

## Review

**Cite this article:** Merçon J, Vetter S, Tengö M, Cocks M, Balvanera P, Rosell JA, 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>

Received: 22 November 2018

Revised: 16 April 2019

Accepted: 17 April 2019

### Keywords:

ecology & biodiversity; human behaviour; natural resources (biological and non-biological); policies; politics and governance; social value

### Author for correspondence:

J. Merçon, E-mail: [jmercon@uv.mx](mailto:jmercon@uv.mx)

# From local landscapes to international policy: contributions of the biocultural paradigm to global sustainability

Juliana Merçon<sup>1</sup>, Susanne Vetter<sup>2</sup>, Maria Tengö<sup>3</sup>, Michelle Cocks<sup>4</sup>,  
Patricia Balvanera<sup>5</sup>, Julieta A. Rosell<sup>6</sup> and Bárbara Ayala-Orozco<sup>5</sup>

<sup>1</sup>Instituto de Investigaciones en Educación, Universidad Veracruzana, Mexico; <sup>2</sup>Department of Botany, Rhodes University, South Africa; <sup>3</sup>Stockholm Resilience Centre, Stockholm University, Sweden; <sup>4</sup>Anthropology Department, Rhodes University, South Africa; <sup>5</sup>Instituto de Investigaciones en Ecosistemas y Sustentabilidad, Universidad Nacional Autónoma de México, 58190, Morelia, Mexico and <sup>6</sup>Laboratorio Nacional de Ciencias de la Sostenibilidad, Instituto de Ecología, Universidad Nacional Autónoma de México, 04510, Mexico City, Mexico

## Non-technical summary

Nature and culture are intricately linked and the rapid loss of both biological and cultural diversity around the globe has led to increasing concerns about its effects on sustainability. Important efforts to understand biocultural relations and bolster sustainable practices have been made by scientists, local communities, civil society organizations and policy makers. In spite of their efforts, a stronger articulation between sectors and biocultural discourses is needed for a broader transformative impact. Here, we analyse the connections between prominent biocultural discourses and discuss how the biocultural paradigm can contribute to both local and global sustainability.

## Technical summary

Biocultural diversity refers to the interdependence between biological and cultural diversity, indicating how significant ensembles of biological diversity are managed, conserved and created by different cultural groups. In the face of the rapid decline of both biological and cultural diversity around the globe, biocultural discourses produced by scientists, practitioners and policy makers have attempted to promote knowledge and actions that contribute to halt such losses. We propose that biocultural approaches, collectively referred to as the biocultural paradigm, can contribute to both local and global sustainability but that a stronger articulation between sectors and biocultural discourses is needed for a broader transformative impact. We analyse some of the main differences and connections between prominent biocultural discourses in the context of sustainability. We propose that biocultural approaches should recognize and articulate an ontological dimension of biocultural diversity, an epistemological dimension through systems thinking, and an ethico-political dimension taking explicitly into account plural values, governance systems and power relations. Ontological, epistemological and ethico-political dimensions of the biocultural paradigm are interconnected and manifested through cultural practices and power relations embedded in specific biocultural landscapes.

## 1. The emergence of a paradigm

The last decades have seen unprecedented changes to the Earth's biological and cultural components. From genes, species, ecosystems, landscapes and seascapes, to languages, practices, traditions, artistic expressions and belief, value, and knowledge systems, these diversities are facing rapid changes and, most importantly, rapid loss (Barnosky *et al.*, 2011; Harmon & Loh, 2010; Maffi, 2005). Although the loss of biocultural diversity is usually associated with local effects on social-ecological systems, it is less clear how this loss could impact global sustainability. Important efforts to understand nature-culture relations and bolster sustainable practices at all scales have been made by scientists, local communities, civil society organizations and policy makers. In spite of their efforts, a stronger articulation between sectors and biocultural discourses is needed for a broader transformative impact. Here, we discuss how biocultural approaches, collectively referred to as the biocultural paradigm, can contribute to both local and global sustainability. Moreover, we analyse some of the main connections between the most prominent biocultural discourses in the context of sustainability. Finally, in order to encourage a greater articulation between science, practice and policy, we propose that discourses produced within the biocultural paradigm should integrate ontological, epistemic and ethico-political dimensions.

© The Author(s) 2019. This is an Open Access article, distributed under the terms of the Creative Commons Attribution licence (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted re-use, distribution, and reproduction in any medium, provided the original work is properly cited.

The term ‘paradigm’ is employed here to designate a common thinking field (shared forms of understanding, values and methods), which suggests ‘new puzzles’ and new approaches to solving them (Kuhn, 1970). In this sense, the ‘biocultural paradigm’, as termed by Maffi (2007) and Toledo (2013), corresponds to a wide-ranging framework that poses novel questions and methodologies around the intricate connections between nature and culture. In its early version, the biocultural paradigm was deeply seated in the concept of biocultural diversity (Maffi, 2007), which arose in the 1990s to denote the inextricable link between areas of high biological and cultural diversity (Maffi & Woodley, 2012; Posey, 1999). Spurring early discussions, the Declaration of Belém (1988) raised alarm over the rapid decline in biological and cultural diversity and recognized the dependence of people on natural resources (Rapport & Maffi, 2010). It also emphasized the importance of native people as stewards of the world’s biodiversity (including genetic resources and the knowledge to manage them), and the inextricable links between all manifestations of life (biological, cultural and linguistic) (Maffi & Woodley, 2012; Posey, 1999). This declaration gave recognition and value to indigenous knowledge, including local indigenous specialists as authorities that need to be consulted in programs affecting indigenous communities, their resources and their environments. These ideas gained prominence in response to concerns about the rapid decline of biocultural diversity and the loss of intergenerational transmission of traditional knowledge, practices and languages (Maffi, 2005; Maffi & Woodley, 2012; Posey, 1999), as evidenced in the Convention on Biological Diversity (CBD; United Nations, 1992), and highlighted again in the 2010 Declaration on Bio-Cultural Diversity (United Nations, 2010).

Recognition of indigenous communities and their knowledge has been growing in the last three decades. Calls have been made for sustainable development approaches to be aligned with local cultural practices and for such communities to have greater control over their land, development and heritage (Brondizio & Tourneau, 2016; Davidson-Hunt *et al.*, 2012; Garnett *et al.*, 2018; Sterling *et al.*, 2017). In 2018, marking the 30th anniversary of the Declaration of Belém, this city hosted again a large international meeting to discuss the rights of indigenous peoples and traditional populations and the sustainable use of biodiversity ([www.ise2018belem.com](http://www.ise2018belem.com)). Attracting over 1600 participants from 45 countries, of whom 500 were indigenous, this event has been by far the largest gathering to date of researchers, scholars, students, indigenous peoples and other traditional communities, government agencies, civil society organizations, and social movements engaged in these discussions. The magnitude and resolutions of this event highlight the currency of these discussions and the crucial role of biocultural diversity for global sustainability. For example, it is known that indigenous peoples and traditional communities manage 95% of the world’s genetic resources (Maffi & Woodley, 2012) and act as stewards of approximately 40% of protected areas and ecologically intact systems worldwide (Garnett *et al.*, 2018). The associated knowledge and local management practices thus become crucial given that the health, agriculture and economy of people around the world are partially or totally dependent on these resources and environments (Corona-M, 2018).

## 2. Expanding the biocultural paradigm and its applications

While the concept of biocultural diversity has been commonly applied to indigenous and traditional communities, especially in

the context of a ‘crisis narrative’ (Brosius & Hitchner, 2010), recent developments have significantly expanded its meanings to include other social and ecological contexts. Cocks (2006) and Cocks and Wiersum (2014) argue that the concept of biocultural diversity is equally applicable to social groups who do not adopt traditional lifestyles and do not live in largely pristine natural environments. Research amongst rural and urban communities in the Global South heavily impacted by hegemonic socio-economic processes shows that more modernized communities maintain cultural practices reliant on natural environments and high biodiversity (Cocks, 2006; Emperaire & Eloy, 2008) and that people retain cultural and spiritual values associated with natural landscapes and vegetation in rural and urban contexts (Cocks, Vetter, & Wiersum, 2018; Cocks & Dold, 2012; Cocks *et al.*, 2015, unpublished data). Along the same lines, Buizer, Elands, and Vierikko (2016) have proposed that biocultural diversity should be considered as a reflexive and sensitizing concept that can be used to assess the different values and knowledge of different human groups living with biodiversity within different contexts. For these authors, biocultural diversity emphasizes the importance of urban green areas for the quality of life in growing cities. In this way, cultural interactions with nature form a crucial part of the city’s cultural heritage and identity (Elands, Wiersum, Buijs, & Vierikko, 2015).

