

Chapter 4

From Human-Nature Dualism Towards More Integration in Socio-ecosystems Studies



Isabelle Boulangeat, Sandrine Allain, Emilie Crouzat, Sabine Girard, Céline Granjou, Clara Poirier, Jean François Ruault, Yoan Paillet, and Isabelle Arpin

Significance Statement In the management of natural resources and biodiversity, humans and nature have traditionally been considered as two distinct systems, one controlling the other. The concept of socio-ecosystems allows a more integrated approach, in which humans and nature are recognized as interdependent. However, this new perspective does not necessarily eliminate a distinction between humans and nature, or even a hierarchy of humans over nature. This chapter aims to raise awareness of the potential human–nature dualism in socio-ecosystem approaches. Other research fields have adopted different approaches regarding human–nature integration versus dualism, offering a window on the advantages and limitations of various positions. We also discuss how methodological choices are important to translate human–nature integration or dichotomy depending on the study aim.

Keywords Human-nature dualism · Socio-ecosystems · Conservation biology · Natural resource management · Human-nature relationships

1 Introduction

Ways of addressing relationships between humans and nature have significantly evolved in science and policy over the last decades. Historically, Holling and Meffe (1996) blamed the ‘command-and-control’ mode of ecosystem management for causing self-reinforcing ecological damage rather than solving it. At the same time, the pristine nature highlighted as a model by ecological science (and conservation biology in particular) revealed its limitations in many problematic situations

I. Boulangeat (✉) · S. Allain · E. Crouzat · S. Girard · C. Granjou · J. F. Ruault · Y. Paillet · I. Arpin
INRAE, LESSEM, Université Grenoble Alpes, St-Martin-d’Hères, Grenoble, France
e-mail: isabelle.boulangeat@inrae.fr

C. Poirier
CEFE, Université Montpellier, CNRS, EPHE, IRD, Montpellier, France

in the late twentieth century (Berkes et al., 2003). In both management practices and in conservation biology, the separation between or hierarchy of humans over nature has created a misleading – or even inoperative – understanding of social and ecological dynamics that are in fact coupled. The history of conservation biology has been one of a shift from a perspective that largely treated humans and nature as separate to viewing them as forming interdependent parts of a socio-ecological system (SES) (Mace, 2014). Research in SES focuses on the manifold elements that link social and ecological systems, encompassing practices, governance, knowledge, values, services and functions, and involving an interdisciplinary research effort (Reyers et al., 2010) that provides new perspectives.

SES research is rooted within complex systems science (*e.g.* concepts of resilience and adaptive capacities, see Berkes & Folke, 1998) and has contributed to the development of widely accepted frameworks (*e.g.* ecosystem services), innovative research settings (*e.g.* Long-term Socio-ecological Research zones, Bretagnolle et al., 2019) and international policy recommendations (*e.g.* IPBES, 2016). Albeit heterogeneous, SES research shares the aim of capturing the interplay of social and ecological dynamics in all their complexity – not exclusively social dynamics as mediated by environmental issues or ecological dynamics as affected by human drivers (Folke, 2016). In SES research, treating humans and nature as fundamentally interacting and interdependent systems is not just an analytical choice, but also an ethical principle: humans and nature are recognized as interconnected, reliant on each other to remain sustainable. The approach uses terms such as ‘stewardship’, ‘integrity’ and ‘reconnection’ to describe socio-ecological systems (Folke, 2016).

However, some criticisms of SES have arisen about the attainment of these objectives. The most well-known target of this criticism is the concept of ecosystem services – central in describing the relationships between ecosystems and socio-economic systems – as the notion of ‘services’ can appear to be strongly anthropocentric (Kolinjivadi, 2019; Muradian & Gómez-Baaggethun, 2021). The very framework of SES is also questioned. Kolinjivadi (2019) suggests that the SES concept has inherited from mainstream natural resource management the principle of human domination over nature, and that this domination manifests itself through managerial and technocratic visions of ecosystem dynamics. Likewise, Cooke et al. (2016) claim that SES frameworks may unintentionally reinforce a mental disconnection and hierarchy between people and the environment, by encouraging people to *act upon* their environment rather than to *act in concert with* other living organisms in order to achieve sustainability. At the same time, SES research is also criticized for its excessive symmetry, in which humans are treated as just another ecological entity and socio-ecological interactions as self-adaptive, thus resulting in an apolitical vision of the ecological crisis (Orach & Schlüter, 2016; Reyers et al., 2010).

