Sustainability Science (2025) 20:287–298
https://doi.org/10.1007/s11625-024-01559-6

CASE REPORT

Interplays between relational and instrumental values: insights from research experiences on human–nature relations

Maraja Riechers[1,2] · Jasmine Pearson[1,3] · Nataly Diaz-Cruz[4,5] · Stefan Ortiz-Przychodzka[1,6] · Emmeline Topp[7]

Received: 22 May 2023 / Accepted: 29 July 2024 / Published online: 27 August 2024
© The Author(s) 2024

Abstract

Relational values have become increasingly recognised within the field of social–ecological systems as an innovative and in-depth approach to uncovering the value of human–nature relationships around the world. As an emerging concept within mainstream Western academia, there is still much to learn about the potential challenges of working with relational values and how to navigate them in applied research. Drawing on empirical research from Colombia, Fiji, Germany, Romania and South Africa, this paper explores the key themes which emerged when working with human–nature relationships. We reveal complex interconnections between relational and instrumental values, livelihood practices and power and politics. We conclude by highlighting the importance of acknowledging the fluidity of relational values and their potential to bridge different worldviews and knowledge systems between researchers and communities.

Keywords Human–nature interactions · Relational values · Social–ecological systems · Sustainability science · Valuation · Worldviews

Introduction

Newest climate records (WMO 2024) exemplify that our biodiversity and climate crises necessitate immediate and transformative action in public decision-making and planning processes to alter the current, unsustainable trajectory of Earth's systems and pave the way towards fairer and more sustainable futures (Rockström et al. 2023). To break the vicious cycles of the global environmental crisis enhancing unsustainable behaviour patterns and vice versa (Chaplin-Kramer et al. 2019), incorporating nature's diverse values into decision-making could be one avenue (IPBES 2022; Pascual et al. 2023). Environmental policies have privileged instrumental values within generally unequal market relationships (Muradian and Gómez-Baggethun 2021), favouring those values that are more easily translatable into monetary terms (TEEB 2010). Other types of values, including non-monetary and relational ones, generally go unnoticed (IPBES 2022). By determining which and whose values are articulated and acknowledged and which are overlooked (e.g. market/monetary values being privileged against nonmaterial values)

Maraja Riechers and Jasmine Pearson have worked equally on this manuscript and can both be contacted as corresponding authors.

Handled by Shizuka Hashimoto, Tokyo Daigaku, Japan.

✉ Maraja Riechers
Maraja.Riechers@thuenen.de

✉ Jasmine Pearson
jasmine.pearson@rmit.edu.au

[1] Social-Ecological Systems Institute, Leuphana University Lüneburg, Universitätsallee 1, 21335 Lüneburg, Germany

[2] Fisheries and Society Group, Thünen Institute of Baltic Sea Fisheries, Alter Hafen Süd 2, 18069 Rostock, Germany

[3] The School of Global, Urban and Social Studies, Centre for Urban Research, Royal Melbourne Institute of Technology (RMIT) University, Melbourne, Australia

[4] Environmental Studies Institute-IDEA, National University of Colombia, Bogotá, Colombia

[5] Space, Technology and Participation Research Group (ESTEPA), National University of Colombia, Bogotá, Colombia

[6] Economy, Environment and Alternatives to Development (GEAAD), National University of Colombia, Bogotá, Colombia

[7] Social-Ecological Interactions in Agricultural Systems, Faculty of Organic Agricultural Sciences, University of Kassel, Kassel, Germany

(Zafra-Calvo et al. 2020), we may be able to recognise a plurality of visions towards sustainability transformations (Abson et al. 2017; Horcea-Milcu et al. 2023).