In the field of sustainability science, the biocultural paradigm overlaps strongly with the social-ecological systems framework. In particular, in early work on social-ecological systems (Berkes, Colding, & Folke, 2003; Berkes, Folke, & Colding, 2000), there is strong emphasis on the co-evolution and deep intertwinedness of humans and nature, which is mirrored in the concept of biocultural diversity (Gavin *et al.*, 2015; Loh & Harmon, 2005; Maffi, 2005). Moreover, in resilience thinking, biocultural diversity is regarded as a crucial component of social-ecological systems and a key resource for surviving crises, adapting to change, and crafting new social-ecological systems in the future. As part of these discussions, it has been suggested that the concept of ‘ecosystem services’ can be usefully expanded to ‘nature’s contributions to people’ (Díaz *et al.*, 2018), highlighting the cultural context of co-construction of nature’s benefits and emphasizing the role of biocultural diversity. Currently, the social-ecological systems approach and terminology is also used in a much broader sense, and the term ‘bioculture’ is employed to emphasize tightly intertwined and co-evolving social-ecological systems, cultural dimensions and implications in such systems (e.g. Barthel, Crumley, & Svedin, 2013; Haider, 2017; Hiron *et al.*, 2018; Kealiikanakaoleohaililani *et al.*, 2018).

The biocultural paradigm has also been adopted by intergovernmental organizations, programs and platforms (e.g. UNESCO, the Convention for Biological Diversity [CBD] and the Intergovernmental Platform on Biodiversity and Ecosystem Services [IPBES]). The concept of biocultural diversity was taken on by a joint UNESCO-CBD programme in 2010, the International Year of Biodiversity, to promote reciprocal knowledge exchange of cultural, ethnic, linguistic and religious diversity, and to foster dialogue for sustainable development based on recognition of and respect for different knowledge systems, including the knowledge of indigenous peoples and local communities (United Nations, 2010). Biocultural perspectives were then integrated into the Strategic Plan for Biodiversity 2011–2020 that included 20 Aichi Biodiversity Targets, within which biocultural heritage was seen as a key promoter of resilience (United Nations, 2010). A plan of action on customary sustainable use

of biological diversity was established to ensure the participation of indigenous and local communities in such a Strategic Plan (United Nations, 2010). The IPBES platform, created in 2012 to strengthen knowledge foundations for better policy through science, recognized from the onset the role of biocultural diversity in shaping nature, as reflected in its conceptual framework (Díaz *et al.*, 2015). In this context, a Task Force was also created to foster the recognition of the knowledge that indigenous people and local communities possess, the way it is constructed and evolves over time, and its relevance for the governance of biodiversity from local to global levels.

In the Global South, particularly in Latin America, the biocultural paradigm has become instrumental for indigenous rights movements and the political agenda of environmental civil society organizations (Argumedo, 2011; Martínez-Esponda *et al.*, 2017; Panduro, 2014). A unifying feature of this perspective is the claim that indigenous conservation knowledge, practices and territories (including food production, biocultural heritage and memory) are threatened by globalized capitalism and neo-colonial powers (Declaration of Ixtlán, 2017). Social movements find in the biocultural paradigm an essential political tool to demand land rights protection, focusing on diverse forms of life in concrete (often contested) territories. Related concepts in this context include biocultural heritage ('patrimonio biocultural' with its connotations of birthright and ownership) (Argumedo, 2008; Boege, 2008, 2015), biocultural memory (Toledo & Barrera-Bassols, 2008) and sociobiodiversity (Almeida, 2012).

A growing array of discourses and applications enlivens an evolving biocultural paradigm, which informs the study, practice and politics of the vital interconnections between culture and nature. However, the local contributions of this paradigm may be more easily deducible than its role in promoting global sustainability, as it is discussed below.

### 3. The biocultural paradigm's crucial role in global sustainability

The biocultural paradigm is inherently systemic and place-based, focusing on practices, knowledge, values and governance systems that relate specific human groups with their environment. As Sterling *et al.* (2017: p. 1800) note, "all biocultural approaches are social-ecological in nature, but not all social-ecological approaches frame interactions from locally relevant cultural perspectives". Despite being associated with human-nature connections from local cultural viewpoints, we argue that the biocultural paradigm is decisive to global sustainability for at least four reasons.

#### 3.1. Global sustainability strongly relies on diversity

Whilst biodiversity has been proven to be crucial for ecosystem functioning (Cardinale *et al.*, 2012), cultural diversity constitutes an invaluable source of knowledge, ways of knowing and learning, governance mechanisms, management practices and innovations toward sustainability that provides options for the future of humanity and the Earth (Barthel *et al.*, 2013; Maffi, 1998; Singh, Pretty, & Pilgrim, 2010; Sterling *et al.*, 2017; Tengö *et al.*, 2017). Biocultural diversity refers to the interdependence between biological and cultural diversity, indicating how significant ensembles of biological diversity are managed, conserved and even created (e.g. agrobiodiversity) by different cultural groups, many of which have had low environmental impact, thus offering

significant stewardship examples of strong relevance for other groups across the globe (Berkes *et al.*, 2000; Brondizio & Tourneau, 2016; Garnett *et al.*, 2018; Gavin *et al.*, 2015). In a highly interconnected world, where local activities can affect and be affected by social-ecological dynamics occurring in other parts of the planet, such culture-based sustainable practices are of benefit to all humans, and facilitate alternative ways of being.

#### 3.2. The biocultural paradigm emphasizes the connections between nature and human well-being, shifting the attention in sustainability debates from economic development to cultural values that guide non-instrumental relationships with nature

Relational values that focus on identity, well-being and a sense of stewardship/responsibility are found across a great variety of cultural groups and societal contexts (Chan *et al.*, 2016). Relational values have become iconic through cultural manifestations such as *Ubuntu* in South Africa, *Sumak Kawsay* in Latin America, *Hālanu 'Ōhi'a* in Hawaii, the Gandhian Economy of Permanence in India, Pope Francis' encyclical letter *Laudato Si'* and the Degrowth movement in Europe. These and other value systems that emphasize individual and collective well-being, and the fundamental dependence of well-being on the environment, tend to conserve and construct forms of relationship with nature and the human community that may potentially counter the negative impacts of the progressive commodification of nature and the loss of traditional governance systems (Acosta, 2016; Fuentes-George, 2013; Gómez-Baggethun & Ruiz-Pérez, 2011; Gudynas, 2015; Kothari, Demaria, & Acosta, 2014; McCauley, 2006).

#### 3.3. The biocultural paradigm is a useful approach to address the social justice aspects of sustainability

Cultural groups contribute differently to environmental changes that currently challenge all humans. Although in the term 'Anthropocene' (Crutzen, 2002) our species as a whole is identified as the major driver of global change, it is important to clarify that the alterations in the climate, water cycles, biodiversity and in various ecosystem dynamics are mainly caused by the forms and levels of production and consumption in industrial and post-industrial societies rather than all of humanity (Baskin, 2015; Malm & Hornborg, 2014; Moore, 2016, 2017). The Great Acceleration (Steffen, Crutzen, & McNeill, 2007) and its significant impacts both on economic wealth and the ecological crisis have been largely associated with the demands and activities of a small fraction of the human population. Steffen and collaborators (2015) show, for example, that in 2010 the OECD countries accounted for 74% of global GDP while representing only 18% of the global population. Wiedman and collaborators (2015) found that with every 10% increase in GDP the material footprint of nations increases by 6%, and that as wealth grows countries not only consume more materials from nature but also tend to rely more on those abroad through international trade. Biocultural perspectives highlight these disparities, as well as the economic, political and epistemic inequalities that lie at the basis of intercultural exchanges and environmental conflicts (Boege, 2015; Leff, 2017). Key areas of biocultural diversity are often under intense dispute, with a great number of local communities facing challenges such as land dispossession and large-scale development projects (Apgar, Ataria, & Allen, 2011). Biocultural approaches

can cast light on the contrasting values, knowledge systems and practices that underpin social-ecological conflicts and contribute, through collaborative and engaged research (Gavin *et al.*, 2018; Salomon *et al.*, 2018; Temper, Del Bene, & Martinez-Alier, 2015), to the construction of peace and justice, necessary conditions for any attempt toward local and global sustainability.

