2009; De Groot 2012; Htun <i>et al.</i> 2012; Bendt <i>et al.</i> 2013; Larson <i>et al.</i> 2013; Lokhorst <i>et al.</i> 2014
Tourism and leisure	Sense of nourishment	Perceived utilitarian value of a place and its ability to satisfy an individual's needs	Choice of destination	Kil <i>et al.</i> 2012; Ramkissoon <i>et al.</i> 2012; Cheng <i>et al.</i> 2013

to nature increases peoples' perceptions of sense of place, promoting personal involvement in conservation (Lokhorst *et al.* 2014). In urban areas, green spaces (like public parks, private gardens, or allotments for horticulture) provide access to nature and sense of place (van Riper *et al.* 2012; Meurk *et al.* 2013), increasing awareness for environmental conservation (Bendt *et al.* 2013), and social collaboration for their management (Andersson *et al.* 2007; van Wyk *et al.* 2014). Moreover, the conservation of soundscapes related to sense of place (such as natural quietness or the sounds of wildlife) may be a way to alleviate human pressure on ecosystems and promote biodiversity conservation (Dumyahn & Pijanowski 2011). Communities that perceived such values and understood the threats to sense of place were helpful in informing land-use planning (Brown & Raymond 2007), and identifying sites of environmental concern (Raymond *et al.* 2009).

One of the main issues hindering the integration of sense of place into ecosystem management is the high variability in how people perceive the environment (which may vary according to cultural background or personal experience; Borrie &

Birzell 2001). Insights designed to overcome this issue may be found in previous studies (see Sevenant & Antrop 2010; Di Minin *et al.* 2013a), where latent class analysis was used to account for heterogeneity when exploring people preferences for environmental attributes. A latent class model implies that preferences are not unique to individuals, but belong to a finite and identifiable number of homogeneous classes of preferences. Individual membership of a class is explained by the sociodemographic profile (Boxall & Adamowicz 2002). However, the application of latent class modelling to explain variability in sense of place perceptions still needs to be explored.

Another issue is related to the unclear relationship between sense of place and biodiversity (Williams & Stuart 1998). Horwitz *et al.* (2001) stated that biodiversity, and its spatially distinctive features (such as species endemism, genetic diversity, and species abundance), is essential if ecosystems are to provoke attachment and stimulate an individual's identification with a particular place. Attractive landscapes elicit stronger emotional responses (Kaltenborn 1998; Larson *et al.* 2013), while interest in a particular species (such as

charismatic megafauna) or ecosystems (like wilderness areas or national parks) is positively related to peoples' attachment to and willingness to conserve such items (Kaltenborn 1998; Martín-López *et al.* 2007). Although people recognize the intrinsic value of biological diversity (Martín-López *et al.* 2007), Larson *et al.* (2013) found that biodiversity was not valued by people for sense of place.

Evidence suggests that playing and exploring in natural environments during childhood may lead to the development of a sense of place and raise environmental awareness (Measham 2006). At the same time, human geographers describe sense of place as a centre of meanings developed by experiencing environments (Tuan 1977). While people can experience the environment through knowing, perceiving, interacting and living within it (Russell *et al.* 2013), the characteristics or activities associated with natural environments (such as fishing, hunting, or beauty of landscape) are also important to establishing a sense of place (Larson *et al.* 2013). Biodiversity features (for example species or ecosystems), and physical attributes related to natural environments, may also affect the way people develop a sense of place.

Interests in species and landscapes are expressions of perceived benefits (such as stress relief; Hartig & Staats 2006) and reflect demand for cultural services (Cardinale *et al.* 2012) like sense of place. Preferences and willingness to pay are often used to assess the economic importance of perceived values for biodiversity (Martín-López *et al.* 2007; Di Minin *et al.* 2013a), and may be explored to assess the value of sense of place for biodiversity-related experiences. There is guidance to quantitatively assess sense of place (Mendoza & Moren-Alegret 2013) and estimate the economic value of cultural services (Chan *et al.* 2012). Among these, stated preferences methods (Adamowicz *et al.* 1998), used in environmental economics, have been suggested for estimating the marginal utility value of non-marketed goods and services (see Chan *et al.* 2012). These approaches can be applied to assess what people value most highly for sense of place when experiencing ecosystems.

