

PERSPECTIVE



A critical perspective on the concept of biocultural diversity and its emerging role in nature and heritage conservation

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Abstract

1. The continuing losses of biodiversity around the world remain problematic for nature conservation. A fundamental issue that has triggered debates in nature conservation is the relationship between human culture, heritage and history, and nature expressed as ecology or biodiversity.
2. Traditionally, nature conservation has been pursued separately from aspects of cultural heritage; a situation which seems perplexing when we consider the importance of traditional management in the maintenance of biodiversity in many areas now 'protected' for nature.
3. To address these broad issues, fundamental to future landscape sustainability, we need to have clear definitions of concepts and terms.
4. This paper considers the historical development of the key concepts that frame biocultural diversity and the paradigms relating to biocultural assets or eco-cultural landscapes. This is pertinent to both researchers and to practitioners or policy-makers, and we suggest ways biocultural diversity can improve global conservation efforts.

1 | INTRODUCTION

The relationships between nature and culture, and between biodiversity and heritage, have been the subject of research and debates over recent decades (e.g. Agnoletti, 2006). Going beyond pure research there have been extensive discussions about how best to turn policies into practice (e.g. Agnoletti, 2007; Agnoletti & Rotherham, 2015). Paradigms developed within these discussions include the need to recognise biocultural assets or heritage within eco-cultural landscapes (e.g. Bridgewater & Walton, 1996; Merçon et al., 2019; Rotherham, 2015) and the importance of recognising 'intangible cultural heritage' (e.g. Rotherham, 2007). The latter paper noted the potential rapid loss of cultural knowledge about landscape management and its traditions, and the resulting changes in stakeholder perceptions and 'sense of place'.

Agnoletti and colleagues have been working with, for example, United Nations Education and Scientific and Cultural Organisation

(UNESCO), UN Food and Agriculture Organisation (FAO) and the International Union of Forest Research Organisations (IUFRO) to raise awareness of intangible cultural heritage by key stakeholder organisations (Agnoletti & Rotherham, 2015). UNESCO note that the term 'cultural heritage' has evolved in recent decades and this is reflected in its own policy instruments, with a useful summary provided on the UNESCO website (UNESCO, 2018).

UNESCO (2018) provides an account of how the definitions and terms have developed and evolved, such as through the 2001 international Round Table of experts at Turin (Italy) who drew up an operational definition of the term 'intangible cultural heritage'. They note that cultural heritage is not merely about monuments and collections of objects but includes traditions or living expressions inherited from ancestors. The latter are passed to descendants, and include oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe. These also include knowledge and skills relating

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to traditional crafts. We extend this concept to include the creation and maintenance of traditional landscapes and the ecological systems within them (Agnoletti, 2006, 2007; Agnoletti & Rotherham, 2015; Bridgewater, 2017; Bridgewater & Walton, 1996; Rotherham, 2015).

UNESCO (2018) notes that fragile, intangible cultural heritage is important in helping maintain cultural diversity in the face of growing globalization. Additionally, understanding the intangible cultural heritage of different communities helps intercultural dialogue to grow mutual respect. However, this awareness should be extended to include elements of the landscapes (such as countryside, paysage, dehesas, Aboriginal Country etc.) produced by long-term traditional management, and the intangible knowledge and cultural heritage which underpin these.

The roots of the issue go back to the 1980s or even earlier. The Declaration of Belém (1988), a key watershed moment, arose from the First International Congress of Ethnobiology, held in Belém, Brazil. At the congress, indigenous and traditional peoples (described in Article 8(j) of the Text of the Convention on Biological Diversity [CBD, 2006], as 'indigenous and local communities embodying traditional lifestyles') from around the world, met with scientists and environmentalists. The objective was to discuss a common strategy to stop the ongoing and often dramatic decline in global diversity of both nature and culture. Key issues were how indigenous and traditional peoples perceived, used and managed natural resources. It was hoped to develop programmes to support the preservation and strengthening of these communities and of their traditional knowledge. That such a declaration was possible arose from writings of, *inter alia*, Posey (1983, 1985), with later formal contributions from Berkes and Folke (1994), Berkes, Folke, and Gadgil (1995) and Posey (1999).

This congress was also a key point in the generation of what has become known as the biocultural concept. Although the term biocultural was not used specifically in the declaration, it noted: 'That there is an inextricable link between cultural and biological diversity'. At that time, use of the term 'biological diversity' was only two years old—but of course much older in concept and in its long gestation. However, even in the late 1980s, the idea that there were links between biodiversity and cultural diversity in all its manifest forms was quite challenging to many in the natural sciences community. Even within UNESCO, the UN agency charged with promoting cultural activities, culture and science were (and are) considered in separate 'silos' of policies and staff.

The work leading to the Declaration of Belém (1988) was chiefly, if not totally, focused on 'indigenous culture', although there was some attention given to 'local' culture as well. In the following decade, the Convention on Biological Diversity (CBD) gained traction as a major global forum to discuss nature (biodiversity) conservation. There followed the slow process of discussing how to implement Article 8(j) of the convention text. This Article requires each Contracting Party '.....subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity

and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices'. While the word culture does not appear as such, 'knowledge, innovations and practices' encompasses all the issues that should be considered under culture.

At the 2016 Conference of Contracting Parties (CBD, 2004, 2016a), the CBD adopted the Mo'otz kuxtal¹ voluntary guidelines that were intended to provide guidance for potential users of knowledge, innovations and practices that are held by indigenous peoples and local communities, embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity (hereafter 'traditional knowledge') to obtain appropriate consent from such indigenous and local communities.

The guidelines specifically identified '.....community protocols that may contain but are not limited to information about:

- Community identity;
- Community history;
- Community territoriality;

The use of culturally important practices relevant to the conservation and sustainable use of biological diversity;

Social organization and decision-making processes (which are often collective decision-making procedures at the community level).'

So, cultural aspects are encompassed in the CBD discussions, even if somewhat hidden. Also, in 2016, the Intergovernmental Science-policy Platform on Biodiversity and Ecosystem Services (IPBES) was discussing the Summary for Policy Makers from its Assessment on Pollination and Pollinators (IPBES, 2016). In these discussions, representatives from several countries were uncomfortable with the term biocultural diversity and with its definition. As often the case in the heat of the moment, the arguments became mixed, unclear and sometimes uncomfortable—but a solution was to have the following definition:

.....'biocultural diversity' (for the purposes of this assessment, defined as biological diversity, cultural diversity and the links between them).

This debate was all at the policy end of the science-policy interface. Therefore, while there has been considerable discussion and argumentation associated with the term in recent decades, it seems appropriate now to review thoroughly the history of the concept. From this we can propose a definition that sits comfortably with the current work of intergovernmental policy bodies. The latter, of course, rely on clear and unambiguous definitions for their work in implementing policy and strategy. Important in this dialogue is the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) which is the intergovernmental body that assesses the state of biodiversity and of the ecosystem services it provides to society. This work is in response to requests

from decision-makers. In view of the crises facing biodiversity conservation, more effective incorporation of biocultural heritage and drivers within the IPBES is clearly desirable. The IPCC has recently also become interested in this topic and biocultural diversity and its impacts on and from climate change are likely to be in future assessments, and possibly joint products with IPBES/IPCC.

2 | NATURE, CULTURE, HERITAGE—CONSERVATION AT A CROSSROADS

Separation of nature from human culture has been identified as a serious problem in the conservation of both nature and heritage (e.g. Rotherham, 2008, 2014). The process has been described as 'cultural severance' and the consequences serve to confuse ideas of, for example, rewilding (Rotherham, 2013a, 2013). The latter argues that 'abandonment' (i.e. cultural severance) and 'rewilding' are different and distinctive. Furthermore, the consequences of cultural severance, rather than enhancing biodiversity as its interpretation as rewilding might suggest, include dramatic declines in ecological richness. In some cases, however, there may be the emergence of distinctive novel and recombinant ecologies (Higgs, Hobbs, & Hall, 2013; Rotherham, 2017).