In this context, it seems useful to question the conceptions of SES researchers regarding human–nature relationships. Other fields of research, some linked to SES research, have adopted distinct perspectives to overcome the issues posed by the human–nature divide (Table 4.1). This chapter offers some definitions and conceptual clarifications that illustrate the gradient between integration and hierarchy

Table 4.1 List of the different research fields presented and their vision of human-nature relationships

Research field	How are addressed Human-nature relationships	Suggested references
Landscape ecology	Involves an integration of human and ecological drivers of landscape change and sometimes their interactions too; human and nature realms are mostly equivalent	Bastian (2001) and Musacchio (2009)
Territorial approaches	Involves an explicit separation between the human territoriality (similarly or distinctively from animal behaviors) and the resources (from both realms, either independently or interactively) over which it exercises power	Chabot-Hanowell and Smith (2012) and DeScioli and Wilson (2011)
Environmental economics	Involves the optimal management of environment issues (from the nature realm) to maximize benefits and minimize costs in the pursuit of human needs (to the human realm)	Balmford et al. (2011, 2002)
Biodiversity economics	Involves the conservative management of biodiversity by better economically valuing the biodiversity benefits and support for human life	Helm and Hepburn (2014) and Dasgupta (2021)
Coevolutionary current of ecological economics	Considers coevolution mechanisms within and across social and ecological systems, as well as resulting dynamics	Kallis and Norgaard (2010)
Actor network theory	Develops within “collectives” of humans and non-humans. Political work consists in defining the rules by which these collectives are composed and organized.	Latour and Porter (2004)
Environmental humanities	Are about encounters human and non-human beings who “become” together.	Haraway (2008)
Political ecology	Unpacks the relations of power, inequities and the production of ‘winners’ and ‘losers’ related to environmental issues and environmental management (in the case of the paper in relation with the circulation of the notion of ecosystem services).	Kull et al. (2015)
Multispecies ethnography	Investigates the effects of living non-humans on human values, experiences or identities. Humans and non-human livings are considered equals.	Kirksey and Helmreich (2010)
Conservation biology	Must consider the intrinsic value of biotic diversity, irrespective of its instrumental or utilitarian value	Soulé (1985)
Historical materialism (<i>sensu</i> Malm)	Interdependent entities (nature and society) with different properties. Acknowledging property dualism is necessary to fight the sources of nature degradation and, in particular, the fossil economy.	Malm (2018)

between humans and nature, and discusses the place and role of human–nature relationships in methodological approaches. It explores some research fields that have proposed various types of integration between humans and nature and/or offered perspectives to address human–nature dualism that may inspire future directions. Interdisciplinary collaboration and exchanges between SES researchers and scholars from other fields interested in human–nature relationships provide a promising avenue to explore.

2 Integration, Dualism, and the Valuation of Nature

SES research is based on the idea that human societies and natural organisms form interdependent and inseparable systems. It focuses on the relationships between these two systems, distinguishing between them while taking into account how they interact. It thus presumes a certain degree of integration of natural and human systems (see Fig. 4.1). Graphical representations of SES (e.g. Collins et al., 2011; Bretagnolle et al., 2019) reflect the dichotomous nature of this approach. Such a dichotomy does not necessarily imply the existence of a judgement about the superiority of one system over another, and can be analytically useful. However, it can equally underpin a domination mechanism in which one system is considered superior, turning the dichotomy into dualism: *i.e.* a theoretical structure based on two principles whose duality gives meaning to the whole system, and in which,

