

Key advantages of the leverage points perspective to shape human-nature relations

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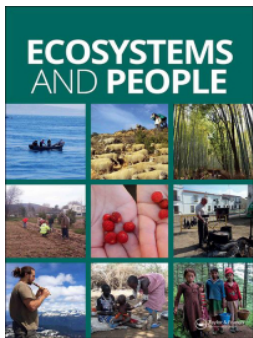
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








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ABSTRACT

This perspective paper synthesises the special issue ‘Human-nature connectedness as a leverage point for sustainability transformation’. Based on the articles in this special issue, we aim to foster the operationalisation of the leverage points perspective to shape human-nature relations to enable sustainability transformations. Specifically, we draw on four key advantages of the leverage points perspective: (i) the explicit recognition of deep leverage points; (ii) the ability to examine the interactions between shallow and deep system changes; (iii) the combination of causal and teleological modes of research; and (iv) the ability to function as a methodological boundary object. The contributions to this special issue revealed three deep leverage points addressing paradigm shifts in research and beyond: relational thinking and values, stewardship philosophy and shifting the economic growth paradigm to focus on human well-being. We highlight interlinkages between leverage points to further strengthen the transformative potential of interventions that aim at triggering shifts in our understanding about human-nature relations. Further, we show a way to bridge causal and teleological approaches by envisioning desired futures. Lastly, we emphasise the potential of arts-based methodologies, including participatory, transdisciplinary research to foster sustainability transformation and how this can be combined within the leverage points perspective.

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Introduction

Many years of effort towards averting the unsustainable trajectory of our world’s development prove that technological and short-term policy strategies are insufficient to achieve the internationally agreed sustainable development goals (Rockström et al. 2009; UN 2015; Steffen et al. 2018). As an example, conservation policies are often unable to halt the severe loss of biodiversity, which stresses the need for more effective interventions at the wider institutional and societal level to reach conservation goals (Rands et al. 2010). In other words, achieving sustainability requires transformations of social-ecological systems (Meadows 2008). Understanding where and how to intervene in social-ecological systems is thus a core question of sustainability research, yet only a few

overarching principles have so far demonstrated effectiveness (Meadows 1999; Dorninger et al. 2020).

To enable transformations of social-ecological systems to more sustainable states, it is important to know where to intervene in a system for leveraging change. Meadows (1999) proposed a hierarchy of places, which Abson et al. (2017) categorized into four system characteristics (Table 1). These leverage points range from shallow (e.g. changes in parameters or feedbacks) to deep and transformative ones (e.g. changes in system intent, goals and paradigms). We argue that many interventions target highly tangible but essentially shallow leverage points (i.e. using interventions that are easy but have limited potential for transformational change). Given the pressing sustainability challenges the world is facing, we see an urgent need to focus on less obvious but potentially

Table 1. Twelve leverage points *sensu* Meadows (1999) and their corresponding system characteristics as summarized by Abson et al. (2017). Deep leverage points = design and intent; Shallow leverage points = parameters and feedbacks.

Leverage points	System characteristics	Examples
12. Constants, parameters, numbers 11. The size of buffers and other stabilizing stocks, relative to their flows 10. Structure of material stocks and flows 9. Length of delays, relative to the rate of system changes 8. Strength of negative feedback loops, relative to the effect they are trying to correct against 7. Gain around driving positive feedback loops 6. Structure of information flow 5. Rules of the system 4. Power to add, change, evolve, or self-organize system structure 3. Goal of the system 2. Mind-set or paradigm that the system – its goals, structure, rules, delays, parameters – arises from 1. Power to transcend paradigms	Parameters: measurable system features Feedbacks: interaction within the system Design: systemic structures Intent: long-term trajectory of system behaviour	Subsidies, taxes, population age structures; transport networks Teleconnections, birth rates, models to predict responses Access to information, formal & informal institutional constraints Value & belief system, economic system, understanding of how the world works

more effective interventions (Fischer and Riechers 2019). One such powerful area of intervention are human-nature relations (Abson et al. 2017; Riechers et al. 2021).

The connection between humans and their surrounding nature has been highlighted in their significance over the past decade (Folke et al. 2011; Russell et al. 2013; Zylstra et al. 2014), as strengthening this connection may simultaneously increase human well-being and the ecological sustainability (Nisbet et al. 2009; Capaldi et al. 2014; Shanahan et al. 2016). Humans constantly interact with their surrounding nature. Through these human-nature interactions grows a relation, which can be seen as one realm of leverage. In this realm, targeting the most effective leverage points has a high potential to transform our world into a more sustainable state (Abson et al. 2017; Riechers et al. 2020a). The authors of the special issue ‘Human-nature connectedness as a leverage point for sustainability transformation’ presented their findings on what some of these leverage points could be. The theoretical and conceptual background of research within the realm of human-nature relations comprises decades of disciplinary and interdisciplinary work. Within this synthesis, we refer to these interactions as ‘human-nature relations’ to enable various concepts that are used in the articles in this special issue to be integrated under this broad umbrella term (Riechers et al. 2021, this issue).

We draw this synthesis on four key advantages of the leverage points perspective (Fischer and Riechers 2019): (i) the explicit recognition of deep leverage points which are influential yet difficult to act upon (Dorninger et al. 2020); (ii) enabling the examination of interactions between shallow and deep system changes (Manlosa et al. 2018); (iii) the combination of causal (change arises from variables influencing one another) and teleological (change arises from human intent) modes of research; and (iv) the ability to function as a methodological boundary object for inter- and transdisciplinary research.

Using the leverage points perspective as analytical lens, we synthesize aspects of the articles in this special issue by putting them into the broader context of transformative research. Our synthesis helps to operationalise and concretize the four key advantages to enable a comprehensive overview on how human-nature relations may serve as a realm of leverage that enables entry points to sustainability transformations. This perspective paper is structured as follows: we will (1) describe exemplary deep leverage points based on paradigm shifts, (2) provide examples for interlinkages between leverage points, (3) discuss the incorporation of causal and intent-based (teleological) approaches through envisioning a desired future and (4) consider arts-based methods to be integrated in sustainability science through the methodological boundary object of the leverage points perspective.