3 | EXAMPLES FROM BRITAIN AND EUROPE OF ABANDONED TRADITIONAL COUNTRYSIDE LEADING TO MAJOR DECLINES IN BIODIVERSITY (FROM ROTHERHAM, 2008, 2013, 2014)

The details of these species' declines are described elsewhere (see Rotherham, 2014, 2014a, for example), and many are well-known. Headline habitats include coppice woodland, limestone grasslands and chalk downs, weed-rich arable fields, heathlands, moors and fens. Among the headline species that have declined associated with the changes during that twentieth century are birds such as nightjar (*Caprimulgus europaeus*), red-backed shrike (*Lanius collurio*), honey buzzard (*Pernis apivorus*), corncrake (*Crex crex*), lesser spotted woodpecker (*Dendrocopos minor*), nightingale (*Luscinia megarhynchos*), turtle dove (*Streptopelia turtur*), corn bunting (*Emberiza calandra*), common redstart (*Phoenicurus phoenicurus*), wood warbler (*Phylloscopus sibilatrix*) and woodlark (*Lullula arborea*). Mammals affected include red squirrel (*Sciurus vulgaris*), dormouse (*Muscardinus avellanarius*), pine marten (*Martes martes*), harvest mouse (*Micromys minutus*), polecat (*Mustela putorius*), wildcat (*Felis silvestris grampia*), and several species of bat. Among the insects that have experienced major declines are numerous species associated with flower-rich grasslands, ancient woodlands and parks, with deadwood habitats, and with ancient wetlands. These species include butterflies such as fritillaries, beetles such as stag beetle and a diversity of dipterans such as hoverflies of old woodlands. Many of the species lost or drastically reduced in numbers and distribution, have declined directly because of the ending of long-term human subsistence management of the landscape.

Furthermore, the ecological characteristics of these species and their ecological trajectories in the modern landscape are effectively described in Grime, Hodgson, and Hunt (2007). Compounding factors have included the massive conversion of extensive upland moors and bogs to intensive grouse moor, sheep grazing or enclosed farming (Rotherham, 2014, 2014a), and of lowland bogs, moors and fens to intensive arable (e.g. Rotherham, 2013, 2013a).

This paper is not the place to discuss these ecological declines and their specific causes in detail. Nevertheless, the examples serve to illustrate the scale of the issue, the importance of the eco-cultural relationship and the need to provide better definition and greater clarity in attempting to understand ecological processes and to focus conservation efforts.

4 | HISTORICAL PERSPECTIVE OF THE TERM 'BIOCULTURAL'

In many ways, the ideas of biocultural systems arose from work which was being undertaken primarily by landscape geographers and ecologists on the more mechanistic socioecological systems and more human-centred cultural landscapes. However, these concepts also grew in a political way through the 'Convention Concerning the Protection of the World Cultural and Natural Heritage' (hereafter 'World Heritage Convention') (UNESCO, 1972) and the impetus that emerged from that international agreement. Twenty years on from its establishment, the World Heritage Convention helped focus attention through linking the previously separate designations of natural and cultural sites through framing landscapes in a biocultural context. The Convention achieved this by embracing the concept of 'Cultural Landscape' as part of its operational guidelines, which it describes in the following way:

There exist a great variety of Landscapes that are representative of the different regions of the world. Combined works of nature and humankind, they express a long and intimate relationship between peoples and their natural environment. Certain sites reflect specific techniques of land use that guarantee and sustain biological diversity. Others, associated in the minds of the communities with powerful beliefs and artistic and traditional customs, embody an exceptional spiritual relationship of people with nature.

From the scientific literature, Nassauer (1995) gave four principles for understanding the dynamics of cultural landscapes. These are:

1. Human landscape perception, cognition and values directly affect the landscape and are affected by the landscape.
2. Cultural conventions (sensu practice) powerfully influence landscape pattern in both inhabited and apparently natural landscapes.
3. Cultural concepts of nature are different from scientific concepts of ecological function.

4. The appearance of landscapes communicates cultural values.

Bridgewater and Walton (1996) used these four principles in introducing 'biocultural' as the term for these sorts of landscapes, but taking it beyond the World Heritage arena:

There is a general failure to recognize that globally, most, if not all, landscapes are blends of human activity with the expression of biodiversity – that is, they are biocultural landscapes.

This was taken up also by Poe, Norman, and Levin (2014) in talking about coastal ecosystems:

Often called “bio-cultural landscapes”, some coastal ecosystems have been historically co-produced through biophysical processes and customary landscape management practices.

The key role of biocultural landscapes in promoting 'safe' living and sustainability has been described by Merçon et al., 2019.

The term 'co-produced' by Poe et al. (2014) is now commonly adopted as a descriptor for outcomes and events shaped by interactions between people and nature. It ideally follows a process of co-design, where different actors work together to express ways to achieve mutually agreed outcomes. Maffi (in Posey (1999), the first UN publication on the matter), provided a detailed definition of biocultural diversity from the basis of linguistic diversity:

Yet this intrinsic and defining role of language in human biocultural diversity is still not well understood in academic, policymaking and advocacy circles alike – while it is salient in the cosmologies, philosophies and traditional narratives of scores of indigenous and minority peoples worldwide. In international debates on biodiversity conservation, it is becoming clear that the link between biological and cultural diversity is an inextricable one, and that it is necessary to think of preserving the world's biocultural diversity as an integrated goal. What has so far largely remained outside the scope of such debates is the role of language, and of the continued presence of a variety of languages on earth, in the maintenance of biocultural diversity (as well as in ensuring equitable and peaceful existence for hundreds of millions of people on earth).

Maffi also uses the term sense of place, bringing another dimension to this issue. Loh and Harmon (2005) gave this definition of biocultural diversity:

It includes biological diversity at all its levels, from genes to populations to species to ecosystems; cultural diversity in all its manifestations (including

linguistic diversity), ranging from individual ideas to entire cultures; and, importantly, the interactions among all of these.

They also added:

On a global scale, the primary importance of biocultural diversity is that it is the fundamental expression of the variety upon which all life is founded. Conceptually, biocultural diversity bridges the divide between disciplines in the social sciences that focus on human creativity and behavior, and those in the natural sciences that focus on the evolutionary fecundity of the non-human world.

Cocks (2006) built on that definition and the earlier one of Posey (1999) with:

Biocultural diversity denotes the link between biodiversity and human diversity. It is important to explicitly recognize the role played by human diversity in biodiversity conservation because biodiversity represents a source of raw material on which the processes of evolution depend. The less diversity there is, the greater the chance that life itself could be destroyed through lack of resilience to environmental change. Different cultures and peoples perceive and appreciate biodiversity in different ways because of their distinct heritage and experience (Posey, 1999). Most discussions on the intricate relationship between the conservation of biodiversity and cultural diversity centre around the argument that cultural diversity can sustain a wide variety of use practices and the conservation of natural resources.

And again,

For the biocultural diversity concept to have relevance and applicability to communities other than indigenous or local it is necessary to reconceptualize two of its key components. The first is the meaning of the word culture. Present thinking within the theory of biocultural diversity fails to consider the multiple dimensions of culture, for example, how aspects of culture can be modified, adapted, and maintained despite changes a community might experience in its social and material context and its removal from pre-colonial residence areas. This is the result of a failure to acknowledge the resilience or persistence of certain dimensions of culture in the face of change, and the implications this might have for biocultural diversity. Secondly, biocultural diversity theory makes repeated reference to the cultural

functions and values of natural areas because the studies using the theory focus predominantly on areas such as sacred forests, rainmaking sites, landmarks, etc. – and not on resources harvested from the wild.

This latter point is especially important as indigenous and local communities are increasingly arguing against concepts such as 'wildlands' and 'wilderness' and point to centuries or millennia of sustainable use of natural resources in areas so described. These debates are often repeated in the context of the CBD (especially implementation of its Article 8(j)) and the organisation International Consortium on Community Conserved Areas (ICCCA) is devoted to articulating this point of view.