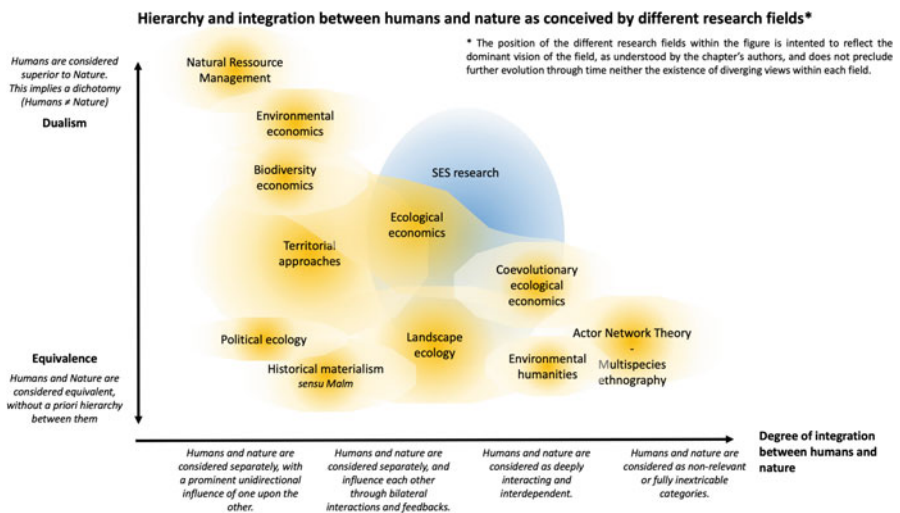


Fig. 4.1 Hierarchy and integration between humans and nature as conceived by different research fields. The position of the different research fields within the figure is intended to reflect the dominant vision of the field, as understood by the chapter’s authors, and does not preclude further evolution through time neither the existence of diverging views within each field

according to Plumwood (2003), one element is necessarily superior to the other. This is the case when, for instance, nature is reduced to a mere resource system for humans (Muradian & Gómez-Baaggethun, 2021).

In the current standard social paradigm, such dualism is likely to support the systematic valuation of humans over nature, rather than the other way around. While this might be desired and explicit, it is often unintended and implicit. The latter case calls into question the ethical foundations of SES. Even without intending dualism, the dichotomic distinction between a human subsystem and a natural subsystem may itself result from culturally dualist principles deeply ingrained in Western thought. It is therefore necessary to consider which aspects of the distinction between human and natural subsystems are really necessary to understand SES.

Human–nature dualism may also manifest itself according to the way in which nature is valued. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2016) marked evolution in the way nature is perceived and valued in SES, but the question still raises debate. The IPBES distinguishes three types of values that can be assigned to nature: (1) ‘intrinsic values’ independent of human experience refer to the inherent value of nature and its components; (2) ‘instrumental values’ refer to material and nonmaterial contributions of nature to people, e.g. ecosystem services; and (3) ‘relational values’ refer to the interactions between human and natural entities that contribute to people’s identity and quality of life. While instrumental and relational values seem rooted in a dual view of human–nature relationships as they place human interests as the primary consideration in the valuation process, taking into account intrinsic values is often put forward as a moral proposition to enlarge this perspective (Batavia & Nelson, 2017). Although intrinsic values are inevitably assigned by humans to non-humans, they need not be restricted to humans (Vucetich et al., 2015), and allow that at least some components of nature deserve direct moral consideration and care. Nonetheless, assigning values to nature involves a critical political dimension, as this valuation is structured around ‘what matters’ to people (Jacobs et al., 2018). Choices relating to this valuation should be justified, as they may reinforce human–nature dualism, which can subsequently influence political views and policy.

3 Insights from Other Research Fields

3.1 *Observing Human-Nature Dualism Through Its Spatial Expressions*

Spatial organization often informs SES views on human–nature relationships (Martin-Lopez et al., 2009), but applying common spatial scales and frameworks to ecosystems and socio-economic systems remains contentious. Certain research fields have an explicit primary focus on the spatiality of human–nature interactions. One example is landscape ecology: it relates spatial patterns (*e.g.* the landscape

mosaic) with socio-ecological processes (*e.g.* farming practices and plant dynamics) using geographical principles (Bastian, 2001). This approach strongly permeates SES research.

Territorial approaches focus on territorial behaviour (of humans as any other animal) and resource control strategies (DeScioli & Wilson, 2011; Chabot-Hanowell & Smith, 2012). This approach is adopted in several disciplines such as ethology, anthropology, geography, political philosophy, management or economics. It involves an explicit separation between the society that expresses its territoriality and the resources (be they natural, manufactured or social) over which it exercises power. Whenever a society is considered exterior to nature, and nature is equated to a resource system, the separation reflects human–nature dualism. However, such approaches have the merit of making human dependence on ecosystems explicit. They also pinpoint the transformative power and impact of humans on the natural environment through their efforts to shape and control space.