Deep leverage points to shape human-nature relations

Deep leverage points may foster transformative change through strengthening connections between humans and their surrounding nature (Riechers et al. 2021). Meadows (1999) named paradigm shifts as one of the deepest levers of change (Table 1). From the contributions in this special issue, we noted three deep leverage points that aim at the following paradigm shifts: (a) acknowledging (and strengthening) relational thinking and values, (b) a stewardship philosophy and (c) shifting from a growth-based economy to one focussed on human well-being.

A relational turn in research and values

Values in sustainability transformation have been discussed extensively over the last decades (Horcea-Milcu et al. 2019). Meadows (1999) highlights ‘values’ as deep leverage points and in the discussion about shaping human-nature relations, researching values becomes paramount (e.g. Chan et al. 2012; Pascual et al. 2017).

In fact, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) included relational values in its classification (Díaz et al. 2015), being understood as the values encompassing all possible relationships between humans and nature, including relationships between people mediated by nature (Chan et al. 2016; Riechers et al. 2020b). Relational values hold a fundamental meaning of human-nature interactions that goes beyond instrumental values, representing meaningful relationships and responsibilities established between humans and nature such as care and stewardship (Himes and Muraca 2018; García-Llorente et al. 2018).

To systemically transform the way researchers approach human-nature relations, West et al. (2020 this issue) argue for a 'relational turn'. Drawing on relational understandings about the nature of reality, the 'relational turn' aims to revise and revisit the reductionists assumptions present in sustainability science to better capture the complexity of human-nature relations (Stenseke 2018; West et al. 2018, 2019; Hertz et al. 2020; Darnhofer 2020). In such a shift, the dichotomous categories of 'humans' and 'nature' would be revised in favour of concepts that better capture the inextricability of humans and nature within holistic assemblages, to avoid identifying system components as *either* 'human/social' or 'natural/ecological' (Ostrom 2009; Schoon and Van Der Leeuw 2015). Such a 'relational turn' may ultimately lead to a shift or an opening up in complexity thinking from substantialist to relational assumptions that may help to overcome false dichotomies between humans and nature. West et al. (2020 this issue) argue that overcoming this conceptual dichotomy may allow for the creation of different types of knowledge and positively influence the science-policy interface through generating novel governance, management and policy approaches.

To operationalise a 'relational turn' in research and values, Chakroun and Droz (2020 this issue) propose bridging the concepts of landscape and milieu. The framework of the milieu developed by Droz (2020) captures how the milieu is both 'the matrix that nurtures human communities, shaping their cultures and their ways of living *and* the imprint that is shaped by the historical relations of humans with each other and with their environment' (Chakroun and Droz 2020 this issue). Thus, humans experience their environment as webs of meanings, values and affordances. The authors apply this framework to three biodiversity-rich cultural landscapes in Japan and highlight how particular cultural meanings and values lead to different usages of space and of the environment and how, in return, certain landscapes can influence people's experiences and therewith lead to pro-environmental behaviour (Hinds and Sparks 2008; Gifford and Nilsson 2014). Approaching sustainability

through landscapes enables researchers to go beyond the artificial and abstract separation between 'internal' (e.g. ethical decision-making) and external processes (e.g. environmental degradations) and complements recent studies that have tended to exclude or limit consideration of the internal state of individuals (e.g. Palomo et al. 2014; Hanspach et al. 2016). Chakroun and Droz (2020, this issue) argue that people's inner worlds are essential for sustainability, especially because the direct sensory interactions with nature help to acknowledge and foster a deeper connection to nature (Abram 1997; Balázs et al. 2019; Riechers et al. 2020b).

Facilitating a 'relational turn' in practise nevertheless may pose challenges (Raymond et al. 2021). The inclusion of people's relation with nature into policy and social structures is often lacking as policies do not cater for recognition of such relations (Mattijsen et al. 2020 this issue). Instead, nature conservation policy focusses more on instrumental or intrinsic values (i.e. biodiversity and economy-based). The authors argue that this simplification of human-nature relations risks to oversee other relations with nature, with negative effects for conservation policy and management (Klain et al. 2017). Lack of consideration of relational values, the authors suggest, could be a reason for why nature policies often fail to address biodiversity loss effectively and often trigger resistance and/or alienation among actors. Humans 'are deeply affected by emotions and stories with meaning. We want to believe our lives are worthwhile and meaningful' (Richardson et al. 2020 this issue). Mattijssen et al. (2020 this issue) further argue that a recognition and incorporation of relational values can serve as deep leverage points for policy interventions that aim to support citizen's contribution to nature conservation and strengthen biodiversity policy. Hence, through values, such as relational ones, social structures and policies can and should re-emerge as Humanity's story.

To counter this lack of recognition, Richardson et al. (2020 this issue) and Mattijssen et al. (2020 this issue) present evidence from practical examples in which relational values and a relational turn can be fostered. Richardson et al. (2020 this issue) suggest a regenerative potential of human-nature relations at multiple levels (from individual to societies), in all of the four system characteristics by Abson et al. (2017). They provide concrete recommendations for specific informed interventions to improve the human-nature relations in education, health, housing, arts, health and transport and governance. In order to promote the incorporation of relational values in nature policy and practice and more effectively engage with citizens in this context, Mattijssen et al. (2020 this issue) describe six possible 'routes' for policy makers:

- (1) The incorporation of pluralized meanings of nature;
- (2) The uptake of relational language in policy discourse;
- (3) A prioritization of landscape-based policy;
- (4) Empowering local citizens in nature conservation;
- (5) Re-orienting nature education to stimulate people's personal experience of nature; and
- (6) Using digital technology to stimulate new relationships with nature.