### 3.4. Global sustainability depends on the enactment of culturally pertinent policies that can be articulated across governance levels and actors

The lack of biocultural approaches in the formulation of top-down policies by governments operating at all scales may lead to the implementation of culturally inappropriate actions, which can result in unproductive and even harmful processes, generating the loss of control over place, resources, knowledge and practices (Sterling *et al.*, 2017). The effectiveness of environmental governance depends on the direct involvement of local and indigenous populations in political platforms that reconcile different cultural perspectives (Brondizio & Tourneau, 2016) and the right to self-determination via traditional governance systems (Lovera, 2010).

The adoption of the biocultural paradigm by academia, practitioners and policy makers may catalyse the joint construction of relevant knowledge, sustainable practices and policies by different social actors. This would imply a greater contribution to sustainability, from local to global scales. Fruitful collaboration between sectors relies, however, on the understanding of different biocultural conceptions, knowledge and applications put forward by distinct actors and their agendas. In the following section, we discuss some of the key features of four main biocultural discourses in the field of sustainability as well as some significant connections between them. These discourses emphasize distinct aspects of the biocultural paradigm's contributions to local and global sustainability, depending on their locus of production and objectives.

## 4. Biocultural discourses in academia, practice and policy

Discourses are both a product and a producer of power as they constitute a response to perceived needs in specific historical and political contexts, and have the potential to drive change by framing problems and solutions (Foucault, 1975). Understanding how different discourses shape human-nature interactions and promote change across actors at different scales is thus key for sustainability (Clement, 2013; Hajer, 1995). Our purpose here is not to provide a thorough analysis of how biocultural discourses are constituted or have contributed to sustainability, but to briefly characterize them and discuss some of their connections in order to better understand the limits and potentialities of the biocultural paradigm.

Drawing on the authors' involvement with distinct discursive fields, and on different sources of information (scientific and grey literature, websites, international policy documents, declarations, conferences), we identified four major biocultural discourses in the field of sustainability. Two of these discourses are represented by scholars working in the fields of (i) social-ecological systems and sustainability science and (ii) anthropology and ethnobiology. Another discourse has emerged among civil society organizations, social movements and engaged scholars ([iii] indigenous rights movements and political ecology) and the fourth in international policy arenas ([iv] intergovernmental bodies) (Table 1).

All of these approaches recognize the reciprocal links between cultural and biological diversity; however, some emphasize

epistemic dimensions from a more ecological (i) or anthropological (ii) perspective, while others focus on ethico-political aspects from a bottom-up (iii) or top-down approach (iv). The strength of the connections between the discourses and their influence on each other vary, as shown in Figure 1 and further described below.

The social-ecological systems and sustainability science discourse is scientific and often employs quantitative methodologies. Even though inclusive and transdisciplinary approaches are gradually increasing, social-ecological perspectives generally tend to place less emphasis on the role of power relations and social inequalities. Due to their scientific status and orientation towards policy influence, this type of narrative strongly informs international bodies (such as IPBES) and maintains synergic ties with other scholarly discourses, but is not significantly influenced by indigenous rights movements. The ties with anthropology and ethnobiology have a long history, where the social-ecological systems literature has drawn from these bodies of work, for example, on indigenous and local knowledge and institutions (e.g. Berkes *et al.*, 2003; Gavin *et al.*, 2015); on cultural aspects of ecosystem services (e.g. Comberti, Thornton, Wyllie de Echeverria, & Patterson, 2015; Pröpper & Haupts, 2014) and values, including relational values (e.g. Chan *et al.*, 2016; West *et al.*, 2018).

Anthropological and ethnobiological discourses often draw on ethnographic and other forms of qualitative research. While biocultural diversity in this context was originally applied to the study of indigenous peoples in remote and more pristine areas, this perspective has extended the notion of bioculturality to modernized communities, and agricultural and urban contexts. The political emancipatory dimension of biocultural views is not a main focus of these discourses, although they argue strongly for indigenous knowledge and practices to be given prominence in development and policy. Anthropological and ethnobiological discourses have had some influence on indigenous movements and some impact on international policy. Stronger synergies are identified with social-ecological scientific discourses with which there is a shared academic basis and on-going cross-fertilization, with many scholars publishing in anthropology, ethnobiology and social-ecological realms (Buizer *et al.*, 2016; Gavin *et al.*, 2015; Vogt *et al.*, 2016).

Indigenous movements and political ecologists have produced biocultural discourses that focus primarily on ethico-political dimensions with a bottom-up approach. These discourses are strategically used to advocate for environmental and indigenous rights and are informed by ecological and anthropological biocultural knowledge, although the term 'biocultural' is not always explicitly employed. The focus on power relations and social inequities is largely expressed through the overt opposition to capitalist globalization and neo-colonialism, with an overall discredit of global intergovernmental initiatives because of their limited impact on national and local levels. The political nature of these discourses often implies a simplification of social-ecological knowledge and the essentialization of ethnic groups, that is, the idealization of the indigenous.

The biocultural discourses produced within and in relation to intergovernmental organizations, programs and platforms (e.g. UNESCO, CBD and IPBES) are also chiefly ethico-political, strongly informed by science, and have a top-down orientation. Strong links are maintained between these international bodies and social-ecological discourses (Diaz *et al.*, 2015, 2018). Other academic discourses are also incorporated in international policy, but with lesser impact. While progress has been made to integrate

**Table 1.** Characteristics of biocultural discourses in academia, practice and policy.

Locus of production	Social-ecological systems, sustainability science	Anthropology, ethnobiology	Indigenous rights movements, political ecology	Intergovernmental bodies
Main dimension	Epistemic	Epistemic	Ethico-political	Ethico-political
By whom?	Mainly academics using a social-ecological systems and resilience thinking approach, often under the broader umbrella of sustainability science	Mainly academics working in the field of conservation and heritage	Indigenous and environmental movements, civil society organizations, engaged scholars	Diverse communities (scientists, governments, civil society organizations, indigenous groups) gathered through intergovernmental bodies, e.g., Convention on Biological Diversity (CBD), UNESCO, Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)
For whom?	Academia (sustainability science, conservation science) targeting policy change and key science-policy arenas such as Future Earth, IPBES, and Sustainable Development Goals	Academia, researchers, conservation and heritage management policy makers	Indigenous and environmental movements, policy makers, judicial system	Policy makers responsible for adopting CBD decisions or operationalizing IPBES results, and academics
What for?	To describe, articulate and study human-nature interdependencies, the co-evolutionary nature of social-ecological systems, and the implications for resilience and transformation in the face of disturbances and crises. Focus on the dynamics and resilience of the social and ecological systems	To recognize the role of biological and cultural diversity, diversity in worldviews, knowledge, beliefs and practices connecting different people to the environment. To ensure the persistence of biodiversity and the locally relevant biocultural heritage, as well as to find ways to reconnect with nature in urban contexts. Focus on diversity and well-being	To protect indigenous rights in the struggle for land and access to natural resources, given that indigenous conservation knowledge, practices, governance systems and land (biocultural heritage and memory) are threatened by globalized capitalism and neo-colonial power dynamics. Focus on social justice	To mainstream biocultural principles and knowledge into decisions and policies, including the CBD programs, the Man and the Biosphere UNESCO reserve network, and all the countries signatories of CBD and IPBES, by establishing sound legal and knowledge bases. Focus on pertinent policy
Case study example	The Hawaiian social-ecological system is described and analysed in terms of biocultural elements, and their role in system dynamics and resilience over time. <i>Kalo</i> (taro) and <i>'uala</i> (sweet potato) cultivation are keystone elements. As such, they are essential entry points in restorations of biocultural landscapes (Winter, Lincoln, & Berkes, 2018)	The Kaa-lya del Gran Chaco National Park and Integrated Management Area in the Bolivian Chaco encompassing approximately 3.5 million hectares was designed and implemented as the result of a collaboration between the Wildlife Conservation Society and the Capitanía de Alto y Bajo Izozog, the organization representing the 10,000 Guaraní people known as Isoceños (Redford & Painter, 2006)	In the northern mountains of the state of Puebla, Mexico, the Maseual people gathered in assemblies of over 3000 people to oppose mining concessions in their land. They won the case arguing for their self-determination rights and cultural control over natural resources, as part of their biocultural heritage (CEMDA, 2018)	IPBES has established a Task Force to recognize and work with indigenous and local knowledge (ILK), to facilitate the incorporation of ILK in all deliverables through dialogues and other activities towards a collaborative definition of problems and goals, to synthesize and incorporate IPBES products from multiple sources of ILK, and to share the results with indigenous peoples and local communities (Thaman <i>et al.</i> , 2013)
Scale and scope of application	Multiple scales, addressing implications for international policy, conservation and development practice	Mainly local scale, recognizing and promoting different ways of living with and co-creating the natural environments. Examples at national scale include those giving prominence and legal protection of different ways of living on and with the land and ensuring the right to one's chosen way of living and managing the territory and natural resources	Mainly local and national application of the concept by social movements and organizations in struggle against governmental decisions (inappropriate policies and programs) and private enterprises (mining, hydropower plants, etc). Regional, national and international scales of application by indigenous and environmental networks	Integration of local knowledge into globally approved documents with implications for their uptake at national, subnational and local levels