Threats, actions and sense of place

Habitat destruction, overexploitation of resources, species introduction, pollution (Diamond 1984), and climate change (Heller & Zavaleta 2009) are major drivers of biodiversity loss. We developed a conceptual framework (Fig. 1) of where sense of place could be included in conservation decision-making, and how it could be used to potentially mitigate threats to biodiversity conservation.

Sense of place development depends on the environment (namely physical features and attributes; an ecosystem's appearance and conditions), and is therefore also subject to threats affecting biodiversity. For example, land transformation occurring in 'special' places for sense of place (visited for recreational purposes; Kil *et al.* 2012), as well as loss of access to traditional place-related lifestyles (resources

harvesting or spiritual and religious symbolic meanings; Alkan *et al.* 2009) may negatively affect individual psychology and a community's cultural values (Devine-Wright 2009). Alien plant invasion can affect environmental features and landscape appearance (by for example increasing soil erosion; Pejchar & Mooney 2009), affecting traditional uses and customs connected to places (MA 2005). Pollution may also negatively affect sense of place, including exposure to noise pollution (Dumyahn & Pijanowski 2011), or perceptions of environmental risks and concern for the future (Bickerstaff 2004). Climate change causes environmental changes (such as rising sea levels, increasing temperatures, and extreme weather events) that alter the physical characteristics of places, causing both identity and emotional disruptions between people and ecosystems (Reser *et al.* 2011).

Understanding how people respond to environmental changes (impacts on psychological health and well-being, response at local, national and global scales; Fresque-Baxter & Armitage 2012; Devine-Wright 2013) is critical in order to identify management actions for adaptation (such as adjustments of structures, processes and practices). Moreover, it has the potential to provide new conceptual understandings that may help build resilience of both human and ecological systems (Devine-Wright 2013). Integrating sense of place into ecosystem management may help identify opportunities that both mitigate threats to biodiversity, and foster human well-being in ecosystem management (Fig. 1).

Mapping communities' sense of place (see Raymond *et al.* 2009) could help identify human-valued priority areas, such as 'critical natural capital', that may have been overlooked (Chiesura & De Groot 2003) (Fig. 1). For example, recreational sites provide access to sense of place (Kil *et al.* 2012), and recreation demonstrates increased value of lands, provides competitive financial support to local stakeholders, and improves species diversity and conservation (Bateman *et al.* 2013; Di Minin *et al.* 2013b). Moreover, companies transforming natural habitats to alternative land uses (such as mining) could help conserve and enhance the service in other areas (McKenney & Kiesecker 2010), thus compensating for habitat destruction (Fig. 1).

In urban planning, the development of a green infrastructure fosters psychological well-being by providing daily access to natural settings and sense of place (Maller *et al.* 2006; Tzoulas *et al.* 2007; Bendt *et al.* 2013), while ensuring a range of ecosystem services in urban areas (such as air filtration, microclimate regulation, and noise reduction; Gaston *et al.* 2013). Urban green spaces may enhance biodiversity through the promotion of ecological corridors and habitat connectivity (Rudd *et al.* 2002), as well as providing a refuge for native biodiversity (Goddard *et al.* 2010). Psychological benefits of green spaces increase with species richness (Fuller *et al.* 2007). Management strategies enhancing biological diversity (such as mosaics of habitat patches; Thwaites *et al.* 2005) and sense of place experiences in urban green space, could contribute to both human well-being and biodiversity conservation (Fig. 1).

In rural areas, the promotion of low impact, traditional land uses (such as subsistence agriculture and small-scale farming) could also promote human well-being through sense of place (Phillips 1998) and sustainable development (Halladay & Gilmour 1995) (Fig. 1). Cultural landscapes represent those areas where human influence (traditional use of land and resources; Urquhart & Acott 2014) has been part of ecosystem dynamics over the centuries, affecting landscape appearance (Phillips 1998), and species adaptation and diversity (Halladay & Gilmour 1995), while maintaining ecological processes (nutrient cycling and connectivity). This is particularly important in developing countries, where the maintenance of traditional systems would help create incentives for traditional land-use practices (Halladay & Gilmour 1995). Enhancing the value of native biodiversity for sense of place experiences could help identify critical native species, such as local cultivar varieties for agricultural practices (Perreault 2005) or wildlife for ecotourism (Martín-López *et al.* 2007; Di Minin *et al.* 2013a), and enhance their conservation (Fig. 1).