While this list of routes is not exhaustive, all points offer significant potential to influence human-nature relations in a way that fosters transformative changes towards sustainability (Mattijssen et al. 2020 this issue).

A stewardship philosophy

Stewardship can be seen as a specific relational value and offers a way to achieve a 'relational turn' (West et al. 2018). For example, a stewardship philosophy towards maintaining natural elements in agricultural landscapes would benefit the conservation of agrobiodiversity (Raatikainen et al. 2020 this issue). To strengthen the connections humans have with their surrounding nature, it is necessary to focus on experiential and emotional aspects, as well as strengthening compassionate relationships (Lumber et al. 2017). A stewardship philosophy may also transform our thinking to include the agency and rights of non-human entities, which can change the underlying conceptualizations of human-nature relations on both the personal and societal scale towards a mindset that encourages sustainable action (Raatikainen et al. 2020 this issue). The relevance of 'green care' activities is recognised as an innovative approach that combines caring for people and caring for land. The stewardship philosophy combines three elements that have not been previously connected: (1) multifunctional landscapes and recognition of the plurality of values; (2) social services and health care; and (3) the possibility of strengthening the farming sector and local communities (García-Llorente et al. 2018).

The notion of 'landscape stewardship' is very much in line with argumentations for a relational turn and invites deliberately considering and opening up discursive spaces for engaging with diverse values of landscape. This may help to alleviate heated conflicts in land management, which often arise at the brink between agriculture and nature conservation. Within the context of land management, Bieling et al. (2020 this issue) define landscape stewardship as a management approach as well as an essentially ethical concept. Landscape stewardship are 'efforts to create, nurture and enable responsibility in land-owners and resource users to manage and protect

land and its natural and cultural heritage (Brown and Mitchell 2000, p. 70)'. Landscape stewardship highlights responsibility, collaboration, participation, plurality and communication (Cockburn et al. 2019). The concept and practice of stewardship combines various landscape values with management practises, comprising (1) prudential aspects like interest in long-term productivity and sustainable use of the land (instrumental values); (2) moral, justice-related aspects like duties to future generations and the global poor (intrinsic values, human rights); and (3) aspects of the Good Life like feelings of attachment, aesthetic ideals or identity (relational values) (Bieling et al. 2020 this issue). In this regard, it is crucial to highlight especially indigenous peoples who manage and influence over one fourth of the earth's surface (Garnett et al. 2018). Indigenous peoples and communities are 'carriers and caregivers of biodiversity and they also hold a unique and invaluable indigenous and local knowledge for sustainable stewardship of nature' (Burgos-Ayala et al. 2020a this issue).

A new economic paradigm

Rana et al. (2020 this issue) emphasize a shift away from the economic growth paradigm (Meadows 1999, 2008). In general, a growing economy can be defined as an increase in the production and consumption of market traded goods and services. This increase in production accounts for a growing use of resources leading to, among others, resource depletion (Brown et al. 2014; Kallis et al. 2018) and climate change (Stern 2004; IPCC 2018; IPBES 2019). Instead of trying to mitigate the negative consequences of an economic growth paradigm, the focus should be on how to transform it into a more sustainable one. Such a transformation is utterly necessary in order to achieve a sustainable economy (IPBES 2019). This need for a paradigm shift was also experienced by the young participants of Rana et al. (2020 this issue) visioning exercise for positive and sustainable futures based on the Seeds of the Good Anthropocene project (Bennett et al. 2016). Core components for a desirable future were alternative economies and new metrics to measure development (i.e. recognizing well-being and happiness). This links back to a rising discussion about alternatives to growth in society, policy and academia (Costanza et al. 2014; Polasky et al. 2015; Raworth 2017). Movements such as degrowth and other alternative economic models could enrich these discussions and are critical for interventions to halt biodiversity losses (Hinton and Maclurcan 2017; D'Alessandro et al. 2020; Otero et al. 2020). Alternatives to the current growth paradigm may be able to challenge the status quo, especially if they are able to provide meaningful and context-specific examples (Berg and Hukkinen 2011). Steering away

from economic growth is complicated because the current dominant paradigm is deeply integrated into the social, institutional, political and economic fabric of global societies (Fournier 2008; Raworth 2017). However, changing and challenging this paradigm can be a deep leverage point to foster a sustainability transformation of the way humans interact with nature (Rana et al. 2020 this issue).

Interlinkages between leverage points to shape human-nature relations

A leverage points perspective postulates that transformative change is unlikely if only shallow leverage points are acted upon; but it also recognizes that acting on deep leverage points is difficult in practice, even if the benefits could be substantial (Ehrlich and Kennedy 2005; Abson et al. 2017). Based on this, it is important to understand better how shallow and deep systemic changes interact in different situations (Manlosa et al. 2018; Riechers et al. 2021). Such interactions among leverage points or changes at different levels of systemic depth suggest that ‘chains of leverage’ (i.e. how shallow, mid-level and deep systemic changes interact with one another) can be studied (Fischer and Riechers 2019). In this section, we exemplify how interlinkages between leverage points can influence human-nature relations by referring to three articles in this special issue: Pérez-Ramírez et al. (2021 this issue) and Rosengren et al. (2021 this issue) show interlinkages between shallow and deep leverage points, while Burgos-Ayala et al. (2020a this issue) highlight that different interlinkages between leverage points may lead to different outcomes.