(Continued)

Table 1. (Continued.)

Locus of production	Social-ecological systems, sustainability science	Anthropology, ethnobiology	Indigenous rights movements, political ecology	Intergovernmental bodies
Main dimension	Epistemic	Epistemic	Ethico-political	Ethico-political
Key authors and publications	Barthel <i>et al.</i> (2013); Berkes, Folke, & Colding (2000); Garibaldi & Turner (2004); Gavin <i>et al.</i> (2015); Haider (2017); Kealiikanakaoleohailil <i>et al.</i> (2018); Olsson, Folke, & Hughes (2008); Sterling <i>et al.</i> (2017); Winter, Lincoln, & Berkes (2018)	Agnoletti & Rotherham (2015); Buizer <i>et al.</i> (2016); Cocks (2006); Cocks & Wiersum (2014); Gavin <i>et al.</i> (2015); Hay-Edie <i>et al.</i> (2011); Hill <i>et al.</i> (2011); Maffi (2005); Maffi & Woodley (2012); Posey (1999)	Argumedo (2008); Boege (2008); Escobar (2010); Pimbert (2017); Posey (2004); Toledo & Barrera-Bassols (2008)	Bridgewater (2017); Drahos (2011); Loh & Harmon (2005); Maffi (2005); United Nations (2010)
Limitations	Academically oriented, even if transdisciplinary, setting out to be policy relevant. Ecological approach may downplay power inequalities and social justice perspective	Conservation oriented. Although indigenous rights and the role of indigenous peoples in conservation are promoted, the political dimension (biocultural diversity as emancipatory) is currently not strong	Focus on indigenous rights excludes other vulnerable groups and urban settings. Simplified notions of culture	Interaction between local knowledge holders and intergovernmental platforms is bounded by rigid rules. Policy and academically oriented with limited interface with local communities
Strengths and opportunities	Social-ecological transdisciplinary work is evolving fast to integrate local knowledge into resilience thinking and strategies that link with larger scale dynamics	Recognition of the different ontologies and the different ways of being with and as part of nature. Declarations emphasize the need to give prominence to indigenous communities in decision-making	Addresses power inequalities, raises ethical issues, bridges gaps between regions	Links between knowledge, policy and cultural rights

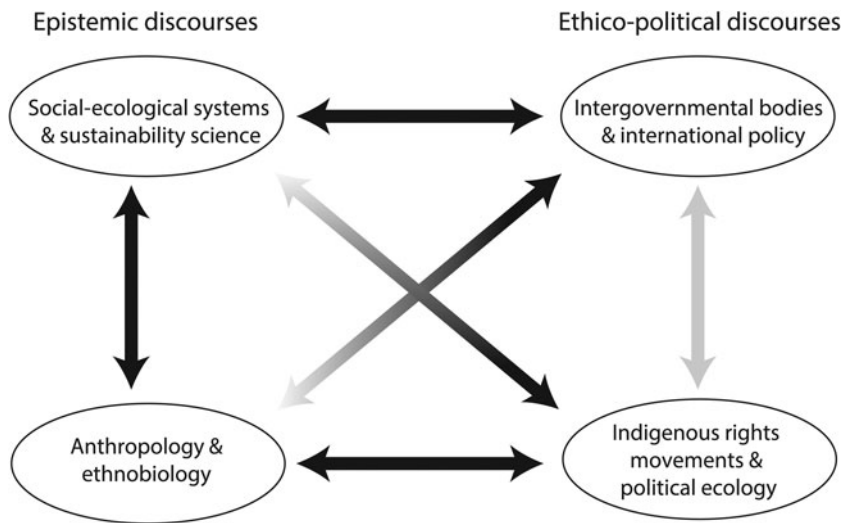
indigenous knowledge, further steps are needed to truly bridge across knowledge systems (Tengö *et al.*, 2017). In some aspects of its work, the CBD has created platforms for engagement with representatives from indigenous peoples and local communities that have led to their biocultural perspectives gaining greater prominence and power. Despite such efforts, there is little adoption or effective application of the recommendations generated in these international arenas by national states and local authorities, whose decisions are heavily informed by competing economic narratives.

In sum, there is limited interaction between scientific, conservation-focused approaches of both international policy makers and academics (themselves in a position of power and privilege within the capitalist system) on one hand, and the overt political focus of indigenous rights movements who struggle for social justice and autonomy over land and the use of biocultural resources. As a matter of fact, abstract scientific approaches and decontextualized policy recommendations stand in stark contrast to civil society and social movements' discourses, which derive from marginalized groups' lived experiences of land dispossession and vulnerability in the face of the dominant economic, political and cultural models. In spite of these differences in form and focus, the biocultural discourses summarized above oppose the homogenizing effects of globalization and many of them assert the need for changes in how development and sustainability are both conceived and driven by official institutions and corporations. Some discursive synergies also include the claim for a broader participation of cultural groups in knowledge co-production and political decisions at all scales.

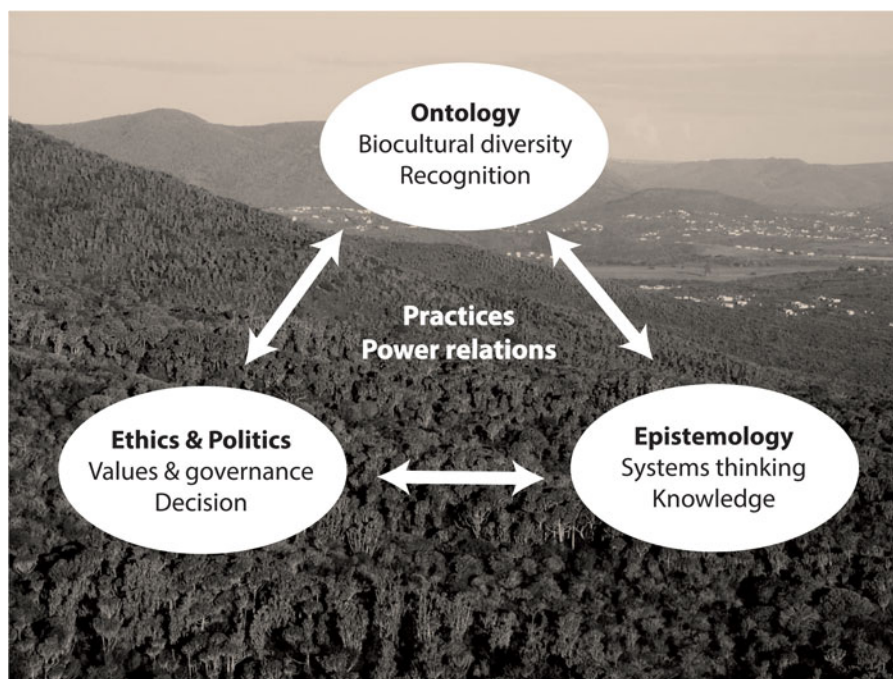
## 5. Ways forward toward a paradigm shift

The current plurality of biocultural discourses reflects the diversity of socio-cultural positions, communities of practice and political orientations involved in their construction and application. Some tensions between these stances are inevitable and can provide meaningful challenges for further dialogue and political changes. Without advocating complete integration or the disappearance of significant discursive differences, we propose here that biocultural approaches recognize and articulate the ontological dimension of biocultural diversity, an epistemological dimension through systems thinking, and an ethico-political dimension taking explicitly into account plural values, governance systems and power relations (Figure 2). These dimensions are essential to connect forms of understanding across actors and to strengthen actions toward global sustainability, as we show below.