Territorial approaches have a strong political component. The institutions guaranteeing the sovereignty of a society over its territory, such as nation states, also place humans in a position of responsibility for the development of their living space and the fair and sustainable management of natural resources. In political philosophy in particular, the allocation of territorial rights over natural resources through the sovereignty of nations is controversial (Banai, 2016; Dahbour, 2019): unsustainable governance of natural resources, land grabbing by private foreign investors (Jurkevics, 2021), and the oppression of indigenous peoples (Finley-Brook & Thomas, 2011) are some of the most problematic effects of the national sovereignty principle. In practice, human-centered territorial approaches recurrently adopt a rather dual vision, focusing their analysis on man-made (*e.g.* industrial apparatus) or market resources (*e.g.* tradable raw materials), the adjustment of territorial scales to those of human mobility, or the impact of territoriality on human conflicts, to give some examples. Recently, however, there have been efforts to limit dualism and, for example, reconcile territorial and ecological scales (Barreteau et al., 2016) or even integrate ecological, socio-ecological, and territorial interdependencies in a common framework (Mathevet et al., 2016) with the aim of managing environmental issues more effectively.

3.2 Attempts to Emancipate Economics from Human-Nature Dualism

Different fields of economics have sought to deal with environmental problems. The main field, environmental economics, suggests assigning an exchange value to nature, so that environmental costs and benefits become visible on the market. This contains the implicit assumption that human-made capital can replace natural capital (perfect substitutability) and that the value of nature lies in its utility for humans. It is thus based on a dualistic view of human–nature relationships.

Ecological economics and biodiversity economics have distanced themselves from this perspective, although in most cases they retain a human–nature dichotomy. Biodiversity economics looks for pragmatic solutions to the dramatic decline in biodiversity, using socio-ecological frameworks and methods (Helm & Hepburn, 2014). The valuation of biodiversity is considered critical, since this is expected to increase the effectiveness of conservation regulations and incentives (Helm & Hepburn, 2014; Barthowski, 2017). However, biodiversity economics privileges the monetization of biodiversity and ecosystem services over other valuation methods. In this way, dualism continues to be expressed in this field: a ‘first zone’ of nature – useful to humans and monetizable – is overemphasized, while a ‘second zone’ (poorly known or difficult to capture in monetary terms) is left invisible.

Ecological economics also distances itself from environmental economics, but with an explicit rejection of human–nature dualism and the assumption of perfect substitutability. Rather, ecological economists consider the economy as embedded in society, which in turn is embedded in the natural environment. Nature is alternately understood as a physical and energetic boundary to the development of human activities (Georgescu-Roegen, 1971), as a system of resources that is governed by complex bundles of rights (Schlager & Ostrom, 1992), or even as the focal point of conflicts of values and languages of valuation (Martinez-Allier, 2009). Much attention is given to the political character of human–nature relationships, however, the ecological functioning of natural systems as living systems is rarely described. Only a few authors have attempted to open this ‘black box’, for instance, through the investigation of long-term coevolutionary mechanisms within and across ecological and social systems (Norgaard & Kallis, 2011). This coevolutionary current of ecological economics provides an understanding of human societies – with their values, technologies, organizations and knowledge – as a specific kind of living system, interacting with others and determining (as well as determined by) their evolutionary pathways.

3.3 Going Beyond Division to Reconcile Human–Nature Relationships

Other approaches reconsider the dichotomy between humans and nature by studying how people cohabit or ‘become’ with (Haraway, 2008) other living beings. While humanities have traditionally focused on relationships between humans, actor network theory (ANT) takes the view that human societies are made up not only of humans, but include a multiplicity of diverse and interrelated ‘actants’, whatever their nature (living and non-living, human and non-human), which constitute complex networks (*e.g.* Latour, 2005). A number of social scientists are exploring these networks and extending them to non-human actants in which agency is not restricted to humans, but distributed among all things that ‘compose’ the world. By placing relationships at the centre of attention, ANT has profoundly redefined ways of

considering and studying human society, fostering the emergence of methods that allow non-humans to be taken into account or even given a voice. For instance, Nabavi and Daniell (2017) have extended the range of relationships connecting actors in a SES by including geographical, financial and political links (*e.g.* institutions, infrastructure, documents, etc.).