Drawing on the system characteristics by Abson et al. (2017) (Table 1), Pérez-Ramírez et al. (2021 this issue) looked at such possible interactions. They defined modifiable and measurable parameters as the number of participants of the farming initiative, of ecological crops, including traditional varieties, productivity, or the number of pollinators. Feedbacks were assessed in relation to the efficiency of the initiative, including the amount of time spent by the participants for the project, the workshops and the evaluation surveys of the project. The design characteristics related to the information flow and self-organization through the collective development of an educational plan and a new social association run by transdisciplinary actors, while the system intent was addressed by the ideological foundations used in agroecology. Through participatory farming activities, Pérez-Ramírez et al. (2021 this issue) noted how some interventions were easy to implement but reached only shallow leverage (e.g. time spent to develop an agro-ecological project), but were important for reaching the set targets. Such shallow leverage points also fostered interventions that were more

difficult to implement, which showed a deeper leverage for transformative change (e.g. working on the agroecological paradigm). A similar synergistic effect was noted by Rosengren et al. (2021 this issue). Their indicated leverage points of ‘gender equality’, ‘social learning’, ‘information and knowledge’ and ‘access to finance’ should not be regarded in isolation but rather as an ensemble of topics conjointly having the potential to create positive change (Rosengren et al. 2021 this issue). The authors identified the leverage point of ‘gender equality’ as holding great potential to create systemic change by impacting the rules of the system. The leverage points of ‘social learning’ and ‘information and knowledge’ are tightly linked and rooted in the power to add, change, evolve or self-organize a system and structures of information flows – both deep leverage points (Meadows 1999). The leverage point ‘access to finance’, will not have the power to improve adaptive capacity substantially on its own – despite often being a focal point in political and economic interventions (Rosengren et al. 2021 this issue).

Interlinkages between leverage points can also be crucial for successful project outcomes. Burgos-Ayala et al. (2020a this issue) highlight two project groups, which combined and concretised deep and shallow leverage points differently and hence, found contrasting outcomes. The authors looked at frequently targeted leverage points within environmental management projects involving indigenous peoples as their main actor. Leverage points were information sharing, participatory praxis and involvement of indigenous peoples but intervention in these leverage points differed (Burgos-Ayala et al. 2020a). Highlighting the intricate and complex nature of the interlinkages between shallow and deep leverage points to foster human-nature relation is crucial for a comprehensive systemic understanding. Operationalising and analysing these interlinkages is a difficult task but the three examples given here suggest ways to achieve this goal in different situations and empirical settings.

Causal and teleological combinations to shape human-nature relations

Sustainability research uses predictive models (e.g. on climate change or resource depletions to forecast the future). Rana et al. (2020 this issue) provide an extension to such investigations by bridging causal (nothing can happen without a cause) and teleological (events and developments are meant to achieve a purpose and happen because of that) approaches can shape human-nature relations today by identifying desired visions for tomorrow. Rana et al. (2020 this issue) used a visioning method adapted from the Seeds of the Good Anthropocene project (Pereira et al. 2018) and Nature Futures Framework (Pereira

et al. 2020) to highlight more sustainable futures and ways to get there. Such visioning exercises can contribute to generating desired social change (Totin et al. 2017). Highlighting the desirability of such a vision can provide an inspiring narrative and engender action (Wiek and Iwaniec 2014). Hence, based on the causal explanation already existing for their specific social-ecological system in question, the authors used a participatory process of visioning to promote collective action for transitions toward desirable futures (Oteros-Rozas et al. 2015; Lundquist et al. 2017; Hamann et al. 2020). With this participatory process; they aimed to generate literacy about the future among their workshop participants to enable changes in values and behaviour (Wiek and Iwaniec 2014; Bennett et al. 2016; Pereira et al. 2018). Through analysing and comparing different possible futures, the authors identified a number of leverage points to shape human-nature relations (Rana et al. 2020 this issue). Key deep leverage points were: an alternative economic paradigm (see above), new governmental structures and institutions to improve justice and inclusive planning and management. These deep leverage points related directly to ongoing debates in the sustainability literature on which pathways and interventions are required to achieve a better future for humanity and the planet, and show how articulating positive visions of the future can help reaching them.

Methodological boundary objects to shape human-nature relations

The leverage points perspective can serve as a methodological boundary object for inter- and transdisciplinary research, as it can combine a wide range of causal to teleological approaches (Fischer and Riechers 2019). Especially in the realm of human-nature relations in which multiple demands, values and emotions are integrated, new methodologies are helpful for developing more encompassing analyses. One such collection of methodologies mentioned by authors of this special issue are arts-based approaches, which can serve as possible methodological additions to strengthen the connections humans have with their surrounding nature (Muhr 2020; Raatikainen et al. 2020; Richardson et al. 2020). Such diverse and flexible approaches towards implementing senses of belonging to overcome the dichotomy between nature and humans have proven useful in various projects, particularly when working with non-academics.

Combining art and transdisciplinarity has the potential to uncover deep connection to landscapes, benefiting from the fact that art can be a direct channel to human emotions (Xenakis et al. 2012; Riechers et al. 2019). Muhr (2020 this issue) describes arts-based research of being capable of tapping into often

neglected emotions and embodied experiences regarding to nature. Most art forms incorporate non-verbal components. This could potentially transcend the cognitive dimensions of human-nature interactions and highlight an unspoken knowledge – making arts-based approaches particularly interesting for researching emotional connections to nature (Muhr 2020 this issue). Working with and through art can be a way of helping communities understand and address their problems through participatory research that incorporates a diversity of knowledge forms (Bodorkós and Pataki 2009). Additionally, art requires active involvement from participants, to go out and observe, create and change natural places. The appreciation of different forms of knowing, acting and using dialogical ways to explore these unfolds the complexity, uncertainties and disputed values of various different actors involved (Fazey et al. 2018). Raatikainen et al. (2020 this issue), for example, focused on the opportunities of arts-based environmental education in advancing environmental management and Richardson et al. (2020 this issue) promote arts-based activities to operationalise pathways to nature connectedness. Arts-based practices allowed participants to recognize their corporality and develop an experiential, expressive and informed connection with nature, independent of the participants' age, native language, or educational background. Another asset of arts-based work is its inherent creativity; stretching the boundaries of the epistemology, ontology and methodology of science.