To foster this transformation, the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), drawing on the Millennium Ecosystem Assessment (Millennium Ecosystem Assessment 2005), published a conceptual framework putting forth the notion of nature's contributions to people (NCP) organised in the three overlapping groups of regulating, material and nonmaterial NCP (Díaz et al. 2018). One suggested way of valuing NCP is through instrumental, intrinsic and relational values (Díaz et al. 2015; Pascual et al. 2017; Schröter et al. 2020). While instrumental values are attributed to something as a means to achieve a particular end (Box 2.2 IPBES 2016), intrinsic values are attributed to an inherent moral value to entities that can be legitimately considered as subjects-of-a-life or ends in themselves in a moral sense (Himes and Muraca 2018). Relational values, in turn, can be defined as preferences, principles and virtues from relationships with nature (individually, shared interpersonally or articulated by policies and institutions) (Chan et al. 2018, 2016) and focus on the relational *content* of the valuation process (and not on the valuation *process* itself, which is always relational, Himes and Muraca 2018) (Gould et al. 2023). Both, relational and instrumental values generally refer to relations that contribute to human's well-being and flourishing (Deplazes-Zemp and Chapman 2021). Yet, in contrast to instrumental values, relational values are non-substitutable because the relationship with a natural entity or process that is of value cannot be replaced (such as eudaimonic values which are moral considerations regarding what is a good life, Chan et al. 2018).

Whereas the framing of relational values is relatively new, the research on this topic has skyrocketed (Himes et al. 2024). The framing incorporates decade-long studies around human–nature relations of various disciplines and has synthesised nine groups of relational values (Riechers et al. 2022): (1) identity, (2) heritage and tradition, (3) social relationships, (4) attachment to places and natural entities, (5) stewardship and responsibility, (6) knowledges, (7) spiritual and religious, (8) aesthetics and inspiration and (9) psychological and therapeutic values. Relational values, hence, help to understand the connections and meaningful relationships between humans and nature, as well as human–human relations (Lehnen et al. 2022) that stem from interactions with and in the natural environment (Muraca 2011). To add to the complexity, natural entities to which people associate relational values may vary and include everything from individual species (Marquina et al. 2022; Skubel et al. 2019), to geographic features, locations, or ecosystems (Riechers et al. 2019; Schmitt et al. 2022; Topp et al. 2022) to concepts and generalisations such as biodiversity or "nature" as a whole entity.

One of the areas in regard to relational values where more exploration is needed is on the linkages between instrumental and relational values (Deplazes-Zemp and Chapman 2021). Recently, researchers had difficulty distinguishing quantitatively assessed relational and instrumental values in practice (See et al. 2020), as conceptually those two value "categories" can be overlapping when analysed in more depth (Chan et al. 2018, 2012; Gould et al. 2023; Muraca 2011). These overlaps call for more research on values' fluidity and elasticity, especially in the context of barriers for the inclusion of diverse values of nature into decision-making (Pascual et al. 2023) and (in)formal institutions (Chapman et al. 2019; Manlosa et al. 2023). Instrumental and relational values might be dynamically linked through, e.g. the multiple ways by which humans make a living interrelated with natural entities (e.g. Gibson-Graham and Miller 2015). In addition, power relations influence and are influenced by relational values (e.g. gendered asymmetries, unequal resource access) (Jacobs et al. 2020; Pascual et al. 2023). In this paper, we aim to answer the research question of how instrumental and relational values can be intertwined and highlight the fluidity of relational and instrumental values in practice by drawing on five empirical (qualitative and quantitative social science) research projects from four continents. In the following, we highlight our methodological process and then discuss our insights on (1) the interplays between relational values, instrumental values and livelihood practices, (2) relational values, instrumental values and their interplay with power and politics and (3) our lessons learnt and suggested ways forward.