Other scholars, inspired by ANT and the environmental humanities, also consider humans and nature in similar, if not equal, terms. Such studies have mostly focused on human–animal relationships, despite communication barriers between species. Examples include a historical investigation of how horses and dogs enrolled in World War I experienced the conflict (Baratay, 2013); innovative sociological and anthropological methods to closely observe how humans and animals interact (Kirksey & Helmreich, 2010); geographical descriptions of how animals shape space (Buller, 2016); and using political ecology to reconsider territorial issues through non-dualistic ontologies, such as those of indigenous peoples (Escobar, 2016).

Multispecies ethnography emerged in the 2010s as an attempt to do justice to the importance of plants and animals in ethnographical accounts of social existence. Beyond ANT, this field develops ethnographical investigations that account for the agency and influence of living non-humans and analyses their capacity to shape and transform human experiences, values and identities. The anthropologists Kirksey and Helmreich (2010) define it as “a new genre of writing and mode of research [in which] creatures previously appearing on the margins of anthropology – as part of the landscape, as food for humans, as symbols – have been pressed into the foreground” (p. 545). Aiming to subvert the emphasis often put on human–nature dualism by Enlightenment philosophers and to do justice to the role and place of non-humans within the social sciences, multispecies ethnography scholarship focuses on the transformative power of mutual encounters and affective dimension between humans and other living beings. For instance, farmers concerned about soil biota can develop an ethical responsibility to care for soil in a way that accounts for the needs of diverse species and possibly leads to management changes at the farm system level (Krzywoszynska, 2019).

4 Methods That Reveal or Attenuate Dualism in SES

The traditional conceptualization of SES relies on a dichotomy that can be reinforced by the different methodologies adopted to study how these systems function: the natural sphere is often examined through biodiversity science methods, while social scientists focus on the social sphere that encompasses human values, institutions and governance (Bretagnolle et al., 2019).

Other methods go beyond the differences between the two systems to focus on their integration. This is the case of causal loop diagrams, composite indicators and narratives (Rissman & Gillon, 2017). Descriptive approaches can also put biophysical and social elements on the same level: for instance, in multivariate analysis, or

by applying diversity metrics to both ecological and social systems (*e.g.* Grêt-Regamey et al., 2019). Another alternative might be to imagine different viewpoints that are not based on the usual human–nature dichotomy, in order to better understand SES complexity. For instance, distinguishing between users, whether humans or animals, and attributes of spatial units, including natural and human infrastructure (Boulangéat, 2018). In this approach, drawing a user–space dichotomy has a conscious purpose: it enables humans to contextualize their actions within a network of similar actions. It does not lie in absolute terms a hierarchical structure between two groups of beings.

Methods applied similarly to the various components in a SES could thus provide a new perspective on human–nature dualism. However, when complex SES dynamics are addressed, especially when this complexity relates to power relations, a full equivalence between humans and nature may be neither necessary, desirable nor possible. The crucial point lies in the choice of relevant variables given the objectives. It is therefore important to clarify the need for integration or dichotomy depending on the study aim.

5 Where Do We Go from Here?

SES studies focus on human–nature relationships. However, the question of what is taken for granted due to the researcher’s scientific and cultural background in the study of these relationships is rarely asked. Examining how scholars from a diversity of research fields have addressed these relationships suggests that dichotomies are common and sometimes useful tools, but that they should be implemented consciously, that their contextual purpose should be made explicit, and that their relevance as well as political and moral consequences should be considered. Social-ecological research is also confronted with the challenge of integrating Indigenous and non-Western science knowledge, *i.e.* types of knowledge that are not based on peer-review process of validation and do not necessarily rely on notions of neutrality and non-commitment or on a separation between a knowing subject and a known object. The recent work of the IPBES started such an integration, which will further broaden our perspectives on human-nature relationships and dualism.

Human–nature dualism has been held to form the theoretical basis for the plundering of nature and thus to be responsible for the resulting environmental crisis. However, the total rejection of human–nature dualism could endanger some humans and jeopardize nature conservation. The risks for humans could be to cease privileging any human being over non-humans, in particular contexts such as medical experimentation. For nature conservation, a rejection of human–nature dualism poses two kinds of risks. First, it may absolve those most involved in the exploitation of natural resources of their responsibility, as stressed by Malm (2018) in a perspective inspired by historical materialism. Second, the idea that dualism is intimately linked to modernity can lead to the wholesale rejection of the latter’s legacy, including its intellectual and conceptual resources (Audier, 2020). Yet some

of these resources – for instance, the concept of ‘solidarism’ (Audier, 2020) – may be valuable in rebuilding a democracy more open to both humans and non-humans and capable of recognizing and respecting their differences.