Arts-based approaches can further inspire discussions that emphasize deep leverage points, as they differ from quantitative and qualitative research in their purposes (Leavy 2009; Barone and Eisner 2012). Muhr (2020 this issue) identified a process of producing and using (scientific) knowledge as leverage point in his work (see also Abson et al. 2017). Transformative art can be a powerful tool to guide and innovate sustainability transition, combined with research that points out the critical needs for transformative action and when building on multiple kinds of knowledges (Raatikainen et al. 2020 this issue). From a leverage points perspective, arts-based interventions can advance the methods and methodologies of research and therewith change the rules of a system – and initiate promising chains of leverage for a different access to sustainability science (Heinrichs 2018, 2019), as stated by Muhr (2020 this issue). By including other and potentially non-scientific types of knowledge, leverage points addressing human-nature relations may spark novel and powerful pathways towards sustainability transformation.

Summary











This synthesis of the special issue 'Human-nature connectedness as a leverage point for sustainability

transformation' reveals insights about human-nature relations based on the key advantages of the leverage points perspective. As we show by our emphasis on specific aspects of each contribution, there seems to be a general need for a paradigm shift from utilitarian to relational interactions, which is represented by a shift away from the prior conceptualisation of human-nature connectedness to a more overarching term (human-nature relations). Another related deep leverage point was the strengthening of a stewardship philosophy to shape human-nature relations to more sustainable states. Lastly, the deep leverage point of shifting away from the economic growth paradigm to a more just and encompassing one was highlighted. However, transformations towards sustainability do not only require focusing on deep leverage points, but also needs to account for how different leverage points are interlinked with each other. Such interlinkages can further strengthen the transformative potential of interventions to shape human-nature relations into a more sustainable state. Further, we exemplified the need to bridge causal and teleological approaches – to not only focus on the status quo of the system (and how we got here) but also on the desired state of the system (and how to get there). This special issue highlights how the leverage points perspective can act as a methodological boundary object that harbours many ways to operationalise human-nature relations and questions academic knowledge. This was exemplified by the work with arts-based methods and participatory, transdisciplinary research aimed to shape human-nature relations from the bottom up. Overall, this special issue has helped to concretize leverage points that can positively shape human-nature relations, identify what these relations may look like and how the leverage points perspective can be used.

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References

- Abram D. 1997. *The spell of the sensuous: perception and language in a more-than-human world*. New York: Random House - Vintage Books.
- Abson DJ, Fischer J, Leventon J, Newig J, Schomerus T, Vilsmaier U, Von Wehrden H, Abernethy P, Ives CD, Jäger NW, et al. 2017. Leverage points for sustainability transformation. *Ambio*. 46(1):30–39. doi:10.1007/s13280-016-0800-y.
- Balázs Á, Riechers M, Hartel T, Leventon J, Fischer J. 2019. The impacts of social-ecological system change on human-nature connectedness: a case study from Transylvania, Romania. *Land Use Policy*. 89:104232. doi:10.1016/j.landusepol.2019.104232.
- Barone T, Eisner EW. 2012. *Arts based research*. Thousand Oaks (CA (USA)): SAGE Publications.
- Bennett EM, Solan M, Biggs R, McPhearsons T, Norström AV, Olsson P, Pereira L, Peterson GD, Raudsepp-Hearne C, Biermann F, et al. 2016. Bright spots: seeds of a good Anthropocene. *Front Ecol Environ*. 14(8):441–448. doi:10.1002/fee.1309.
- Berg A, Hukkinen JI. 2011. The paradox of growth critique: narrative analysis of the Finnish sustainable consumption and production debate. *Ecol Econ*. 72:151–160. doi:10.1016/j.ecolecon.2011.09.024.
- Bieling C, Eser U, Plieninger T. 2020. Towards a better understanding of values in sustainability transformations: ethical perspectives on landscape stewardship. *Ecosyst People*. 16(1):188–196. doi:10.1080/26395916.2020.1786165.
- Bodorkós B, Pataki G. 2009. Linking academic and local knowledge: community-based research and service learning for sustainable rural development in Hungary. *J Clean Prod*. 17(12):1123–1131. doi:10.1016/j.jclepro.2009.02.023.
- Brown J, Mitchell B. 2000. The stewardship approach and its relevance for protected landscapes. *The George Wright Forum*.
- Brown JH, Burger JR, Burnside WR, Chang M, Davidson AD, Fristoe TS, Hamilton MJ, Hammond ST, Kodric-Brown A, Mercado-Silva N, et al. 2014. Macroecology meets macroeconomics: resource scarcity and global sustainability. *Ecol Eng*. 65:24–32. doi:10.1016/j.ecoleng.2013.07.071.
- Burgos-Ayala A, Jiménez-Aceituno A, Torres-Torres AM, Rozas-Vásquez D, Lam DPM. 2020a. Indigenous and local knowledge in environmental management for human-nature connectedness: a leverage points perspective. *Ecosyst People*. 16(1):290–303. doi:10.1080/26395916.2020.1817152.
- Capaldi CA, Dopko RL, Zelenski JM. 2014. The relationship between nature connectedness and happiness: a meta-analysis. *Front Psychol*. 5:976. doi:10.3389/fpsyg.2014.00976.
- Chakroun L, Droz L. 2020. Sustainability through landscapes: natural parks, satoyama, and permaculture in Japan. *Ecosyst People*. 16(1):369–383. doi:10.1080/26395916.2020.1837244.
- Chan KMA, Balvanera P, Benessaiah K, Chapman M, Díaz S, Gómez-Baggethun E, Gould R, Hannahs N, Jax K, Klain S, et al. 2016. Opinion: why protect nature? Rethinking values and the environment. *Proc Natl Acad Sci U S A*. 113(6):1462–1465. doi:10.1073/pnas.1525002113.
- Chan KMA, Satterfield T, Goldstein J. 2012. Rethinking ecosystem services to better address and navigate cultural values. *Ecol Econ*. 74:8–18. doi:10.1016/j.ecolecon.2011.11.011.