Rozzi, Massardo, Anderson, Heidinger, and Silander (2006) reinforce these issues and note a consensus among conservation practitioners of a need for:

1. Social involvement by scientists;
2. Interdisciplinary approaches that integrate human and biological factors;
3. A focus on local, regional and global levels; and
4. The establishment of international agreements on biodiversity and environmental protection, referenced by UNESCO (2000).

Bridgewater, Arico, and Scott (2007) explored the critical links between natural and cultural heritage in Multilateral Environment Agreements and identified roles for:

.....better understanding of heritage issues in those Agreements. In the case of human-dominated nature, which is the nature we face nowadays, diversity of genes, species, ecosystems and landscapes allows us to develop a matrix of human activities while maintaining those benefits of nature that are important to human well-being. Diversity of culture in its different expressions contributes to the sustainability of human interactions and therefore provides an important contribution to the human element of sustainable development.

Paolisso and Dery (2010) noted that:

Culture is not an epiphenomenon, to be used if compatible with ecological or economic goals or bypassed if not. Rather, culture plays a significant role in defining what is ecological and economic for most environmental stakeholders.

An important point here is the combining of ecology and economics.

Hill, Cullen-Unsworth, Talbot, and McIntyre-Tamwoy (2011) give a definition, essentially identical to Loh and Harmon (2005), but not referenced as such:

Biocultural diversity, defined as the total variety exhibited by the world's natural and cultural systems, denotes three concepts: diversity of life includes human cultures and languages; links exist between biodiversity and cultural diversity; and these links have developed over time through mutual adaptation and possibly co-evolution.

The inclusion of biocultural matters in differing worldviews was considered in the framework of the 'The Economics of Ecosystems and Biodiversity' (TEEB, 2010). Sukhdev, Wittmer, and Miller (2014) recognize that values are a product of different worldviews and perceptions on the relationship of humans and nature. They treat them as legitimate and valid in their respective sociocultural contexts. TEEB (2010, 151) specifically noted that:

For example, Judaeo-Christian culture and beliefs see Man as "inheritor of Earth", as owner. However, such a view contrasts sharply with naturalist or tribal views of humanity as part of the fabric of nature. TEEB argues that neither is incorrect nor invalid in their respective socio-cultural contexts, as values are always derived from worldviews and perceptions. Because of this multi-dimensional and socio-cultural embeddedness of "value", any exercise of valuation is purely a reflection of how certain people perceive their natural environment, and their relationship to it, at a certain point in time.

At the eighteenth ICOMOS (International Council on Monuments and Sites) General Assembly in 2014, (ICOMOS, 2014), attention was drawn to the biocultural component of landscapes in the following manner:

In many landscapes, concepts such as "natural" and "cultural" have lost much of their meaning, being replaced by a biocultural understanding, where not only settlements and agriculture, but also species and habitats are determined and preserved by people.

One might take offence at the use of the word 'preserve' but replaced by 'conserve' you have a continuing view of the evolution of the biocultural concept. In discussions at the congress, the view was expressed by the then Director-General of UNESCO that biocultural diversity was an 'emerging paradigm' across many of UNESCO's programmes and the culture sector generally. In 2017, ICOMOS and IFLA (International Federation of Landscape Architects) presented a document on principles concerning rural landscape as heritage (ICOMOS-IFLA, 2017), which stated:

Considering the International Union for the Conservation of Nature (sic) (IUCN) recognition of Category V Protected Landscapes and Seascapes in their management system, the IUCN efforts of

sustaining pastoral nomadism, the joint ICOMOS-IUCN initiative “Connecting Practice - nature and culture” and the importance of people interacting with their environment in ways that sustain bio-cultural diversity (including agrobiodiversity, as well as cultural and spiritual values).

This approach unites both ICOMOS and IUCN in the biocultural discussions and, since both bodies are technical advisors to the World Heritage Convention, brings biocultural matters into the arena of heritage.

Diaz et al. (2015), in the context of the IPBES Conceptual Framework, give a specific definition, essentially the same as Hill et al. (2011) and Loh and Harmon (2005):

Biocultural diversity, defined as the total variety exhibited by the world’s natural and cultural systems, explicitly considers the idea that culture and nature are mutually constituting, and denotes three concepts: Firstly, diversity of life includes human cultures and languages; secondly, links exist between biodiversity and cultural diversity; and finally, these links have developed over time through mutual adaptation and possibly co-evolution. Biocultural diversity incorporates ethnobiodiversity.

The incorporation of ethnobiodiversity seems to add unnecessary complexity without adding clarity and we do not take it further. Interestingly, a related paper, Diaz et al. (2018), does not mention the term biocultural at all. However, Gavin et al. (2015) discuss biocultural approaches in the context of nature conservation, and outline eight principles, but do not elaborate a definition.

Agnoletti and Rotherham (2015) point out that:

.....a major question, which then emerges, is in the definition of “nature”. In this sense, the human perception and psychological construct of what are

“natural” landscapes is often misleading. This issue becomes more than an intellectual exercise because it then influences, if not determines, the human response to landscape management. Misunderstanding of ecosystem processes and of related biodiversity in terms of the reality of the cultural aspect of “landscape” becomes especially troublesome.

They also discuss the Florence Declaration (UNESCO-SCBD, 2014), which forms an important part of the work of UNESCO and the Secretariat of the CBD on Biocultural Diversity. While having a strong European focus, this has much of global relevance. A further declaration in 2016 at a similar meeting for the Asia-Pacific region (Ishikawa, 2016), acknowledged ‘the importance of the UNESCO-SCBD Joint Programme on the Links between Biological and Cultural Diversity in advancing our understanding of Biocultural Diversity as the complex interplay between biodiversity and cultural diversity, and its vital impacts on economic, political, environmental, social and cultural sustainability’. Here, the key is the phrase ‘complex interplay between biodiversity and cultural diversity’ which we represent in Figures 1 and 2.

The IPBES Task Force on Indigenous and Local Knowledge has agreed principles for a proposed approach to working with indigenous and local knowledge in the IPBES that included a short definition of biocultural diversity as:

Maintained and produced in individual and collective ways, indigenous and local knowledge is at the interface between biological and cultural diversity. Manifestations of indigenous and local knowledge are evident in many social and ecological systems. In this context, the approach understands “biocultural” as describing a particular state resulting from the interaction of people and nature at a given time and in a given place and “biocultural diversity” as a dynamic, place-based aspect of nature arising from links and feedback between cultural diversity and biological diversity.