These risks could be avoided by cultivating our capacity to make distinctions. It is possible to recognize the existence of differences between beings and even to favour humans over non-humans without assuming the universal superiority of humans over nature. Distinguishing between dualism and dichotomy can be useful in this: the notion of ‘differentiation’ seems more appropriate than that of ‘dichotomy’, as it allows for distinction without implying division. Approaches from other fields of research concerned with human–nature relationships make sound arguments for avoiding both extremes – excessive continuity or excessive separation – in efforts to further integrate humans and nature in SES (Plumwood, 2003; Maris, 2015). The ability to recognize and respect differences should thus be a fundamental principle in future SES research.

References

- Audier, S. (2020). *La cité écologique*. Pour un éco-républicanisme. <https://doi.org/10.3917/dec.audie.2020.01>
- Balmford, A., Bruner, A., Cooper, P., Costanza, R., Farber, S., Green, R. E., ... & Turner, R. K. (2002). Economic reasons for conserving wild nature. *science*, 297, 950–953. doi: <https://doi.org/10.1126/science.1073947>.
- Balmford, A., Fisher, B., Green, R. E., Naidoo, R., Strassburg, B., Turner, R. K., & Rodrigues, A. S. (2011). Bringing ecosystem services into the real world: An operational framework for assessing the economic consequences of losing wild nature. *Environmental and Resource Economics*, 48, 161–175. <https://doi.org/10.1007/s10640-010-9413-2>
- Banai, A. (2016). Sovereignty over natural resources and its implications for climate justice. *Wiley Interdisciplinary Reviews: Climate Change*, 7, 238–250. <https://doi.org/10.1002/wcc.383>
- Baratay, E. (2013). *Écrire l'histoire des non-humains, le cas des animaux*. *Entropia : Revue d'étude théorique et politique de la décroissance*, *Entropia* (pp. 149–160).
- Barreteau, O., Giband, D., Schoon, M., Cerceau, J., DeClerck, F., Ghiotti, S., et al. (2016). Bringing together social-ecological system and territoire concepts to explore nature-society dynamics. *Ecology and Society*, 21, 42. <https://doi.org/10.5751/ES-08834-210442>
- Bartkowski, B. (2017). *Economic valuation of biodiversity: An interdisciplinary conceptual perspective*. Taylor & Francis.
- Bastian, O. (2001). Landscape ecology – Towards a unified discipline? *Landscape Ecology*, 16, 757–766. <https://doi.org/10.1023/A:1014412915534>
- Batavia, C., & Nelson, M. P. (2017). For goodness sake! What is intrinsic value and why should we care? *Biological Conservation*, 209, 366–376. <https://doi.org/10.1016/j.biocon.2017.03.003>
- Berkes, F., & Folke, C. (Eds.). (1998). *Linking social and ecological systems: Management practices and social mechanisms for building resilience*. Cambridge University Press.
- Berkes, F., Colding, J., & Folke, C. (2003). *Navigating social-ecological systems: Building resilience for complexity and change*. Cambridge University Press.
- Boulangeat, I. (2018). A practical framework to analyse the resilience of socio-ecological systems. In *International Conference on Ecological Sciences*.
- Bretagnolle, V., Benoit, M., Bonnefond, M., Breton, V., Church, J. M., Gaba, S., et al. (2019). Action-orientated research and framework: Insights from the French long-term social-ecological research network. *Ecology and Society*, 24. <https://doi.org/10.5751/ES-10989-240310>