Methodological process

In this article, we draw on results from five empirical social science research studies to analyse how instrumental and relational values can be intertwined. The five studies conducted by the authors empirically investigated human–nature relations in four continents (Africa, Europe, Oceania, South America) and five countries (Colombia, Fiji, Germany, Romania and South Africa). Although not all these studies were initially framed in terms of "relational values" specifically, all studies draw on concepts that are encompassed by the broad framing of "relational values" (see similar approach in Riechers et al. 2022). We used the conceptual framing of relational values a posteriori to re-analyse and interpret the individual datasets and empirical findings of each case study for this article. For our comparison, we applied a relational value framing defining relational values as "preferences, principles, and virtues associated with relationships, both interpersonal and as articulated by policies and social norms" (Chan et al. 2016, p 1462). Relational value can arise from human–nature relations (e.g. sense of place, cultural heritage) and from human–human

interactions (e.g. social relations) that stem from interactions with and within the natural environment and its entities (Muraca 2011). Hence, we use relational values both as a discrete category of analysis and as a boundary object to bridge between our different studies (Stålhammar and Thorén 2019) by acknowledging that values emerge from relationships.

The methods and approaches of the research done in the different projects can be found in Box 1, Fig. 1, Table 1 and Supplementary 1. Commonality between all the projects were that each study was based on empirical data (qualitative and quantitative) collected from stakeholders in a social–ecological system of interest. Data collection methods were qualitative interviews, quantitative surveys and participatory mapping (Box 1). For this synthesis article, we used a systematic approach through asking us a series of questions designed to stimulate reflection on how the studies revealed relational values. These questions were developed

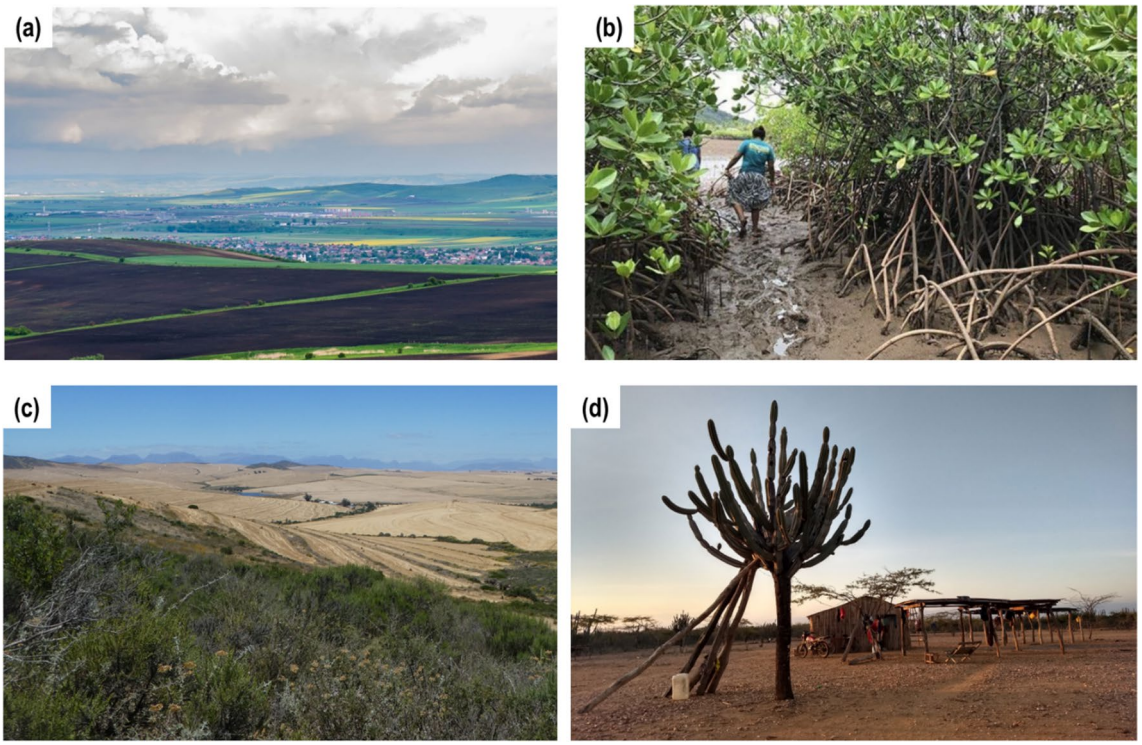

Fig. 1 Some of the case study landscapes that this synthesis paper draws upon. **a** Transylvania, Romania; **b** Vanua Levu, Fiji; **c** Cape Floristic region, South Africa; **d** Wayuu territory, Guajira, Colombia