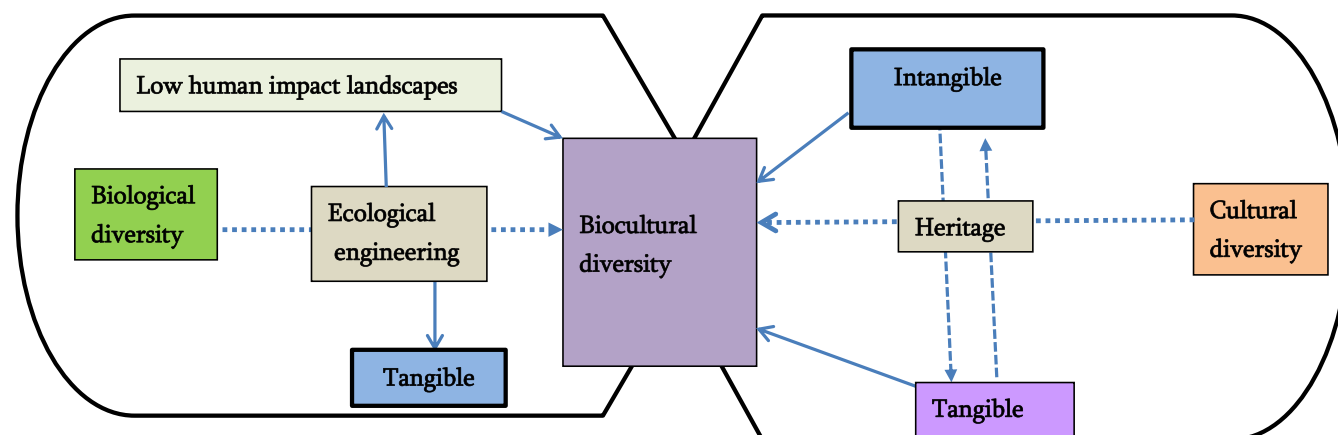
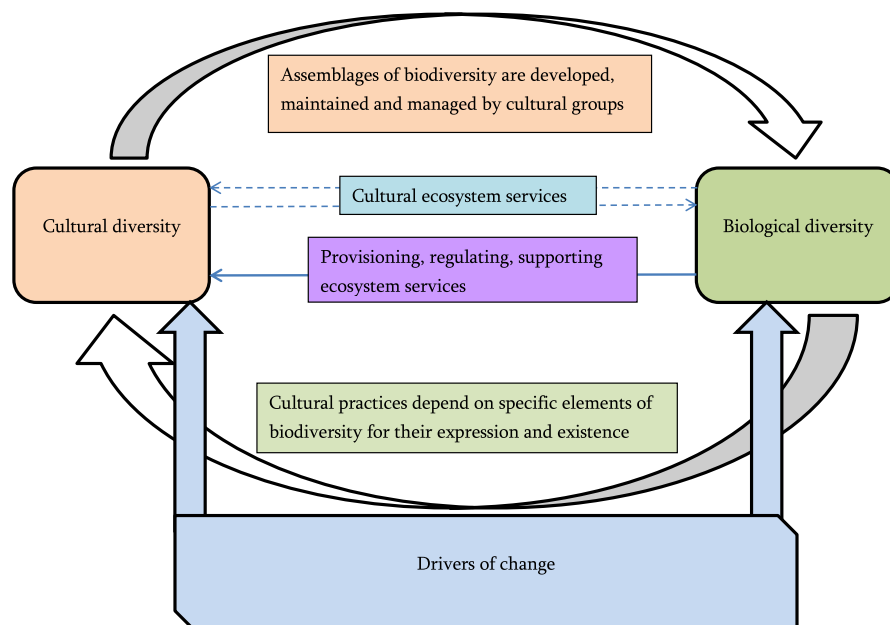


FIGURE 1 Biological diversity and cultural diversity blend to form biocultural diversity, with ecological engineering (Mitsch, 1992) and heritage acting as lenses to focus the strengths of both diversities in combination

FIGURE 2 Showing feedbacks between cultural and biological diversity, with a range of change drivers influencing both diversities. The influence of different ecosystem services (MA, 2005) is also identified. Ecosystem services can also be seen through the prism of nature's contributions to people (Diaz et al., 2015)



This definition was accepted by the IPBES Plenary meeting in 2017 (IPBES, 2017). However, the CBD-UNESCO Joint Programme on bio-cultural diversity (Convention on Biological Diversity (CBD), 2004, 2016b) had a cautionary note on the acceptance and use of the term biocultural:

The concept of “biocultural” diversity and “biocultural” heritage has emerged in recent decades as part of the efforts to narrow the widening nature-culture divide. These concepts provide important starting points for the reflections on the links between biological and cultural diversity and have proven effective in raising awareness on the inextricable link between biological and cultural diversity, including the diversity of living organisms or habitats whose present features are due to cultural action. However, there is still a lack of consensus on the precise meaning of the term “biocultural” and how it links to diversity agenda(s).

And, ‘The convergence between biological and cultural diversity extends far beyond the ‘hotspot’ areas. Ensembles of biodiversity are developed, maintained and managed by cultural groups. Diversity of cultural practices depends upon specific elements of biodiversity for their existence and expression.’

However, definitions by a subsequent working group on Article 8(j) (CBD, 2017), removed this uncertainty by including an important link to heritage:

Biocultural diversity is considered as biological diversity and cultural diversity and the links between them. Biocultural heritage reflects the holistic approach of many indigenous peoples and local communities. This holistic and collective conceptual approach also

recognises knowledge as “heritage”, thereby reflecting its custodial and intergenerational character. The cultural landscapes inscribed under the World Heritage Convention are examples of biocultural heritage.

Additionally, work being undertaken in connection with IPBES assessments and policy support deliverables has begun to focus on the evolving concept of ‘Nature’s Contributions to People’. This builds on the ecosystem service paradigm, as elaborated in the Millennium Ecosystem Assessment (MA, 2005). Recent publications by Pascual et al. (2017) and Diaz et al. (2015) developed this idea, and IPBES bodies and others (Braat, 2018; Masood, 2018) continue to debate the concept.

The details of the discussions need not concern us here, but an important aspect missing from this debate is indeed that of ‘People’s Contributions to Nature’. That is, the cultural shaping of many of the world’s landscapes by indigenous peoples over millennia. This tension between the human shaping of nature we see today, and the continuing benefits/ goods/ services/ contributions that nature offers, is an important aspect of this ongoing, and long overdue, debate. Ideas being developed as relational values (Chan et al., 2016) also contribute to the discussions.

Finally, Decision 14 of CBD Conference of the Parties in 2018 (CBD, 2018a) had the following two definitions:

‘*Biocultural diversity* is considered as biological diversity and cultural diversity and the links between them’ and ‘*Biocultural heritage* reflects the holistic approach of many indigenous peoples and local communities. This holistic and collective conceptual approach also recognizes knowledge as ‘heritage’, thereby reflecting its custodial and intergenerational character. The cultural landscapes inscribed

under the World Heritage Convention are examples of biocultural heritage'.

Held during that Conference of the Parties was a summit on nature and culture (CBD, 2018b), the declaration of which noted the need to *acknowledge* that indigenous, traditional and local languages epitomize the links between cultural and biological diversity, as recognized by the United Nations International Year of Indigenous Languages (Resolution 71/178) in 2019 and the need to *explore* the intersectionality of biological and cultural diversity and a growing awareness of the concept of 'biocultural diversity'. This latter point is significant in that it highlights the growing awareness of the concept, leading to the need for clearer and less ambiguous definitions for biocultural diversity.

The work of Rozzi et al. (2006) on biocultural diversity and nature conservation was undertaken in an area of far southern America, including the Cabo de Hornos Biosphere Reserve. Biosphere Reserves are important as a collection of sites to nurture biocultural diversity; a point noted and promoted in the 'Biocultural Challenge for Biosphere Reserves' (UNESCO, 2014) issued at the Fourth World Congress for Biosphere Reserves in Lima, Peru. In this context, the need for the conservation of biocultural diversity has been recognised in establishing the World Network of Biosphere Reserves. Working in and around this Biosphere Reserve, Rozzi et al. (2006) present ten interrelated principles to link biocultural conservation to nature conservation. These are:

1. Inter-institutional cooperation
2. Participatory approach
3. Interdisciplinary conservation approach (bridging humanities and sciences)
4. Networking and international cooperation
5. Communication through the media
6. Flagship species
7. Outdoor education
8. Economic sustainability and ecotourism
9. Administrative sustainability
10. Research and conceptual sustainability for conservation (the continuously evolving process for perceiving, understanding and co-existing with biocultural diversity).

These principles relate particularly to the specific place the authors write about, but they have wider application.

In a similar vein, Gavin et al. (2015) outlined eight principles for promoting biocultural diversity in nature conservation:

1. That conservation can have multiple objectives and stakeholders
2. Recognize the importance of intergenerational planning and institutions for long-term adaptive governance
3. Recognize that culture is dynamic, and this dynamism shapes resource use and conservation
4. Tailor interventions to the social-ecological context
5. Devise and draw upon novel, diverse and nested institutional frameworks

6. Prioritize the importance of partnership and relation building for conservation outcomes
7. Incorporate the distinct rights and responsibilities of all parties
8. Respect and incorporate different worldviews and knowledge systems into conservation planning

These eight principles are not limited to biocultural issues (e.g. No. 1 is simply stating the obvious) and the article itself is somewhat confused on the topic. Nevertheless, point 3 echoes many comments noted earlier, and number 4 is useful in reminding about the socioecological context. Generally, the principles presented by Rozzi et al. (2006) and Gavin et al. (2015) reflect the 12 principles of the ecosystem approach of the 'Convention on Biological Diversity' (CBD, 1992). However, with the emerging ideas in this field there would be value in the CBD bringing its ecosystem approach in line with current thinking on the importance of biocultural diversity in supporting global nature conservation/biodiversity conservation, site management and benefit-sharing.