- Buller, H. (2016). Animal geographies III: Ethics. *Progress in Human Geography*, 40, 422–430. <https://doi.org/10.1177/0309132515580489>
- Chabot-Hanowell, B., & Smith, E. A. (2012). 5 territorial and nonterritorial routes to power: Reconciling evolutionary ecological, social agency, and historicist approaches. *Archeological Papers of the American Anthropological Association*, 22, 72–86. <https://doi.org/10.1111/apaa.12004>
- Collins, S. L., Carpenter, S. R., Swinton, S. M., Orenstein, D. E., Childers, D. L., Gragson, T. L., et al. (2011). An integrated conceptual framework for long-term social–ecological research. *Frontiers in Ecology and the Environment*, 9, 351–357. <https://doi.org/10.1890/100068>
- Cooke, B., West, S., & Boonstra, W. J. (2016). Dwelling in the biosphere: Exploring an embodied human–environment connection in resilience thinking. *Sustainability Science*, 11, 831–843. <https://doi.org/10.1007/s11625-016-0367-3>
- Dahbour, O. (2019). On the ecological blindspot in the territorial rights debate. *Territory, Politics, Governance*, 7, 217–232. <https://doi.org/10.1080/21622671.2017.1360196>
- Dasgupta, P. (2021). *The economics of biodiversity: The Dasgupta review*. HM Treasury.
- DeScioli, P., & Wilson, B. J. (2011). The territorial foundations of human property. *Evolution and Human Behavior*, 32, 297–304. <https://doi.org/10.1016/j.evolhumbehav.2010.10.003>
- Escobar, A. (2016). Sentipensar con la Tierra : las luchas territoriales y la dimensión ontológica de las epistemologías del Sur. *Revista de antropología iberoamericana*, 11, 11–32. <https://doi.org/10.11156/aibr.110102>
- Finley-Brook, M., & Thomas, C. (2011). Renewable energy and human rights violations: Illustrative cases from indigenous territories in Panama. *Annals of the Association of American Geographers*, 101, 863–872.
- Folke, C. (2016). Resilience (republished). *Ecology and Society*, 21. <https://doi.org/10.5751/ES-09088-210444>
- Georgescu-Roegen, N. (1971). *The entropy law and the economic process*. Harvard University Press.
- Grêt-Regamey, A., Huber, S. H., & Huber, R. (2019). Actors’ diversity and the resilience of social-ecological systems to global change. *Nature Sustainability*, 2, 290–297. <https://doi.org/10.3929/ethz-b-000329567>
- Haraway, D. (2008). *When species meet*. University of Minnesota Press.
- Helm, D., & Hepburn, C. (2014). *Nature in the balance: The economics of biodiversity*. Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199676880.001.0001>
- Holling, C., & s., Meffe, G.K. (1996). Command and control and the pathology of natural resource management. *Conservation Biology*, 10, 328–337.
- IPBES. (2016). *Preliminary guide regarding diverse conceptualisation of multiple values of nature and its benefits, including biodiversity and ecosystem functions and services*. UNEP. http://www.ipbes.net/sites/default/files/downloads/IPBES-4-INF-13_EN.pdf.
- Jacobs, S., Martín-López, B., Barton, D. N., Dunford, R., Harrison, P. A., Kelemen, E., ... Kopperoinen, L. (2018). The means determine the end—pursuing integrated valuation in practice. *Ecosystem Services*, 29, 515–528. <https://doi.org/10.1016/j.ecoser.2017.07.011>
- Jurkevics, A. (2021). Land grabbing and the perplexities of territorial sovereignty. *Political Theory*, 00905917211008591. <https://doi.org/10.1177/00905917211008591>
- Kallis, G., & Norgaard, R. B. (2010). Coevolutionary ecological economics. *Ecological economics*, 69, 690–699. <https://doi.org/10.1016/j.ecolecon.2009.09.017>
- Kirksey, S. E., & Helmreich, S. (2010). The emergence of multispecies ethnography. *Cultural Anthropology*, 25(4), 545–576. <https://doi.org/10.1111/j.1548-1360.2010.01069.x>
- Kolinjivadi, V. (2019). Avoiding dualisms in ecological economics: Towards a dialectically-informed understanding of co-produced sacionatures. *Ecological Economics*, 163, 32–41. <https://doi.org/10.1016/j.ecolecon.2019.05.004>
- Krzywoszyńska, A. (2019). Caring for soil life in the Anthropocene: The role of attentiveness in more-than-human ethics. *Transactions of the Institute of British Geographers*, 44, 661–675. <https://doi.org/10.1111/tran.12293>