- Cockburn J, Cundill G, Shackleton S, Rouget M, Zwinkels M, Cornelius S, Metcalfe L, Van Den Broeck D. 2019. Collaborative stewardship in multifunctional landscapes: toward relational, pluralistic approaches. *Ecol Soc.* 24(4). doi:10.5751/ES-11085-240432.
- Costanza R, Kubiszewski I, Giovannini E, Lovins H, McGlade J, Pickett KE, Ragnarsdóttir KV, Roberts D, De Vogli R, Wilkinson R. 2014. Development: time to leave GDP behind. *Nat.* 505(7483):283–285. doi:10.1038/505283a.
- D'Alessandro S, Cieplinski A, Distefano T, Dittmer K. 2020. Feasible alternatives to green growth. *Nat Sustainability.* 3(4):329–335. doi:10.1038/s41893-020-0484-y.
- Darnhofer I. 2020. Farming from a Process-relational perspective: making openings for change visible. *Sociol Ruralis.* 60(2):505–528. doi:10.1111/soru.12294.
- Díaz S, Demissew S, Carabias J, Joly C, Lonsdale M, Ash N, Larigauderie A, Adhikari JR, Arico S, Báldi A, et al. 2015. The IPBES conceptual framework — connecting nature and people. *Curr Opin Environ Sustainability.* 14:1–16. doi:10.1016/j.cosust.2014.11.002.
- Dorninger C, Abson DJ, Apetrei CI, Derwort P, Ives CD, Klanićki K, Lam DPM, Langsenlehner M, Riechers M, Spittler N, et al. 2020. Leverage points for sustainability transformation: a review on interventions in food and energy systems. *Ecol Econ.* 171:106570. doi:10.1016/j.ecolecon.2019.106570.
- Droz L. 2020. The milieu as common grounds for global environmental ethics. [PhD Thesis]. Kyoto University
- Ehrlich PR, Kennedy D. 2005. Millennium assessment of human behavior. *Sci.* 309(5734):562–563. doi:10.1126/science.1113028.
- Fazey I, Schöpke N, Caniglia G, Patterson J, Hultman J, Van Mierlo B, Säwe F, Wiek A, Wittmayer J, Aldunce P, et al. 2018. Ten essentials for action-oriented and second order energy transitions, transformations and climate change research. *Energy Res Social Sci.* 40:54–70. doi:10.1016/j.erss.2017.11.026.
- Fischer J, Riechers M. 2019. A leverage points perspective on sustainability. *People and Nature.*
- Folke C, Jansson A, Rockström J, Olsson P, Carpenter SR, Chapin FS, Crépin A-S, Daily G, Danell K, Ebbesson J, et al. 2011. Reconnecting to the biosphere. *Ambio.* 40(7):719–738. doi:10.1007/s13280-011-0184-y.
- Fournier V. 2008. Escaping from the economy: the politics of degrowth. *Int J Sociol Social Policy.* 28(11/12):528–545. doi:10.1108/01443330810915233.
- García-Llorente M, Rubio-Olivar R, Gutierrez-Briceño I. 2018. Farming for life quality and sustainability: a literature review of green care research trends in Europe. *Int J Environ Res Public Health.* 15(6):1282. doi:10.3390/ijerph15061282.
- Garnett ST, Burgess ND, Fa JE, Fernández-Llamazares Á, Molnár Z, Robinson CJ, Watson JEM, Zander KK, Austin B, Brondizio ES, et al. 2018. A spatial overview of the global importance of Indigenous lands for conservation. *Nat Sustainability.* 1(7):369–374. doi:10.1038/s41893-018-0100-6.
- Gifford R, Nilsson A. 2014. Personal and social factors that influence pro-environmental concern and behaviour: a review. *Int J Psychol.* 49(3):141–157. doi:10.1002/ijop.12034.
- Hamann M, Biggs R, Pereira L, Preiser R, Hichert T, Blanchard R, Warrington-Coetzee H, King N, Merrie A, Nilsson W, et al. 2020. Scenarios of good Anthropocenes in southern Africa. *Futures.* 118:102526. doi:10.1016/j.futures.2020.102526.
- Hanspach J, Loos J, Dorresteijn I, Abson DJ, Fischer J. 2016. Characterizing social-ecological units to inform biodiversity conservation in cultural landscapes. *Diversity and Distributions.*
- Heinrichs H. 2018. Sustainability science with Ozzy Osbourne, Julia Roberts and Ai Weiwei: the potential of arts-based research for sustainable development. *GAIA.* 27(1):132–137. doi:10.14512/gaia.27.1.8.
- Heinrichs H. 2019. Strengthening sensory sustainability science—theoretical and methodological considerations. *Sustainability.* 11(3):769. doi:10.3390/su11030769.
- Hertz T, Mancilla Garcia M, Schlüter M. 2020. From nouns to verbs: how process ontologies enhance our understanding of social-ecological systems understood as complex adaptive systems. *People and Nature.*
- Himes A, Muraca B. 2018. Relational values: the key to pluralistic valuation of ecosystem services. *Curr Opin Environ Sustainability.* 35:1–7. doi:10.1016/j.cosust.2018.09.005.
- Hinds J, Sparks P. 2008. Engaging with the natural environment: the role of affective connection and identity. *J Environ Psychol.* 28(2):109–120. doi:10.1016/j.jenvp.2007.11.001.
- Hinton J, Maclurcan D. 2017. A not-for-profit world beyond capitalism and economic growth? *Ephemera.*
- Horcea-Milcu A-I, Abson DJ, Apetrei CI, Duse IA, Freeth R, Riechers M, Lam DPM, Dorninger C, Lang DJ. 2019. Values in transformational sustainability science: four perspectives for change. *Sustainability Sci.* 14(5):1425–1437. doi:10.1007/s11625-019-00656-1.
- IPBES. 2019. Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the intergovernmental science-policy platform on biodiversity and ecosystem services. IPBES secretariat, Bonn (Germany).
- IPCC. 2018. Global warming of 1.5°C. Summary for policy makers. Switzerland: IPCC.
- Kallis G, Kostakis V, Lange S, Muraca B, Paulson S, Schmelzer M. 2018. Research on degrowth. *Annu Rev Environ Resour.* 43(1):291–316. doi:10.1146/annurev-environ-102017-025941.
- Klain SC, Olmsted P, Chan KMA, Satterfield T, Zia A. 2017. Relational values resonate broadly and differently than intrinsic or instrumental values, or the new ecological paradigm. *Plos One.* 12(8):e0183962. doi:10.1371/journal.pone.0183962.
- Leavy P. 2009. Method meets art: arts-based research practice. New York, NY (USA). The Guilford Press.
- Lumber R, Richardson M, Sheffield D, Bastian B. 2017. Beyond knowing nature: contact, emotion, compassion, meaning, and beauty are pathways to nature connection. *Plos One.* 12(5):e0177186. doi:10.1371/journal.pone.0177186.
- Lundquist CJ, Pereira HM, Alkemade JRM. 2017. Visions for nature and nature's contributions to people for the 21st century. Report from an IPBES visioning workshop held on 4-8 September 2017 in *nature and nature's . . .*
- Manlosa AO, Schultner J, Dorresteijn I, Fischer J. 2018. Leverage points for improving gender equality and human well-being in a smallholder farming context. *Sustainability Sci.* 14(2):1–13.
- Mattijssen TJM, Ganzevoort W, van den Born RJG, Arts BJM, Breman BC, Buijs AE, van Dam RI, Elands BHM, de Groot WT, Knippenberg LWJ. 2020. Relational values of nature: leverage points for nature policy in Europe. *Ecosyst People.* 16:402–410. doi:10.1080/26395916.2020.1848926.
- Meadows DH. 1999. Leverage points: places to intervene in a system. Hartland: The Sustainability Institute.