Furthermore, there would be value in separating 'indigenous biocultural diversity', which has cosmological echoes, from local or traditional knowledge which can incorporate many levels of cultural knowledge and links with nature. Local traditional knowledge is often associated with agro-biodiversity. The global inventory of agro-biodiversity heritage sites (Globally Important Agricultural Heritage Systems [GIAHS] of the Food and Agriculture Organization [FAO]), is just one example of the role of biocultural diversity in this case in the agro-biodiversity context.

To halt the rapid degradation of GIAHS, their dynamism must first be recognized. Their resilience depends on the ability to adapt to new challenges without losing their biological and cultural wealth or their productive capacity, as indicated in Figure 2. This requires continuous agro-ecological and social innovation combined with careful transfer of accumulated knowledge and experience across the generations. Trying to conserve GIAHS by freezing them in time typically fails and leads to degradation. Furthermore, attempts at such conservation condemn their communities to poverty (FAO, 2018).

In order to address these challenges, it is important to gain a more effective understanding of the drivers of these landscapes. To address some of the issues, Rotherham (2015) explored the 'eco-cultural nature' of landscape (Rotherham, 2014a, 2014), as derived from long-term, intimate, interactions between people and ecology. It is often this interplay of humanity with nature that generates both sense of 'place' and local distinctiveness. Across Europe in particular, twenty-first century depopulation means that rural landscapes are 'abandoned' but Rotherham (2015) notes that they are not necessarily subsequently 'wilded'. The results for ecology, communities and economies can be potentially devastating and there is a frequently dramatic decline in biodiversity as the eco-cultural landscapes change through ecological successional or regenerative processes. Major drivers of these changes are urbanization and migration of people from the countryside to towns and cities with consequent socioeconomic and demographic changes. This process was described by (Rotherham, 2008, 2013),

TABLE 1 A summary of the work undertaken over the past decades

Definitions, concepts, sources and comments on biocultural diversity and heritage			
Authors or report	Date	Key contribution	Comment
World Heritage Convention UNESCO	1972	Bringing together of work on socioecological systems and human-centred cultural landscapes; focus on world heritage and in many ways a policy beginning	In 1992, the convention adopted cultural landscapes as a distinct categorization of world heritage
Declaration of Belém	1988	Direct involvement of indigenous and traditional peoples in formulating policy; inextricable link between culture and biological diversity	The first tentative conversations between Indigenous peoples and scientist on views about nature and culture—bringing together different world views.
Convention on Biological Diversity (CBD)	1992	Indigenous and local communities embodying traditional lifestyles; inclusion of knowledge, innovations and practices	International convention and protocols—adopted definitions in 2018 that reflect our conclusions
Posey	1983, 1985, 1999	Issues of indigenous ecological knowledge	Amazonian case studies
Berkes et al.	1994, 1995	Communities, traditional knowledge, resilience	Research and conceptual development
Nassauer	1995	Established four principles for dynamics of cultural landscapes	Remains an important paper framing these discussions
Bridgewater & Walton	1996	Need to recognize biocultural assets and heritage; used the four principles of Nassauer (1995) to establish the concept “biocultural” beyond merely world heritage; landscapes as blends of human activity and the expression of biodiversity	
Maffi	1999	Detailed definition of biocultural diversity	In Posey (1999) the first UN publication on this subject
International Round Table, Turin	2001	Intangible cultural heritage, cultural heritage to include traditions	
Harmon	2005	Defined biocultural diversity to bridge social sciences and natural sciences perspectives	
Loh & Harmon	2005	Definitions of biological diversity and of cultural diversity	Formal definitions put forward
Agnoletti	2006	Cultural heritage, intangible cultural heritage	Definitions and conceptual developments
Cocks	2006	Provided definition of biocultural diversity to link between biodiversity and human diversity; raises separation of theory focused on things like sacred forests as opposed to resources harvested from the wild	Cultural diversity can help sustain use practices and associated natural resources Important in relation to discussions on wildlands and wilderness
Rozzi et al.	2006	Links interdisciplinary issues between biodiversity and culture, conservation, and the role of UNESCO, including the Biosphere Reserve approach	Brings conservation into the discussions on nature and culture highlighting UNESCO's work
Agnoletti (ed.)	2007	Policy and conceptual development	Forest-related case study
Bridgewater et al.	2007	Explored critical links between natural and cultural heritage	Important in discussions of sustainable development, and to multilateral environmental agreements.
Rotherham	2007	Concept of “cultural severance” with ending of tradition to break human subsistence cultural ties with nature	further develops concepts and definitions
Bavikatte & Jonas	2009	Established biocultural community protocols (BCPs)	
TEEB	2010	Provides a broad framework for discussion	Brings the culture/nature discussion into the Ecosystem Services framing

(Continues)

TABLE 1 (Continued)

Definitions, concepts, sources and comments on biocultural diversity and heritage			
Authors or report	Date	Key contribution	Comment
Paolisso & Dery	2010	Noted how culture plays a role for stakeholders in defining what is ecological and economic	Combination of ecology and economics
Hill et al.	2011	Biocultural diversity is the total variety exhibited by the world's natural and cultural systems	
International Council on Monuments and Sites (ICOMOS)	2014	Attention drawn to biocultural components of landscape	Policy statement
Poe & Levin	2014	Considered coastal ecosystems as biocultural landscapes	Case study examples
UNESCO-SCBD	2014	Cautionary note on the acceptance and use of the term biocultural	
Sukhdevet et al.	2014	Biocultural matters included in various worldviews	
Agnoletti & Rotherham	2015	Cultural heritage, intangible cultural heritage, biocultural assets	Work with UNESCO, IUFRO, FAO etc
Rotherham	2015	Eco-cultural landscapes with biocultural heritage	Concepts and definitions
Diaz et al.	2015	Biocultural diversity defined as the total variety of the global natural and cultural systems.	further definition of biocultural diversity in the conceptual framework of IPBES
Gavin et al.	2015	Outlined eight principles to promote biocultural diversity in nature conservation	Development of core principles linking conservation with nature and culture
Convention on Biological Diversity (CBD)	2016	Cultural aspects included in discussions, even if rather disguised	International convention and protocols
ICOMOS & International Federation of Landscape Architects (IFLA)	2017	Importance of sustaining biocultural diversity to include agrobiodiversity plus cultural and spiritual values	International policy statement
IPBES Indigenous and Local knowledge Task Force	2017	Questions about the term biocultural diversity and its definition	Discussions but no resolution on the matter of a definition
UNESCO	2018	Evolution of relevant definitions and terms; biological diversity, cultural diversity and the links between them	

as 'cultural severance', and is the long-term breakdown of subsistence utilisation leading to long-term, often rapid, loss of biodiversity and landscape quality.

In a similar vein a key global threat to biocultural diversity is that of Biocultural Homogenization, identified by Rozzi as a 'wicked problem' (Rozzi, 2018). Biocultural diversity, as a pairing of biological and cultural diversity, suffers doubly from the twin and compounded effects of cultural homogenization, and ecological homogenization. Particular effects from ecological homogenization focus on invasive alien species (Crowl, Crist, Parmenter, Belovsky, & Lugo, 2008). Climate change, land use and transport vectors interact in complex ways to determine the spread of native and non-native invasive species, pathogens and their effects on ecosystem dynamics. Cultural Homogenizations, according to Singh (2015) as 'Janus-faced', speaking at the same time to cosmopolitanism and also to loss of local ways of life.

Combining the effects of biocultural diversity, while suffering from the effects of globalization, is paradoxically also a buffer against the general effects of globalization. Important in this

discussion (Agnoletti & Rotherham, 2015; Rotherham, 2015) is the idea that at a landscape level we can identify an eco-cultural resource made up of components of biocultural heritage embedded in a cultural landscape. Recognising and then managing appropriately these biocultural elements is the key to successful future conservation of nature and cultural expression. Furthermore, to achieve this objective effectively, a more integrated and joined-up approach is required from research, to policy, and to implementation.