The *ontological* dimension of the biocultural paradigm refers to the recognition of diverse ways of conceiving and experiencing nature and their cultural embeddedness. Acknowledging the diversity of ontological systems co-existing on the planet is a necessary condition for a full understanding of human-nature relationships. Many of these relationships, which are not completely conditioned by hegemonic culture, are particularly important given their historical invisibility but crucial contribution to local and global well-being and sustainability (Masterson *et al.* unpublished data). Making biocultural diversity visible in academia, practice and policy has implications on decisions and actions at different scales. The study of biocultural manifestations



**Fig. 1.** Connections between biocultural discourses. Arrows indicate the degree of mutual influence between discourses. Some discourses influence each other more strongly (solid black arrows), whereas some have weaker connections (solid grey arrows). Some other connections reflect an unbalanced influence between discourses (arrows with color gradients; black arrowheads point to the discourse that is influenced to a larger degree, and grey arrowheads point to the discourse that is influenced to a lesser degree). A more detailed characterization of these connections is provided in the text.



**Fig. 2.** Ontological, epistemological and ethico-political dimensions of the biocultural paradigm are interconnected and manifested through cultural practices and power relations embedded in specific biocultural landscapes (Photo: Tony Dold).

in urban contexts and the extension of the concept to non-indigenous groups enlarge the diversity spectrum and contribute to novel knowledge and applications. In any case, a broader attention to Global South experiences is key to reveal how a great number of (currently threatened) human-nature relations contribute to global sustainability.

Holistic or systems thinking broadly characterizes the biocultural paradigm's *epistemology*. This type of approach focuses on the interaction between socio-cultural and ecological components, acknowledging their interdependence and dynamic nature, as proposed by the social-ecological systems perspective (Berkes *et al.*, 2000). Systemic forms of understanding involve the direct participation of indigenous and local knowledge holders through transdisciplinary processes, boundary work, action research and other forms of place-based collaborative knowledge production. Such engagement place needs to be carried out in ways founded in

respect, equity and usefulness for all involved (Tengö, Brondizio, Elmqvist, Malmer, & Spierenburg, 2014; Tengö *et al.*, 2017). Collaboratively produced knowledge with a systemic perspective creates more holistic and complexity-oriented ways of understanding sustainability (Ayala-Orozco *et al.*, 2018; Merçon, Ayala-Orozco, & Rosell, 2018; Mistry & Berardi, 2016) and may impact on the values, decisions and practices that constitute biocultural realities. This could lead to greater recognition and protection of biocultural systems as well as influence policies and sustainable practices beyond the local. To enable this potential and allow for real collaboration in contexts of power asymmetries, the study of and engagement with diverse biocultural knowledge systems should take a series of ethico-political and epistemological considerations into account, including, for example, the use of co-formulated biocultural protocols, dedicated implementation of Free Prior and Informed Consent, and support

of indigenous-led initiatives and movements (Bavikatte & Robinson, 2011; Ward, 2011). Such change in perspective would demand a strong commitment and capacity building for a constructive engagement in high-level policy fora.

The ethico-political dimension encompasses values and governance regimes whose decisions impact on the ontological manifestation and understanding of biocultural systems and vice-versa. For example, the biocultural paradigm can cast light on how relational values and local governance systems contribute to nature conservation, thus providing elements for the legitimation at national and international levels of such systems in indigenous peoples' struggles for self-determination (Brondizio & Tourneau, 2016; Garnett et al., 2018; Rozzi, 2013). Moreover, the development and implementation of full participatory mechanisms to include the values, governance systems, needs and knowledge of vulnerable groups in policy making may ensure more comprehensive understandings of biocultural systems and hence more culturally appropriate actions (Ruiz-Mallén, Corbera, Novkovic, Calvo-Boyer, & Reyes-García, 2013; Sterling et al., 2017).

Despite being present in the practices that sustain all dimensions (ontology, epistemology, ethics and politics), power relations have had little recognition in biocultural discourses (Table 1). As various scholars have demonstrated, neglecting the role of structural, actor-based and discursive power leads to partial and naive understandings of human-nature interactions (Boonstra, 2016; Bryant, 1998; Meadowcroft, 2009; Smith & Stirling, 2010; Zimmerer & Bassett, 2003). Understanding biocultural systems from a power relations perspective is needed to account for different types of inequities that accentuate cultural groups' vulnerability in the face of hegemonic cultural, political and economic forces. With such understanding, the biocultural paradigm can be used to counter globalization's homogenizing drivers and the loss of cultural practices, languages, knowledge, values and governance systems. This emancipatory nature of the biocultural paradigm places social and environmental justice at the core of global sustainability.

## 6. Conclusions

In a growingly globalized world, where the accelerated loss of biological and cultural components leads to profound inequitable social and ecological repercussions, biocultural approaches collectively represent a promising paradigm. By focusing on the connections between cultural and biological diversity, human well-being, social justice and the formulation of culturally pertinent policies, biocultural discourses hold great transformative potential. The full actualization of such potential relies, however, on the construction of bridges between current discourses, embodied by scientists, practitioners and policy makers who tend to emphasize distinct dimensions of the biocultural paradigm (ontological, epistemological or ethico-political). In this sense, the recognition and articulation, in theory, practice and policy, of biocultural diversity, holistic or systems thinking, plural values, governance systems and power relations contribute to a more encompassing and effective perspective. From local landscapes, urban spaces and social movements to academia and international policy, discursive bridging and inter-sectorial collaboration potentialize the crucial contributions of the biocultural paradigm to local and global sustainability.

**Author ORCIDs.**  Juliana Merçon, 0000-0001-7249-1994

**Acknowledgements.** The authors gratefully acknowledge the initial contribution of Karla Karina Pérez López for her support in the systematic literature review. JM, PB, JAR and BA-O are also thankful for the support of the Socioecosystems and Sustainability Network (Red de Socioecosistemas y Sustentabilidad, CONACYT, Mexico). MT acknowledges support from the Swedish Research Council. The initial discussions presented here were held at the Second Open Science Conference of the Programme for Ecosystem Change and Society (PECS) of Future Earth, in Oaxaca, Mexico. Inspiration for this paper also came from the Multi-Actor Dialogues on Biocultural Diversity and Social-Ecological Resilience, held in Ixtlán, Oaxaca, and financially supported by Sida (through SwedBio) and PECS.

**Author contributions.** All authors participated, at some stage, in the conception and design of the article, as well as data gathering. JM, SV, MT, MC and PB wrote the article and all authors reviewed it.

**Financial support.** This research received no specific grant from any funding agency, commercial or not-for-profit sectors.