- Meadows DH 2008. Thinking in systems: a primer.
- Muhr MM. 2020. Beyond words– the potential of arts-based research on human-nature connectedness. *Ecosyst People*. 16(1):249–257. doi:10.1080/26395916.2020.1811379.
- Nisbet EK, Zelenski JM, Murphy SA. 2009. The nature relatedness scale: linking individuals' connection with nature to environmental concern and behavior. *Environ Behav*. 41(5):715–740. doi:10.1177/0013916508318748.
- Ostrom E. 2009. A general framework for analyzing sustainability of social-ecological systems. *Science*. 325(5939):419–422. doi:10.1126/science.1172133.
- Otero I, Farrell KN, Pueyo S, Kallis G, Kehoe L, Haberl H, Plutzer C, Hobson P, García-Márquez J, Rodríguez-Labajos B, et al. 2020. Biodiversity policy beyond economic growth. *Conservation letters*:e12713.
- Oteros-Rozas E, Martín-López B, Daw TM, Bohensky EL, Butler JRA, Hill R, Martín-Ortega J, Quinlan A, Ravera F, Ruiz-Mallén I, et al. 2015. Participatory scenario planning in place-based social-ecological research: insights and experiences from 23 case studies. *Ecol Soc*. 20(4). doi:10.5751/ES-07985-200432.
- Palomo I, Montes C, Martín-López B, Gonzalez JA, García-Llorente M, Alcorlo P, Mora MRG. 2014. Incorporating the Social-ecological approach in protected areas in the Anthropocene. *Biosci*. 64(3):181–191. doi:10.1093/biosci/bit033.
- Pascual U, Balvanera P, Díaz S, Pataki G, Roth E, Stenseke M, Watson RT, Başak Dessane E, Islar M, Kelemen E, et al. 2017. Valuing nature's contributions to people: the IPBES approach. *Curr Opin Environ Sustainability*. 26–27:7–16. doi:10.1016/j.cosust.2016.12.006.
- Pereira LM, Davies KK, Belder E, Ferrier S, Karlsson-Vinkhuyzen S, Kim H, Kuiper JJ, Okayasu S, Palomo MG, Pereira HM, et al. 2020. Developing multiscale and integrative nature–people scenarios using the Nature Futures Framework. *People Nat*. doi:10.1002/pan3.10146.
- Pereira LM, Karpouzoglou T, Frantzeskaki N, Olsson P. 2018. Designing transformative spaces for sustainability in social-ecological systems. *Ecol Soc*. 23(4). doi:10.5751/ES-10607-230432.
- Pérez-Ramírez I, García-Llorente M, Sabán de la Portilla C, Benito A, Castro AJ. 2021. Participatory collective farming as a leverage point for fostering human-nature connectedness. doi:10.1080/26395916.2021.1912829.
- Polasky S, Bryant B, Hawthorne P, Johnson J, Keeler B, Pennington D. 2015. Inclusive wealth as a metric of sustainable development. *Annu Rev Environ Resour*. 40(1):445–466. doi:10.1146/annurev-environ-101813-013253.
- Raatikainen KJ, Juhola K, Huhmarniemi M, Peña-Lagos H. 2020. “Face the cow”: reconnecting to nature and increasing capacities for pro-environmental agency. *Ecosyst People*. 16(1):273–289. doi:10.1080/26395916.2020.1817151.
- Rana S, Ávila-García D, Dib V, Familia L, Gerhardinger LC, Martin E, Martins PI, Pompeu J, Selomane O, Tauli JJ, et al. 2020. The voices of youth in envisioning positive futures for nature and people. *Ecosyst People*. 16(1):326–344. doi:10.1080/26395916.2020.1821095.
- Rands MRW, Adams WM, Bennun L, Butchart SHM, Clements A, Coomes D, Entwistle A, Hodge I, Kapos V, Scharlemann JPW, et al. 2010. Biodiversity conservation: challenges beyond 2010. *Sci*. 329(5997):1298–1303. doi:10.1126/science.1189138.
- Raworth K. 2017. Doughnut economics. Seven ways to think like a 21st-century economist. London: Random House Business Books.
- Raymond CM, Kaaronen R, Giusti M, Linder N, Barthel S. 2021. Engaging with the pragmatics of relational thinking, leverage points and transformations– reply to West et al. *Ecosyst People*. 17(1):1–5. doi:10.1080/26395916.2020.1867645.
- Richardson M, Dobson J, Abson DJ, Lumber R, Hunt A, Young R, Moorhouse B. 2020. Applying the pathways to nature connectedness at a societal scale: a leverage points perspective. *Ecosyst People*. 16(1):387–401. doi:10.1080/26395916.2020.1844296.
- Riechers M, Balázs Á, Abson DJ, Fischer J. 2020a. The influence of landscape change on multiple dimensions of human–nature connectedness. *Ecol Soc*. 25(3). doi:10.5751/ES-11651-250303.
- Riechers M, Balázs Á, Betz L, Jiren TS, Fischer J. 2020b. The erosion of relational values resulting from landscape simplification. *Landscape Ecology*.
- Riechers M, Balázs Á, García-Llorente M, Loos J. 2021. Editorial: human-nature connectedness as leverage point for sustainability transformation. *Ecosystems and People*.
- Riechers M, Henkel W, Engbers M, Fischer J. 2019. Stories of favourite places in public spaces: emotional responses to landscape change. *Sustainability*. 11(14):3851. doi:10.3390/su11143851.
- Rockström J, Steffen W, Noone K, Persson Å, Chapin FSI, Lambin E, Lenton TM, Scheffer M, Folke C, Schellnhuber HJ, et al. 2009. Planetary boundaries: exploring the safe operating space for humanity. *Ecol Soc*. 14(2). doi:10.5751/ES-03180-140232.
- Rosengren LM, Raymond CM, Sell M, Vihinen H. 2021. Identifying leverage points for strengthening adaptive capacity to climate change. *Ecosyst People*. 16(1):427–444. doi:10.1080/26395916.2020.1857439.
- Russell R, Guerry AD, Balvanera P, Gould RK, Basurto X, Chan KMA, Klain S, Levine J, Tam J. 2013. Humans and Nature: how Knowing and Experiencing Nature Affect Well-Being. *Annu Rev Environ Resour*. 38(1):473–502. doi:10.1146/annurev-environ-012312-110838.
- Schoon M, Van Der Leeuw S. 2015. The shift toward social-ecological systems perspectives: insights into the human-nature relationship. *Natures Sciences Sociétés*.
- Shanahan DF, Bush R, Gaston KJ, Lin BB, Dean J, Barber E, Fuller RA. 2016. Health Benefits from Nature Experiences Depend on Dose. *Sci Rep*. 6(1):28551. doi:10.1038/srep28551.
- Steffen W, Rockström J, Richardson K, Lenton TM, Folke C, Liverman D, Summerhayes CP, Barnosky AD, Cornell SE, Crucifix M, et al. 2018. Trajectories of the earth system in the Anthropocene. *Proc Natl Acad Sci U S A*. 115(33):8252–8259. doi:10.1073/pnas.1810141115.
- Stenseke M. 2018. Connecting ‘relational values’ and relational landscape approaches. *Curr Opin Environ Sustainability*. 35:82–88. doi:10.1016/j.cosust.2018.10.025.
- Stern DI. 2004. The rise and fall of the environmental kuznets curve. *World Dev*. 32(8):1419–1439. doi:10.1016/j.worlddev.2004.03.004.
- Totin E, Butler JR, Sidibé A, Partey S, Thornton PK, Tabo R. 2017. Can scenario planning catalyse transformational change? Evaluating a climate change policy case study in Mali. *Futures*.
- UN. 2015. Transforming our world: the 2030 agenda for sustainable development, A/RES/70/1. <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf>.
- West S, Haider LJ, Masterson V, Enqvist JP, Svedin U, Tengö M. 2018. Stewardship, care and relational values.