5 | SUMMARY, DEFINITIONS AND CONCLUSIONS

Building on the materials and histories described, key elements emerge regarding development of the role biocultural diversity can play in nature conservation and thus sustainability. These are:

1. A clearly established nexus between cultural diversity and biological diversity;

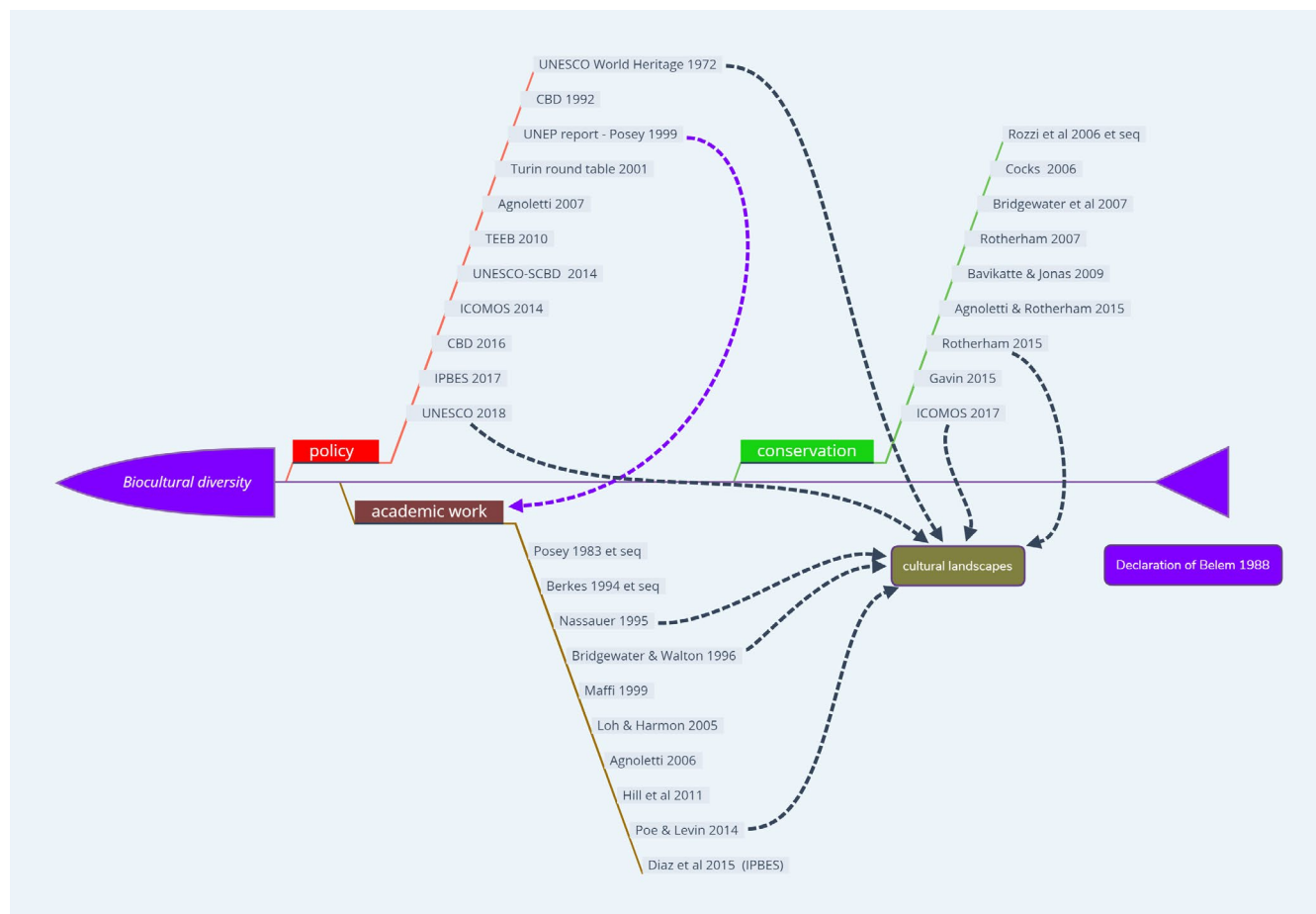


FIGURE 3 Schematic showing key publications on biocultural diversity since 1972 contributing to the three areas of academic endeavour, policy development and nature conservation and sustainability. The figure demonstrates that there are contributions from all three areas to the focal issue of (bio)Cultural Landscapes, adopted as a formal designation by the UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage in 1992

2. Cultural diversity and biological diversity have extensive feed-backs, both positive and negative, between them;
3. The nexus between biological and cultural diversity is influenced by both temporal and place-based elements;
4. Cultural heritage may be intangible and held within the particular culture;
5. Biocultural heritage may relate to specific aspects of biodiversity dependent on traditional management practices, and may include recognisable biological 'assets' (e.g. the flagship species of Rozzi et al., 2006);
6. Biocultural heritage underpins recognisable eco-cultural landscapes.

Inherent in this emerging concept are the rights and responsibilities of indigenous peoples and local communities to manage and safeguard their knowledge both for their benefit, and for the planet. Bavekatté and Jonas (2009) developed biocultural community protocols (BCPs) for local communities as one way in which communities can increase their capacity to conserve, manage, use and share local biodiversity. Furthermore, such an approach can drive local implementation of international and national environmental laws. BCPs are protocols

developed after a community undertakes a consultative process to outline their core ecological, cultural and spiritual values and customary laws. These relate to their traditional knowledge and resources and based on which they provide clear terms and conditions to regulate access to their knowledge and resources.

6 | A DEFINITION—BIOCULTURAL DIVERSITY AS A KEY TOOL FOR NATURE CONSERVATION

Considering the developing ideas since Belém and assuming nature includes people (*Homo sapiens*), Figures 1 and 2 highlight relevant links and feedbacks. In Figure 1, which deals with links, we also show the roles of heritage on one side and ecological engineering (Mitsch, 1992) on the other. In Figure 2, we demonstrate how ecosystem services fit in a biocultural framework and show the influences of drivers of change. This does not distinguish between direct and indirect drivers. We also provide in Table 1 and Figure 3 a brief synthesis of the work undertaken over the past decades in summary form, for ease of reference. Bringing the foregoing together we propose

below definitions of biocultural and biocultural diversity for use in further academic work, but especially in the work of, and decisions arising from, biodiversity-related multi-lateral environment agreements, IPBES products etc.

1. **Biocultural assets and heritage** result from interactions between people and nature at a given time in a given place.
2. **Biocultural diversity** is a dynamic, place-based, aspect of nature arising from links and feedbacks between human cultural diversity and biological diversity.

The assets, heritage and diversity (comprising (1) and (2) above), are placed within eco-cultural landscapes which result from long-term human–nature interactions, varying from centuries to tens of millennia.

These core concepts are placed jointly within a culture on the one hand, and a landscape with its ecology, on the other. Much of the biocultural heritage which is then manifested is inherently 'intangible'.

Biocultural is an adjective which implies a state resulting from the interaction of people and nature at a given time and in a given place. At its most basic, the expression biocultural refers to interactions between genes and memes.² Biocultural diversity is a dynamic, place-based, aspect of nature arising from links and feedbacks between human cultural diversity and biological diversity. These core concepts are placed jointly within a culture on the one hand, and a landscape with its ecology, on the other. Much of the biocultural heritage which is then manifested is inherently 'intangible'.

Application of the definitions of biocultural diversity provided above, set in the context of reconfigured principles in the CBDs ecosystem approach, offers a positive way to reduce the erosion of biodiversity. This will help efforts to restore biodiversity at genetic, species and ecosystem levels. Importantly, this approach helps provide an effective toolkit for decision-makers at many levels and can unify otherwise potentially disparate conservation management processes.