Table 1 Relational values across each case study

Case study	Relational value categories	References
Romania and Germany	Aesthetics, care/stewardship, cultural and individual identity, sense of place, spiritual, social relations, social responsibility, social cohesion, social memory	Riechers et al. (2021a, b)
Fiji	Aesthetic and inspiration, cultural identity; customary law, educational, environmental awareness, knowledge sharing and reciprocity, empowerment and autonomy, social relations, spiritual; stewardship, therapeutic values	Pearson et al. (2019, 2020, 2021)
South Africa	Aesthetics, family ties and future generations, interdependency of nature and farming, moral duty and concern for nature, recreation and leisure, sense of place, sensing wildlife and nature	Topp et al. (2022)
Colombia	Cultural identity and heritage, sacredness, sense of place, care, social cohesion, territory and political action, well-being and flourishing	Consuegra et al. (2021), Ortiz et al. (2021a, b), IDEA and ESTEPA (2020), Diaz Cruz (2019)

based on our previous discussions within the social–Ecological Systems Institute (SESI) at Leuphana University Lüneburg, Germany (see supplementary 2), and split into categories, such as methodological approach, conflicts and contrasts, and benefits and challenges of using relational values as an analytical framework. Based on literature (e.g. Arias-Arévalo et al. 2018; Chan et al. 2018; Himes and Muraca 2018), we identified in our research data: (a) relational value categories and (b) contextual categories based on the discourses of the people and communities. Once all authors had finished compiling the relevant information into a database, the main author identified the common and diverging themes of (1) interplays between relational values, instrumental values and livelihood practices and (2) their interplay with power and politics, across the case studies using summarising qualitative content analysis (Mayring 2008). Then, the overarching themes and how they are reflected in the different case studies were discussed in depth. By reflecting and discussing our research experiences, we derived insight as to how relational values have been applied in real-world cases and to what extent they could be a helpful concept in social–ecological system science. The results of these discussions were finalised in this article. Table 1 below provides an overview of the types of specific relational value categories that were identified across each case study.

Box 1 Short description of the case studies that this synthesis paper draws upon. Articles on these projects can be found in supplementary 1

Romania and Germany

Based on 73 interviews and 819 questionnaires (collected between 2016 and 2018) in *Transylvania*, Romania and *Lower Saxony*, Germany. The interviews were conducted with experts of the landscapes, such as long-term residents, foresters, farmers, etc., and the questionnaires used a stratified random sampling with inhabitants above 16 years of age. Landscapes were selected on their difference in land-use intensity and landscape changes. Further, we included one small-scale art-based research in Lower Saxony, Germany, done with a group of interested inhabitants. All research projects covered relational values specifically, as well as human–nature connectedness more broadly. The relational values were linked to agricultural landscapes and to specific biophysical aspects (such as trees, a view or a whole landscape)

Fiji

In 2017, 41 interviews were conducted with *iTaukei* (Indigenous Fijian) communities across six coastal and rural village sites within the Bua Province of Vanua Levu, Fiji. Purposive sampling was used to select key knowledge holders on mangrove ecosystems. *iTaukei* women are traditionally responsible for collecting resources from and taking care of mangrove ecosystems. Therefore, most interviewees were with women. The interview guide was structured to explore the ways in which participants interact with, use and value mangrove ecosystems. To elicit values of mangroves, participants were asked questions such as: *why are mangrove ecosystems important to you?* With the consent of participants, interviews were recorded so they could be transcribed and analysed. Using a relational value lens, the interview transcripts were coded into 12 relational value categories in MAXQDA software. Relational values were predominantly linked to culture and heritage; stewardship; and social relations