- Curr Opin Environ Sustainability. 35:30–38. doi:[10.1016/j.cosust.2018.10.008](https://doi.org/10.1016/j.cosust.2018.10.008).
- West S, Haider LJ, Stålhammar S, Woroniecki S. 2020. A relational turn for sustainability science? Relational thinking, leverage points and transformations. *Ecosyst People*. 16 (1):304–325. doi:[10.1080/26395916.2020.1814417](https://doi.org/10.1080/26395916.2020.1814417).
- West S, Van Kerkhoff L, Wagenaar H. 2019. Beyond “linking knowledge and action”: towards a practice-based approach to transdisciplinary sustainability interventions. *Policy Stud*. 40(5):534–555. doi:[10.1080/01442872.2019.1618810](https://doi.org/10.1080/01442872.2019.1618810).
- Wiek A, Iwaniec D. 2014. Quality criteria for visions and visioning in sustainability science. *Sustainability Sci*. 9 (4):497–512. doi:[10.1007/s11625-013-0208-6](https://doi.org/10.1007/s11625-013-0208-6).
- Xenakis I, Arnellos A, Darzentas J. 2012. The functional role of emotions in aesthetic judgment. *New Ideas Psychol*. 30(2):212–226. doi:[10.1016/j.newideapsych.2011.09.003](https://doi.org/10.1016/j.newideapsych.2011.09.003).
- Zylstra MJ, Knight AT, Esler KJ, Le Grange LLL. 2014. Connectedness as a core conservation concern: an interdisciplinary review of theory and a call for practice. *Springer Sci Rev*. 2(1–2):119–143.