**Conflict of interest.** None.

## References

- Acosta, A. (2016). Repensar el mundo desde el Buen Vivir. *Degrowth in Bewegung (En)*. Retrieved from: [https://www.degrowth.info/wp-content/uploads/2016/09/DIB\\_Buen-Vivir\\_es.pdf](https://www.degrowth.info/wp-content/uploads/2016/09/DIB_Buen-Vivir_es.pdf)
- Agnoletti, M., & Rotherham, I. D. (2015). Landscape and biocultural diversity. *Biodiversity and Conservation*, 24(13), 3155–3165. <https://doi.org/10.1007/s10531-015-1003-8>
- Almeida, M. W. B. (2012). Sociodiversidade e desenvolvimento; considerações entre centro e margem. *Reunião Brasileira de Antropologia, São Paulo*, 28, 1–20.
- Apgar, J. M., Ataria, J. M., & Allen, W. J. (2011). Managing beyond designations: Supporting endogenous processes for nurturing biocultural development. *International Journal of Heritage Studies*, 17(6), 555–570. <https://doi.org/10.1080/13527258.2011.618250>
- Argumedo, A. (2008). The Potato Park, Peru: Conserving agrobiodiversity in an Andean indigenous biocultural heritage area. In T. Amend, J. Brown, A. Kothari, A. Phillips, & S. Stolton (eds), *Protected Landscapes and Agrobiodiversity Values* (Vol. 1, pp. 45–58). Heidelberg, Germany: International Union for the Conservation of Nature (IUCN) & Deutsche Gesellschaft für Technische Zusammenarbeit, Kaspark Verlag.
- Argumedo, A. (2011). Community biocultural protocols: Building mechanisms for access and benefit sharing among the communities of the Potato Park based on Quechua customary norms (summary report). International Institute for Environment and Development. Retrieved from <http://pubs.iied.org>
- Ayala-Orozco, B., Rosell, J. A., Merçon, J., Bueno, I., Alatorre-Frenk, G., Langle-Flores, A., & Lobato, A. (2018). Challenges and strategies in place-based multi-stakeholder collaboration for sustainability: learning from experiences in the Global South. *Sustainability*, 10(9), 3217. <https://doi.org/10.3390/su10093217>
- Barnosky, A. D., Matzke, N., Tomiya, S., Wogan, G. O. U., Swartz, B., Quental, T. B., ... Ferrer, E. A. (2011). Has the Earth's sixth mass extinction already arrived? *Nature*, 471(7336), 51–57. <https://doi.org/10.1038/nature09678>
- Barthel, S., Crumley, C., & Svedin, U. (2013). Bio-cultural refugia – Safeguarding diversity of practices for food security and biodiversity. *Global Environmental Change*, 23(5), 1142–1152. <https://doi.org/10.1016/j.gloenvcha.2013.05.001>
- Baskin, J. (2015). Paradigm dressed as epoch: the ideology of the Anthropocene. *Environmental Values*, 24(1), 9–29.
- Bavikatte, K., & Robinson, D. F. (2011). Hacia una historia de la ley de los pueblos a través de la jurisprudencia biocultural y el Protocolo de Nagoya sobre acceso y participación en los beneficios. *Law, Environment and Development Journal*, 7(1), 35–54. Retrieved from <http://www.lead-journal.org/content/11035a.pdf>



- Berkes, F., Colding, J., & Folke, C. (2003). *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge: Cambridge University Press.
- Berkes, F., Folke, C., & Colding, J. (2000). *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*. Cambridge: Cambridge University Press.
- Boege, E. (2008). *El patrimonio biocultural de los pueblos indígenas de México: hacia la conservación in situ de la biodiversidad y agrodiversidad en los territorios indígenas*. Mexico: Instituto Nacional de Antropología e Historia.
- Boege, E. (2015). Em direção a uma antropologia ambiental para a apropriação do patrimônio biocultural dos povos indígenas na América Latina. *Desenvolvimento e Meio Ambiente*, 35. <https://doi.org/10.5380/dma.v35i0.43906>
- Boonstra, W. J. (2016). Conceptualizing power to study social-ecological interactions. *Ecology and Society*, 21(1), 21. <https://doi.org/10.5751/ES-07966-210121>
- Bridgewater, P. (2017). The intergovernmental platform for biodiversity and ecosystem services (IPBES) – a role for heritage? *International Journal of Heritage Studies*, 23(1), 65–73. <https://doi.org/10.1080/13527258.2016.1232657>
- Brondizio, E. S., & Tourneau, F.-M. L. (2016). Environmental governance for all. *Science*, 352(6291), 1272–1273. <https://doi.org/10.1126/science.aaf5122>
- Brosius, J. P., & Hitchner, S. L. (2010). Cultural diversity and conservation. *International Social Science Journal*, 61(199), 141–168. <https://doi.org/10.1111/j.1468-2451.2010.01753.x>
- Bryant, R. L. (1998). Power, knowledge and political ecology in the third world: a review. *Progress in Physical Geography: Earth and Environment*, 22(1), 79–94. <https://doi.org/10.1177/030913339802200104>
- Buizer, M., Elands, B., & Vierikko, K. (2016). Governing cities reflexively – The biocultural diversity concept as an alternative to ecosystem services. *Environmental Science and Policy*, 62, 7–13. <https://doi.org/10.1016/j.envsci.2016.03.003>
- Cardinale, B. J., Duffy, J. E., Gonzalez, A., Hooper, D. U., Perrings, C., Venail, P., ... Naeem, S. (2012). Biodiversity loss and its impact on humanity. *Nature*, 486(7401), 59–67. <https://doi.org/10.1038/nature11148>
- CEMDA (2018). *Amparan a comunidades del Pueblo Maseual de la Sierra Nororiental de Puebla en contra de concesiones mineras*. Centro Mexicano de Derecho Ambiental. Retrieved from [www.cemda.org.mx/amparan-a-comunidades-del-pueblo-maseual-de-la-sierra-nororiental-de-puebla-en-contra-de-concesiones-mineras/2018](http://www.cemda.org.mx/amparan-a-comunidades-del-pueblo-maseual-de-la-sierra-nororiental-de-puebla-en-contra-de-concesiones-mineras/2018)
- 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. *Proceedings of the National Academy of Sciences*, 113(6), 1462–1465. <https://doi.org/10.1073/pnas.1525002113>
- Clement, F. (2013). For critical social-ecological system studies: integrating power and discourses to move beyond the right institutional fit. *Environmental Conservation*, 40(1), 1–4. <https://doi.org/10.1017/S0376892912000276>
- Cocks, M. (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>
- Cocks, M., & Dold, T. (2012). Perceptions and values of local landscapes: Implications for the conservation of biocultural diversity and intangible heritage. In *Forest-people Interfaces: Understanding Community Forestry and Biocultural Diversity* (pp. 167–179). [https://doi.org/10.3920/978-90-8686-749-3\\_10](https://doi.org/10.3920/978-90-8686-749-3_10)
- Cocks, M., Vetter, S., & Wiersum, K. F. (2018). From universal to local: perspectives on cultural landscape heritage in South Africa. *International Journal of Heritage Studies*, 24(1), 35–52. <https://doi.org/10.1080/13527258.2017.1362573>
- Cocks, M., & Wiersum, F. (2014). Reappraising the concept of biocultural diversity: A perspective from South Africa. *Human Ecology*, 42(5), 727–737. <https://doi.org/10.1007/s10745-014-9681-5>
- Combetti, C., Thornton, T. F., Wyllie de Echeverria, V., & Patterson, T. (2015). Ecosystem services or services to ecosystems? Valuing cultivation and reciprocal relationships between humans and ecosystems. *Global Environmental Change*, 34, 247–262. <https://doi.org/10.1016/j.gloenvcha.2015.07.007>
- Corona-M, E. (2018). Noticia: Belem + 30, un evento clave para el desarrollo de las etnociencias. *Etnobiología*. Retrieved from <https://dialnet.unirioja.es/servlet/articulo?codigo=6536865>
- Crutzen, P. J. (2002). Geology of mankind. *Nature*, 415, 23. <https://doi.org/10.1038/415023a>
- Davidson-Hunt, I. J., Turner, K. L., Te Pareake Mead, A., Cabrera-Lopez, J., Bolton, R., Idrobo, C. J., ... Robson, J. P. (2012). Biocultural design: A new conceptual framework for sustainable development in rural indigenous and local communities. *Sapiens*, 5(2), 32–45.
- Declaration of Belem (1988). *First International Congress of Ethnobiology*. International Society for Ethnobiology. Retrieved from [www.ethnobiology.net/what-we-do/core-programs/global-coalition-2/declaration-of-belem/](http://www.ethnobiology.net/what-we-do/core-programs/global-coalition-2/declaration-of-belem/)
- Declaration of Ixtlán (2017). *Workshop on Biocultural Diversity and Social-Ecological Resilience. II Conference of the Programme for Ecosystem Change and Society (PECS). Oaxaca, Mexico*. 2017. Oaxaca, Mexico. Retrieved from [www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/declaration\\_ixtlan\\_en.pdf](http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/declaration_ixtlan_en.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. <https://doi.org/10.1016/j.cosust.2014.11.002>
- Díaz, S., Pascual, U., Stenseke, M., Martín-López, B., Watson, R. T., Molnár, Z., ... Shirayama, Y. (2018). Assessing nature’s contributions to people. *Science*, 359(6373), 270–272. <https://doi.org/10.1126/science.aap8826>
- Drahos, P. (2011). When cosmology meets property: indigenous people’s innovation and intellectual property. *Prometheus*, 29(3), 233–252. <https://doi.org/10.1080/08109028.2011.638213>
- Elands, B. H. M., Wiersum, K. F., Buijs, A. E., & Vierikko, K. (2015). Policy interpretations and manifestation of biocultural diversity in urbanized Europe: conservation of lived biodiversity. *Biodiversity and Conservation*, 24(13), 3347–3366. <https://doi.org/10.1007/s10531-015-0985-6>
- Emperaire, L., & Eloy, L. (2008). A cidade, um foco de diversidade agrícola no Rio Negro (Amazonas, Brasil)? *Boletim Do Museu Paraense Emílio Goeldi Ciências Humanas*, 3(2), 195–211.
- Escobar, A. (2010). *Territorios de diferencia: lugar, movimientos, vida, redes*. Popayán, Colombia: Enviñon Editores.
- Foucault, M. (1975). *Surveiller et punir, Naissance de la prison*. Paris, France: Gallimard.
- Fuentes-George, K. (2013). Neoliberalism, environmental justice, and the Convention on Biological Diversity: How problematizing the commodification of nature affects regime effectiveness. *Global Environmental Politics*, 13(4), 144–163. [https://doi.org/10.1162/GLEP\\_a\\_00202](https://doi.org/10.1162/GLEP_a_00202)
- Garibaldi, A., & Turner, N. (2004). Cultural keystone species: Implications for ecological conservation and restoration. *Ecology and Society*, 9(3), 1.
- Garnett, S. T., Burgess, N. D., Fa, J. E., Fernández-Llamazares, Á., Molnár, Z., Robinson, C. J., ... Leiper, I. (2018). A spatial overview of the global importance of indigenous lands for conservation. *Nature Sustainability*, 1(7), 369. <https://doi.org/10.1038/s41893-018-0100-6>
- Gavin, M., McCarter, J., Berkes, F., Mead, A., Sterling, E., Tang, R., & Turner, N. (2018). Effective biodiversity conservation requires dynamic, pluralistic, partnership-based approaches. *Sustainability*, 10(6), 1846. <https://doi.org/10.3390/su10061846>
- Gavin, M., McCarter, J., Mead, A., Berkes, F., Stepp, J., Peterson, D., & Tang, R. (2015). Defining biocultural approaches to conservation. *Trends in Ecology and Evolution*, 30(3), 140–145. <https://doi.org/10.1016/j.tree.2014.12.005>
- Gómez-Baggethun, E., & Ruiz-Pérez, M. (2011). Economic valuation and the commodification of ecosystem services. *Progress in Physical Geography: Earth and Environment*, 35(5), 613–628. <https://doi.org/10.1177/0309133311421708>
- Gudynas, E. (2015). *Extractivismos: Ecología, economía y política de un modo de entender el desarrollo y la Naturaleza*. La Paz: CLAES-CEDIB.
- Haider, L. J. (2017). *Development and Resilience: Re-thinking poverty and intervention in biocultural landscapes* (PhD Dissertation). Stockholm: Stockholm University.
- Hajer, M. A. (1995). *The politics of environmental discourse: ecological modernization and the policy process*. Oxford: Clarendon Press.
- Harmon, D., & Loh, J. (2010). The index of linguistic diversity: A new quantitative measure of trends in the status of the world’s languages. *Language Documentation & Conservation*, 4, 97–151.
- Hay-Edie, T., Howard, P., Martin, G., & McCandless, S. (2011). The roles of local, national and international designations in conserving biocultural