- Kull, C., Arnauld de Sartre, X., & Castro, M. (2015). The political ecology of ecosystem services. *Geoforum*, *61*, 122–134. <https://doi.org/10.1016/j.geoforum.2015.03.004>
- Latour, B., & Porter, C. (2004). *Politics of nature*. Harvard University Press. <https://doi.org/10.2307/j.ctv1bzfprt>
- Latour B (2005) Reassembling the social-an introduction to actor-network-theory. Oxford University Press, p 316 <https://doi.org/10.1080/10967490701515606>
- Mace, G. M. (2014). Whose conservation? *Science*, *345*, 1558–1560. <https://doi.org/10.1126/science.1254704>
- Malm, A. (2018). *The progress of this storm. Nature and society in a warming world*. Verso.
- Marris, V. (2015). Back to the Holocene - a conceptual, and possibly practical, return to a nature not intended for humans. In C. Hamilton, C. Bonneuil, & F. Gemenne (Eds.), *The Anthropocene and the global environmental crisis: Rethinking modernity in a new epoch* (pp. 123–133). Routledge.
- Martinez-Alier, J. (2009). Social metabolism, ecological distribution conflicts, and languages of valuation. *Capitalism Nature Socialism*, *20*(1), 58–87.
- Martín-López, B., Gómez-Baggethun, E., González, J. A., Lomas, P. L., & Montes, C. (2009). The assessment of ecosystem services provided by biodiversity: Re-thinking concepts and research needs. In J. B. Aronoff (Ed.), *Handbook of nature conservation*. Nova Publishers.
- Mathevet, R., Thompson, J. D., Folke, C., & Chapin, F. S. (2016). Protected areas and their surrounding territory: Socioecological systems in the context of ecological solidarity. *Ecological Applications*, *26*, 5–16. <https://doi.org/10.1890/14-0421>
- Muradian, R., & Gómez-Baggethun, E. (2021). Beyond ecosystem services and nature's contributions: Is it time to leave utilitarian environmentalism behind? *Ecological Economics*, *185*, 107038. <https://doi.org/10.1016/j.ecolecon.2021.107038>
- Muscacchio, L. R. (2009). The scientific basis for the design of landscape sustainability: A conceptual framework for translational landscape research and practice of designed landscapes and the six Es of landscape sustainability. *Landscape Ecology*, *24*, 993–1013. <https://doi.org/10.1007/s10980-009-9396-y>
- Nabavi, E., & Daniell, K. A. (2017). Rediscovering social-ecological systems: Taking inspiration from actor-networks. *Sustainability Science*, *12*, 621–629. <https://doi.org/10.1007/s11625-016-0386-0>
- Norgaard, R., & Kallis, G. (2011). Coevolutionary contradictions: Prospects for a research programme on social and environmental change. *Geografiska Annaler Series B, Human Geography*, *93*, 289–300. <https://doi.org/10.1111/j.1468-0467.2011.00383.x>
- Orach, K., & Schlüter, M. (2016). Uncovering the political dimension of social-ecological systems: Contributions from policy process frameworks. *Global Environmental Change*, *40*, 13–25. <https://doi.org/10.1016/j.gloenvcha.2016.06.002>
- Plumwood, V. (2003). *Feminism and the mastery of nature*. Routledge.
- Reyers, B., Roux, D. J., & O'Farrell, P. J. (2010). Can ecosystem services lead ecology on a transdisciplinary pathway? *Environmental Conservation*, *37*, 501–511. <https://doi.org/10.1017/S0376892910000846>
- Rissman, A. R., & Gillon, S. (2017). Where are ecology and biodiversity in social-ecological systems research? A review of research methods and applied recommendations: Ecology in social-ecological systems. *Conservation Letters*, *10*, 86–93. <https://doi.org/10.1111/conl.12250>
- Schlager, E., & Ostrom, E. (1992). Property-rights regimes and natural resources: A conceptual analysis. *Land Economics*, *68*, 249–262. <https://doi.org/10.2307/3146375>
- Soulé, M. (1985). What is conservation biology? *Conservation Biology*, *35*, 727–734. <https://doi.org/10.2307/1310054>
- Vucetich, J. A., Bruskotter, J. T., & Nelson, M. P. (2015). Evaluating whether nature's intrinsic value is an axiom of or anathema to conservation. *Conservation Biology*, *29*, 321–333. <https://doi.org/10.1111/cobi.12464>

Open Access This chapter is licensed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