Globally, sense of place has the potential to contribute to actions for climate change adaptation (by increasing the network of nature reserves, alleviating pressure on land use practices, and creating culturally appropriate management interventions; Heller & Zavaleta 2009). However, of greater importance is the value of the collective actions and pro-environmental behaviours that sense of place, at a local (neighbourhood) and global scale, elicits in people (Lewicka 2005). Moreover, the development of a sense of 'global place' (Feitelson 1991) increases public concern for worldwide environmental issues, such as environmental changes (Devine-Wright 2013) and land transformations (Foley *et al.* 2011), enhancing social collaborations and public acceptance of management intervention for global resilience goals (Devine-Wright 2013).

Integrating sense of place in community-based management (Manzo 2006) and environmental impact assessment (Kaltenborn 1998) (Fig. 1) provides an opportunity to tap into peoples' attachment and stimulate pro-environmental behaviours (Brehm *et al.* 2013). Involving local people in decision-making reduces conflicts with communities (Chan *et al.* 2007) and provides support to the long-term success of conservation actions (Tallis *et al.* 2008). This is relevant in avoiding public opposition to environmental development in places considered important for sense of place (referred as the 'not in my backyard' [NIMBY] attitude; Devine-Wright 2009). This reaction may be the result of imposed changes, often unrelated to local identities, and may generate conflicts between institutions, conservation and people (Devine-Wright 2009).

While conserving sense of place may produce positive benefits (Fig. 1), peoples' preferences for environmental attributes and qualities may, in some cases, be misaligned with biodiversity conservation objectives (Kerley *et al.* 2003). This is the case, for example, with species introduction (ornamental plants or horticulture; Reichard & White 2001), human-wildlife conflict (involving overkilling of predators

to avoid livestock predation, concerns for the future, and concerns about maintaining quality of life; Treves *et al.* 2013), or natural environment transformation (Buijs *et al.* 2009). People may perceive heavily-managed landscapes (such as commercial forests or monocultures) as aesthetically pleasing, while natural habitats (such as wetlands or deserts) may appear unattractive (Buijs *et al.* 2009). Although sense of place conservation does not necessarily match ecologically important ecosystems, peoples' cultural values related to sense of place (Phillips 1998) may promote beneficial opportunities to address threats to biodiversity. As stated by Saunders (2013, p. 17) 'incorporating local cultural aspects into conservation interventions does not necessarily mean privileging local material concerns, but it would mean that local embodied experiences and interests can be more fully integrated into conservation planning decisions'.

CONCLUSION

Sense of place can potentially provide positive solutions for both human well-being and biodiversity conservation. While sense of place provides a variety of benefits to people in various contexts (Table 1), the economic value of sense of place is usually neglected. Experiencing biodiversity is also an essential component of sense of place and human well-being that needs to be further explored in future studies. Biodiversity loss (for example the loss of iconic species like rhinoceros or elephant; Di Minin *et al.* 2015) may have negative effects on sense of place, related to changes in environmental qualities and the physical characteristics of places, and loss of peoples' identity, attachment and the meanings attributed to places. At the same time, the 'construction' of a sense of place could sometimes result in an increase in human disturbance and in enhanced threats to biodiversity (via habitat transformation or species introduction). Providing a sense of place experience (through recreation) should have a minimum impact on natural ecosystems.

Improved assessment and knowledge of the benefits that biodiversity-related experiences provide as a sense of place, and the inclusion of these into policies for land-use and resource management planning, could uncover positive benefits for both biodiversity conservation and human well-being. In particular, recognizing the value of sense of place in ecosystem management processes (through environmental impact assessment, land-use planning, ecotourism development, and climate change adaptation) is essential to ensure human access (through sites for outdoor activities, urban green spaces, and cultural landscapes) to sense of place benefits, while promoting biological conservation (by expanding the network of protected areas, enhancing habitat connectivity, promoting sustainable development, and gaining public support; Di Minin & Toivonen 2015). Our research indicates that sense of place must be integral to the Intergovernmental Platform on Biodiversity and Ecosystem Services (www.ipbes.net).

Supplementary material

To view supplementary material for this article, please visit <http://dx.doi.org/10.1017/S0376892915000314>.

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