- diversity on a landscape scale. *International Journal of Heritage Studies*, 17(6), 527–536. <https://doi.org/10.1080/13527258.2011.618244>
- 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>
- Hirons, M., Boyd, E., McDermott, C., Asare, R., Morel, A., Mason, J., ... Norris, K. (2018). Understanding climate resilience in Ghanaian cocoa communities – Advancing a biocultural perspective. *Journal of Rural Studies*, 63, 120–129. <https://doi.org/10.1016/j.jrurstud.2018.08.010>
- Kealiikanakaolehailani, K., Kurashima, N., Francisco, K. S., Giardina, C. P., Louis, R. P., McMillen, H., ... Yogi, D. (2018). Ritual + sustainability science? A portal into the science of aloha. *Sustainability*, 10(10), 3478. <https://doi.org/10.3390/su10103478>
- Kothari, A., Demaria, F., & Acosta, A. (2014). Buen Vivir, degrowth and ecological Swaraj: Alternatives to sustainable development and the green economy. *Development*, 57(3), 362–375. <https://doi.org/10.1057/dev.2015.24>
- Kuhn, T. S. (1970). *The Structure of Scientific Revolutions*, 2nd enl. ed. Chicago: University of Chicago Press.
- Leff, E. (2017). Las relaciones de poder del conocimiento en el campo de la ecología política. *Ambiente & Sociedade (Online)*, 20, 229–262.
- Loh, J., & Harmon, D. (2005). A global index of biocultural diversity. *Ecological Indicators*, 5(3), 231–241. <https://doi.org/10.1016/j.ecolind.2005.02.005>
- Lovera, S. (2010). Los pueblos indígenas empeoran desde las políticas REDD. Protocolos Comunitarios Bioculturales fortalecen los Beneficios de la Biodiversidad. *Revista Compas. Desarrollo Endógeno*, 17, 22–24.
- Maffi, L. (1998). Language: a resource for nature. *Nature and Resources*, 34(4), 12–21.
- Maffi, L. (2005). Linguistic, cultural, and biological diversity. *Annual Review of Anthropology*, 34(1), 599–617. <https://doi.org/10.1146/annurev.anthro.34.081804.120437>
- Maffi, L. (2007). Biocultural diversity and sustainability. In J. Pretty, A. S. Ball, T. S. Benton, J. Guivant, D. R. Lee, D. Orr, ... H. Ward (eds), *The Sage Handbook of Environment and Society* (pp. 267–278). Sage Publications.
- Maffi, L., & Woodley, E. (2012). *Biocultural Diversity Conservation: A Global Sourcebook*. London: Taylor & Francis.
- Malm, A., & Hornborg, A. (2014). The geology of mankind? A critique of the Anthropocene narrative. *The Anthropocene Review*, 1(1), 62–69. <https://doi.org/10.1177/2053019613516291>
- Martínez-Esponda, F. X., Benítez, M., Ramos Pedrueza, X., García Maning, G., Bracamontes, L. N., & Vázquez, B. Q. (2017). *Derechos humanos y patrimonio biocultural. El sistema milpa como cimiento de una política de Estado cultural y ambientalmente sustentable* (p. 136). México: Centro Mexicano de Derecho Ambiental.
- McCauley, D. J. (2006). Selling out on nature. *Nature*, 443, 27–28. <https://doi.org/10.1038/443027a>
- Meadowcroft, J. (2009). What about the politics? Sustainable development, transition management, and long term energy transitions. *Policy Sciences*, 42(4), 323. <https://doi.org/10.1007/s11077-009-9097-z>
- Merçon, J., Ayala-Orozco, B., & Rosell, J. A. (2018). *Experiencias de colaboración transdisciplinaria para la sustentabilidad*. Mexico City: Copit Arxives.
- Mistry, J., & Berardi, A. (2016). Bridging indigenous and scientific knowledge. *Science*, 352(6291), 1274–1275. <https://doi.org/10.1126/science.aaf1160>
- Moore, J. W. (2016). *Anthropocene or Capitalocene? Nature, History and the Crisis of Capitalism*. Oakland: PM Press.
- Moore, J. W. (2017). The Capitalocene, Part I: On the nature and origins of our ecological crisis. *The Journal of Peasant Studies*, 44(3), 594–630. <https://doi.org/10.1080/03066150.2016.1235036>
- Olsson, P., Folke, C., & Hughes, T. P. (2008). Navigating the transition to ecosystem-based management of the Great Barrier Reef, Australia. *Proceedings of the National Academy of Sciences*, 105(28), 9489–9494. <https://doi.org/10.1073/pnas.0706905105>
- Panduro, R. M. (2014). Regeneración de los paisajes bioculturales en la amazonía alta del Perú. *LEISA. Revista de Agroecología*, 30(3). Retrieved from [www.leisa-al.org/web/index.php/volumen-30-numero-3/1058-regeneracion-de-los-paisajes-bioculturales-en-la-amazonia-alta-del-peru](http://www.leisa-al.org/web/index.php/volumen-30-numero-3/1058-regeneracion-de-los-paisajes-bioculturales-en-la-amazonia-alta-del-peru)
- Pimbert, M. (2017). *Food Sovereignty, Agroecology and Biocultural Diversity: Constructing and Contesting Knowledge*. New York: Routledge.
- Posey, D. A. (1999). Cultural and Spiritual Values of Biodiversity. A Complementary Contribution to the Global Biodiversity Assessment. In D. A. Posey (ed.), *Cultural and Spiritual Values of Biodiversity* (pp. 1–19). London, UK: UNEP and Intermediate Technology Publications.
- Posey, D. A. (2004). *Indigenous Knowledge and Ethics: A Darrell Posey Reader*. New York, NY: Routledge.
- Pröpper, M., & Haupts, F. (2014). The culturality of ecosystem services. Emphasizing process and transformation. *Ecological Economics*, 108, 28–35. <https://doi.org/10.1016/j.ecolecon.2014.09.023>
- Rapport, D., & Maffi, L. (2010). The dual erosion of biological and cultural diversity: Implications for the health of ecocultural systems. In S. Pilgrim & J. Pretty (eds), *Nature and Culture: Rebuilding Lost Connections* (pp. 103–119). London: Routledge and Earthscan.
- Redford, K. H., & Painter, M. (2006). *Natural Alliances Between Conservationists and Indigenous Peoples*, Wildlife Conservation Society New York Paper No. 25. New York, NY: Wildlife Conservation Society.
- Rozzi, R. (2013). Biocultural ethics: from biocultural homogenization toward biocultural conservation. In R. Rozzi, S. Pickett, C. Palmer, J. Armesto, & J. Callicott (eds), *Linking Ecology and Ethics for a Changing World* (pp. 9–32). Dordrecht: Springer.
- Ruiz-Mallén, I., Corbera, E., Novkovic, A., Calvo-Boyero, D., & Reyes-García, V. (2013). *Adapting to Environmental Change in Latin America: Planning the Future from the Bottom-Up*. Policy implications of COMBIOERVE, an EU-funded research project on community-based conservation in Latin America. European Policy Brief. Retrieved from [http://estevorbera.com/wp-content/uploads/2018/01/policy\\_brief\\_adapting\\_to\\_environmental\\_change\\_sept\\_2013.pdf](http://estevorbera.com/wp-content/uploads/2018/01/policy_brief_adapting_to_environmental_change_sept_2013.pdf)
- Salomon, A. K., Lertzman, K., Brown, K., Wilson, K. B., Secord, D., & McKechnie, I. (2018). Democratizing conservation science and practice. *Ecology and Society*, 23(1). <https://doi.org/10.5751/ES-09980-230144>
- Singh, R. K., Pretty, J., & Pilgrim, S. (2010). Traditional knowledge and biocultural diversity: Learning from tribal communities for sustainable development in northeast India. *Journal of Environmental Planning and Management*, 53(4), 511–533. <https://doi.org/10.1080/09640561003722343>
- Smith, A., & Stirling, A. (2010). The politics of social-ecological resilience and sustainable socio-technical transitions. *Ecology and Society*, 15(1), 11.
- Steffen, W., Broadgate, W., Deutsch, L., Gaffney, O., & Ludwig, C. (2015). The trajectory of the Anthropocene: The Great Acceleration. *The Anthropocene Review*, 2(1), 81–98. <https://doi.org/10.1177/2053019614564785>
- Steffen, W., Crutzen, P. J., & McNeill, J. R. (2007). The Anthropocene: are humans now overwhelming the great forces of nature. *AMBIO* 36(8), 614–621. [https://doi.org/10.1579/0044-7447\(2007\)36\[614:TAAHNO\]2.0.CO;2](https://doi.org/10.1579/0044-7447(2007)36[614:TAAHNO]2.0.CO;2)
- Sterling, E. J., Filardi, C., Toomey, A., Sigouin, A., Betley, E., Gazit, N., ... Bergamini, N. (2017). Biocultural approaches to well-being and sustainability indicators across scales. *Nature Ecology & Evolution*, 1, 1798–1806. <https://doi.org/10.1038/s41559-017-0349-6>
- Temper, L., Del Bene, D., & Martínez-Alier, J. (2015). Mapping the frontiers and front lines of global environmental justice: the EJAtlas. *Journal of Political Ecology*, 22(1), 255–278.
- Tengö, M., Brondizio, E. S., Elmqvist, T., Malmer, P., & Spierenburg, M. (2014). Connecting diverse knowledge systems for enhanced ecosystem governance: the multiple evidence base approach. *AMBIO*, 43(5), 579–591. <https://doi.org/10.1007/s13280-014-0501-3>
- Tengö, M., Hill, R., Malmer, P., Raymond, C. M., Spierenburg, M., Danielsen, F., ... Folke, C. (2017). Weaving knowledge systems in IPBES, CBD and beyond – lessons learned for sustainability. *Current Opinion in Environmental Sustainability*, 26–27, 17–25. <https://doi.org/10.1016/j.cosust.2016.12.005>
- Thaman, R., Lyver, P., Mpande, R., Perez, E., Cariño, J., & Takeuchi, K. (2013). *The Contribution of Indigenous and Local Knowledge Systems to IPBES: Building Synergies with Science* (IPBES Expert Meeting Report) (p. 49). Paris: UNESCO/UNU.
- Toledo, V. M. (2013). El paradigma biocultural: crisis ecológica, modernidad y culturas tradicionales. *Sociedad y Ambiente*, 1, 50–60.