7 | REWILDING CONCEPTS AND CONSERVATION

It is difficult to fully address the issues raised in this paper without reference to ongoing debates about so-called rewilding of nature and landscapes (e.g. Sandom et al., 2018). Essentially, in response to continuing declines in species and overall biodiversity at every level from national to global, an approach has emerged that claims to halt the losses and turn back the ecological systems to processes prior to major human impacts (Rotherham, 2014, 2014a). In popular, professional and academic literature, the idea of 'rewilding' has taken hold and stimulated discussion about future landscapes and their ecologies. The broad concept has been taken to offer great benefits in terms of halting species declines and restoring ecosystem functions (e.g. Monbiot, 2013).

In this context we agree that appropriate rewilding offers major potential for slowing species declines and triggering some recoveries (see Sandom et al., 2018). Nevertheless, this needs to be set in the broader context of the essential eco-cultural nature of the landscape in which humanity is a major component. The culture versus nature paradigm is etched deeply into this debate and serves to emphasize further the need for clarity in finding effective definitions. It is hoped that the suggestions offered here will help avoid misunderstanding and thus focus efforts on pragmatic solutions which join nature, culture and heritage in effective conservation of biocultural resources.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHORS' CONTRIBUTIONS

P.B. conceived the idea of the perspective; after discussion, writing was undertaken by both P.B. and I.D.R. Final editing after review mainly by I.D.R.

DATA AVAILABILITY STATEMENT

No data were used in writing this paper.

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ENDNOTES

¹ Meaning "roots of life" in the Maya language.

² Inherent in a discussion of biocultural heritage is the question of how the knowledge and practice are passed down the generations. While there is considerable debate, especially among Anthropologists, about the ability for culture *sensu lato* to be reduced to "memes", some (e.g. Dawkins, 1976) have argued that memes could be transmitted in a way similar to genes. Memes represent a way of describing cultural information being shared as an element of a culture or system of behaviour that may be passed from individual to individual by non-genetic or epigenetic means. This concept seems a useful and simple way forward, without closing off continued research, reflection and discussion.

REFERENCES

- Agnoletti, M. (Ed.) (2006). *The conservation of cultural landscapes* (p. 320). Wallingford, Oxon: CAB International.
- Agnoletti, M. (ed.) (2007). Guidelines for the Implementation of Social and Cultural Values in Sustainable Forest Management. A Scientific Contribution to the Implementation of MCPFE – Vienna Resolution 3. IUFRO Occasional Paper No. 19, Vienna.

- Agnoletti, M., & Rotherham, I. D. (2015). Landscape and biocultural diversity. *Biodiversity and Conservation*, 24, 3155–3165. <https://doi.org/10.1007/s10531-015-1003-8>
- Bavikatte, K., & Jonas, H. (Eds.). (2009). Bio-cultural community protocols. *A community approach to ensuring the integrity of environmental law and policy* (pp. 88). Nairobi, Kenya: United Nations Environment Programme and Natural Justice.
- Berkes, F., & Folke, C. (1994). Investing in cultural capital for the sustainable use of natural capital. In A. M. Jansson, M. Hammer, C. Folke, & R. Costanza (Eds.), *Investing in natural capital: The ecological economics approach to sustainability* (pp. 128–149). Washington, D.C.: ISEE/Island Press.
- Berkes, F., Folke, C., & Gadgil, M. (1995). Traditional ecological knowledge, biodiversity, resilience and sustainability. In: C. A. Perrings, K.-G. Mäler, C. Folke, C. S. Holling, & B.-O. Jansson (Eds.), *Biodiversity conservation* (281–300). Dordrecht, The Netherlands: Kluwer.
- Braat, L. C. (2018). Five reasons why the Science publication “Assessing nature’s contributions to people” (Díaz et al., 2018) would not have been accepted in Ecosystem Services. *Ecosystem Services*, 30, A1–A2.
- Bridgewater, P. (2017). The intergovernmental platform for biodiversity and ecosystem services (IPBES) – A role for heritage? *International Journal of Heritage Studies*, 23, 65–73. <https://doi.org/10.1080/13527258.2016.1232657>
- Bridgewater, P., Arico, S., & Scott, J. (2007). Biological diversity and cultural diversity – The heritage of nature and culture through the looking glass of multilateral agreements. *International Journal of Heritage Studies*, 13(4–5), 405–419.
- Bridgewater, P., & Walton, D. W. (1996). Towards a new framework for vertebrate conservation. In D. J. Kitchener, & A. Suyanto (Eds.), *Proceedings of the 1st Eastern Indo-Australian Conference on Vertebrates*, Western Australian Museum, Perth (pp. 59–63).
- Chan, K. M. A., Balvanera, P., Benessaiah, K., Chapman, M., Díaz, S., Gómez-Baggethun, E., ... Turner, N. (2016). Opinion: Why protect nature? Rethinking values and the environment. *PNAS*, 113, 1462–1465. <https://doi.org/10.1073/pnas.1525002113>
- Cocks, M. L. (2006). Biocultural diversity: Moving beyond the realm of ‘indigenous’ and ‘local’ people. *Human Ecology*, 34(2), 185–200. <https://doi.org/10.1007/s10745-006-9013-5>
- Convention on Biological Diversity (CBD). (1992). The Text of the Convention. Retrieved from <https://www.cbd.int/convention/articles/default.shtml?a=cbd-08>
- Convention on Biological Diversity (CBD). (2004). The Ecosystem Approach. Retrieved from <https://www.cbd.int/ecosystem/>
- Convention on Biological Diversity (CBD). (2016a). Mo’otz Kuxtal Voluntary guidelines. Retrieved from <https://www.cbd.int/doc/decisions/cop-13/cop-13-dec-18-en.pdf>
- Convention on Biological Diversity (CBD). (2016b). Linking biological and cultural diversity. UNESCO-SCBD Programme. Retrieved from <https://www.cbd.int/lbcd/>
- Convention on Biological Diversity (CBD). (2017). Definitions of biocultural. Retrieved from <https://www.cbd.int/doc/c/03e6/17df/da9bb92bc05355119598a511/wg8j-10-l-03-en.pdf>
- Convention on Biological Diversity (CBD). (2018a). Definitions of biocultural. Retrieved from <https://www.cbd.int/doc/c/4122/306d/328640de37d0490162fc32be/cop-14-l-10-en.pdf>
- Convention on Biological Diversity (CBD). (2018b). The Sharm El-Sheikh Declaration on Nature and Culture. Retrieved from <https://www.cbd.int/doc/c/8b76/d85e/c62f920c5fd8c4743e5193e1/cop-14-inf-46-en.pdf>
- Crowl, T. A., Crist, T. O., Parmenter, R. R., Belovsky, G., & Lugo, A. E. (2008). The spread of invasive species and infectious disease as drivers of ecosystem change. *Frontiers in Ecology and the Environment*, 6, 238–246. <https://doi.org/10.1890/070151>
- Dawkins, R. (1976). *The selfish gene*. Oxford and New York: Oxford University Press.
- Declaration of Belém. (1988). The Declaration of Belém. Retrieved from <http://www.ethnobiology.net/wp-content/uploads/Decl-Belém-Eng-from-Posey.pdf>
- Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N., ... Zlatanova, D. (2015). The IPBES Conceptual Framework – Connecting nature and people. *Current Opinion in Environmental Sustainability*, 14, 1–16.
- FAO. (2018). Globally Important Agricultural Heritage Systems. Retrieved from <http://www.fao.org/giahs/background/strategy-and-approach/en/>
- Gavin, M. C., McCarter, J., Mead, A., Berkes, F., Stepp, J. R., Peterson, D., & Tang, R. (2015). Defining biocultural approaches to conservation. *Trends in Ecology & Evolution*, 30(3), 140–145. <https://doi.org/10.1016/j.tree.2014.12.005>
- Grime, J. P., Hodgson, J. G., & Hunt, R. (2007). *Comparative plant ecology. A functional approach to common British species* (2nd ed.). Dalbeattie, Scotland: Castlepoint Press.
- Hill, R., Cullen-Unsworth, L. C., Talbot, L. D., & McIntyre-Tamwoy, S. (2011). Empowering indigenous peoples’ biocultural diversity through World Heritage cultural landscapes: A case study from the Australian humid tropical forests. *International Journal of Heritage Studies*, 17(6), 571–591. <https://doi.org/10.1080/13527258.2011.618252>
- Hobbs, R. J., Higgs, E. S., Hall, C. M. (eds.) (2013). *Novel ecosystems: Intervening in the new ecological world order* (p. 380). New Jersey, NJ: John Wiley & Sons.
- ICOMOS. (2014). The Florence Declaration on Heritage and Landscape as Human Values. Retrieved from https://www.icomos.org/image/s/DOCUMENTS/Secretariat/2015/GA_2014_results/GA2014_Symposium_FlorenceDeclaration_EN_final_20150318.pdf
- ICOMOS-IFLA. (2017). ICOMOS-IFLA principles concerning rural landscapes as heritage. Retrieved from https://www.icomos.org/image/s/DOCUMENTS/Charters/GA2017_6-3-1_RuralLandscapesPrinciples_EN_adopted-15122017.pdf
- IPBES. (2016). *Summary for policymakers of the assessment report of the intergovernmental science-policy platform on biodiversity and ecosystem services (IPBES) on pollinators, pollination and food production*. Bonn, Germany: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.
- IPBES. (2017). Indigenous and local knowledge systems (deliverable 1 (c)). Retrieved from <https://www.ipbes.net/system/tdf/downloads/pdf/ipbes-5-4-en.pdf?file=1&type=node&xmlid=474>
- Loh, J., & Harmon, D. (2005). A global index of biocultural diversity. *Ecological Indicators*, 5, 231–241. <https://doi.org/10.1016/j.ecolind.2005.02.005>
- MA. (2005). *Ecosystems and human well-being: Synthesis*. Washington, D.C.: Island Press.
- Masood, E. (2018). Battle over biodiversity. *Nature*, 560, 423–425.
- Merçon, J., Vetter, S., Tengö, M., Cocks, M., Balvanera, P., Rosell, J. A., & Ayala-Orozco, B. (2019). From local landscapes to international policy: Contributions of the biocultural paradigm to global sustainability. *Global Sustainability*, 2(e7), 1–11. <https://doi.org/10.1017/sus.2019.4>
- Mitsch, W. J. (1992). Preface. *Ecological Engineering*, 1, vii–viii. [https://doi.org/10.1016/0925-8574\(92\)90020-3](https://doi.org/10.1016/0925-8574(92)90020-3)
- Monbiot, G. (2013). *Feral: Searching for enchantment on the frontiers of rewilding*. London, UK: Allen Lane.
- Nassauer, J. I. (1995). Culture and changing landscape structure. *Landscape Ecology*, 10, 229–238. <https://doi.org/10.1007/BF00129257>
- Paolisso, M., & Dery, N. (2010). A cultural model analysis of Chesapeake Bay oyster restoration. *Human Organization*, 69, 169–179.
- Pascual, U., Balvanera, P., Díaz, S., Pataki, G., Roth, E., Stenseke, M., ... Yagi, N. (2017). Valuing nature’s contributions to people: The IPBES approach. *Current Opinion in Environmental Sustainability*, 26–27, 7–16. <https://doi.org/10.1016/j.cosust.2016.12.006>

- Poe, M. R., Norman, K. C., & Levin, P. S. (2014). Cultural dimensions of socioecological systems: Key connections and guiding principles for conservation in coastal environments. *Conservation Letters*, 7, 166–175. <https://doi.org/10.1111/conl.12068>
- Posey, D. A. (1983). Indigenous ecological knowledge and the development of the Amazon. In E. F. Moran (Ed.), *The dilemma of Amazonian development* (pp. 225–257). Boulder, CO: Westview Press.
- Posey, D. A. (1985). Native and indigenous guidelines for new Amazonian development strategies: Understanding biological diversity through ethnecology. In J. Hemming (Ed.), *Change in the Amazon Basin* (Vol. 1, pp. 156–180). Manchester, UK: Manchester University Press.
- Posey, D. A. (Ed.) (1999). *Cultural and spiritual values of biodiversity*. London, UK: United Nations Environmental Programme and Intermediate Technology Publications.
- Rotherham, I. D. (2007). The implications of perceptions and cultural knowledge loss for the management of wooded landscapes: A UK case-study. *Forest Ecology and Management*, 249, 100–115. <https://doi.org/10.1016/j.foreco.2007.05.030>
- Rotherham, I. D. (2008). The importance of cultural severance in landscape ecology research. In: A. Dupont & H. Jacobs (Eds.), *Landscape ecology research trends* (pp. 71–87). Hauppauge, NY: Nova Science Publishers Inc., Chapter 4. ISBN 978-1-60456-672-7
- Rotherham, I. D. (Ed.) (2013). *Cultural severance and the environment: The ending of traditional and customary practice on commons and landscapes managed in common*. Dordrecht, Netherlands: Springer.
- Rotherham, I. D. (2013a). *The Lost Fens: England's greatest ecological disaster*. Stroud, UK: The History Press.
- Rotherham, I. D. (2014). *Eco-History: A short history of conservation and biodiversity*. Cambridge, UK: The White Horse Press.
- Rotherham, I. D. (2014a). The call of the wild. Perceptions, history people & ecology in the emerging paradigms of wilding. *ECOS*, 35(1), 35–43.
- Rotherham, I. D. (2015). Bio-cultural heritage & biodiversity – Emerging paradigms in conservation and planning. *Biodiversity & Conservation*, 24, 3405–3429.
- Rotherham, I. D. (2017). *Recombinant ecology – A hybrid future?* Dordrecht, the Netherlands: Springer.
- Rozzi, R. (2018). Biocultural homogenization: A wicked problem in the anthropocene. In: R. Rozzi, R. H. May, F. S. ChapinIII, F. Massardo, I. Klaver, A. Pauchard, M. A. Nuñez, & D. Simberloff (Eds.), *From biocultural homogenization to biocultural conservation. Ecology and ethics* (Vol. 3). Cham, Switzerland: Springer.
- Rozzi, R., Massardo, F., Anderson, C., Heidinger, K., Silander, J. A. Jr. (2006). Ten principles for biocultural conservation at the southern tip of the Americas: The approach of the Omora Ethnobotanical Park. *Ecology and Society*, 11(1), 43. <https://doi.org/10.5751/ES-01709-110143>
- Sandom, C. J., Dempsey, B., Bullock, D., Ely, A., Jepson, P., Jimenez-Wisler, S., ... Senior, R. A. (2018). Rewilding in the English uplands: Policy and practice. *Journal of Applied Ecology*, 00, 1–8. <https://doi.org/10.1111/1365-2664.13276>
- Singh, J. P. (2015). Cultural globalization and the convention. In: C. DeBeukelaer, M. Pyykkönen, & J. P. Singh (Eds.), *Globalization, culture, and development*. London, UK: Palgrave Macmillan. https://doi.org/10.1057/9781137397638_3
- Sukhdev, P., Wittmer, H., & Miller, D. (2014). The Economics of Ecosystems and Biodiversity (TEEB): Challenges and Responses. In D. Helm, & C. Hepburn (Eds.), *Nature in the Balance: The Economics of Biodiversity*. Oxford, UK: Oxford University Press.
- TEEB. (2010). The economics of ecosystems and biodiversity: Ecological and economic foundations. In P. Kumar (Ed.) *Earthscan*. London: Routledge.
- UNESCO. (1972). World Heritage Convention. Convention concerning the protection of the world cultural and natural heritage adopted by the General Conference at its seventeenth session Paris, 16th November 1972, United Nations Educational, Scientific and Cultural Organisation, Paris.
- UNESCO. (2000). Solving the puzzle: the ecosystem approach and biosphere reserves. Retrieved from <http://www.unesdoc.unesco.org/images/0011/001197/119790eb.pdf>
- UNESCO. (2014). The Lima Challenge for Action on Biocultural diversity in Biosphere Reserves. Retrieved from http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/images/The_Lima_Challenge_14_03.pdf
- UNESCO. (2018). What is Intangible Cultural Heritage? Retrieved from <https://ich.unesco.org/en/what-is-intangible-heritage-00003>
- UNESCO-SCBD. (2014). Linking biological and cultural diversity. Retrieved from <https://www.cbd.int/lbcd/>

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