- Toledo, V. M., & Barrera-Bassols, N. (2008). *La memoria biocultural: la importancia ecológica de las sabidurías tradicionales*. Barcelona: Icaria Editorial.
- United Nations (1992). *Convention on Biological Diversity*. New York, NY: Environmental Law and Institutions Programme Activity Centre, United Nations Environmental Programme.
- United Nations (2010). A Proposed Joint Programme of Work on Biological and Cultural Diversity Lead by the Secretariat of the CBD and UNESCO. Retrieved from [www.cbd.int/meetings/ICBCD](http://www.cbd.int/meetings/ICBCD)
- Vogt, N., Pinedo-Vasquez, M., Brondízio, E. S., Rabelo, F. G., Fernandes, K., Almeida, O., ... Dou, Y. (2016). Local ecological knowledge and incremental adaptation to changing flood patterns in the Amazon delta. *Sustainability Science*, 11(4), 611–623. <https://doi.org/10.1007/s11625-015-0352-2>
- Ward, T. (2011). The right to free, prior, and informed consent: Indigenous peoples' participation rights within international law. *Northwestern University Journal of International Human Rights*, 10, 54.
- West, S., Haider, L. J., Masterson, V., Enqvist, J. P., Svedin, U., & Tengö, M. (2018). Stewardship, care and relational values. *Current Opinion in Environmental Sustainability*, 35, 30–38. <https://doi.org/10.1016/j.cosust.2018.10.008>
- Wiedmann, T. O., Schandl, H., Lenzen, M., Moran, D., Suh, S., West, J., & Kanemoto, K. (2015). The material footprint of nations. *Proceedings of the National Academy of Sciences*, 112(20), 6271–6276. <https://doi.org/10.1073/pnas.1220362110>
- Winter, K. B., Lincoln, N. K., & Berkes, F. (2018). The social-ecological keystone concept: A quantifiable metaphor for understanding the structure, function, and resilience of a biocultural system. *Sustainability*, 10(9), 3294. <https://doi.org/10.3390/su10093294>
- Zimmerer, K. S., & Bassett, T. J. (2003). *Political ecology: An Integrative Approach to Geography and Environment-Development Studies*. New York, NY: The Guilford Press.