South Africa

Thirty semi-structured interviews were conducted in 2017 and 2018 with land managers in the *Swartland, Western Cape*, South Africa. Interviewees were managing land that contained fragments of renosterveld, a critically endangered shrubland habitat that is globally recognised for biodiversity. The majority of interviewees were also farming cereals and/or vines. The interviews were designed to elicit intrinsic, instrumental and relational values and were analysed qualitatively. Relational values were categorised into seven categories, covering interactions with nature, appreciation of nature and ethics related to nature on farmland. Values were also linked to knowledge and rule types as well as nature's contributions to people (Díaz et al. 2015)

Colombia

The fieldwork in Colombia covered three main areas of the country: the Northern Caribbean with the *Wayuu* and the *Arhuaco* Indigenous people, the Central-East Andes with smallholder farmers and inhabitants of rural areas of Bogota and the Southern Andes with the Nasa Indigenous people. The data was collected from 2016 to 2020, during different projects financed by institutions such as FAO, UN Women and Bogotá's Botanical Garden. All these studies addressed people's experiences and perceptions of human–nature relations as part of their livelihood practices or daily life routines. The methods included focus groups, participatory mapping and walking interviews with community leaders, both men and women. The work with the Wayuu included most of the members (70 people) of two different communities (Machonutchi and Mashelarrain) who shared in collaborative mapping sessions their knowledge about the human–nature relations that give shape to their territory. The research with the smallholder farmers of rural Bogota applied 47 semi-structured interviews, with the Arhuaco and the Nasa two focus groups each with 15 to 20 people, depicting their relations to cultivated and non-cultivated biodiversity. Relational values were mostly linked to categories including cultural heritage and identity, sacredness, sense of place and social cohesion

Interplays between relational values, instrumental values and livelihood practices

Our analysis and discussion highlight the fluidity of relational and instrumental values in practice that might be explained through the strong connection we found between relational values and livelihood practices. Gibson-Graham and Miller (2015) define livelihood practices as the multiple ways through which humans make a living, which are interrelated with non-human/nature's living and well-being. While livelihood practices fundamentally involve instrumental relationships, relational values can also emerge from them (Ortiz-Przychodzka et al. 2023). These interplays contribute to recognise the social and ecological integrations of livelihood practices (Gibson-Graham and Miller 2015). Here, we highlight two differing ways in which instrumental and relational values can interact with livelihood practices: (1) instrumental values and livelihood practices eroding relational values and (2) instrumental values, livelihood practices and relational values strengthening each other.

Instrumental values and livelihood practices can erode relational values

Results from a large-scale quantitative study on relational, intrinsic and instrumental values in Romania and Germany suggest that instrumental values had a tendency to be inversely related to relational and intrinsic values of nature (see Riechers et al. 2021a). Specifically, instrumental values seemed to increase with land-use intensity, while intrinsic and relational values decreased. Adding to this, results from a qualitative study only in the German study areas showed that different priorities and values of nature between social groups can cause contrasts and potential conflicts between these groups (in this study, mainly large-scale farmers focused on instrumental values and smaller-scale farmers and inhabitants prioritised relational values) (Riechers et al. 2021b). Further, Transylvania, Romania, when the socioeconomic paradigm shifted from a pre-socialist and socialist to a capitalist society, the property rights were privatised. These changes disrupted the relations inhabitants and land owners were able to form with their rural landscape, favouring individual instrumental values over collective relational values to land (Balázsi et al. 2019).

A similar story was apparent in the results from Colombia. The majority of contrasts in regard to resource use between actors in the study area in rural Bogota arose from conflicting relational and instrumental values. Although most of the smallholder farmers of the conducted participatory research shared a similar narrative on the importance of their relation to land and biodiversity as a base of their territorial identity reflecting relational values, some seemed to prioritise the instrumental values through market opportunities (Consuegra et al. 2021). This study revealed conflicting values when some groups expressed the will to preserve land and biodiversity (and their relationship with them), while others prioritised the expansion of monocultures for market-oriented food production responsible for deforestation and biodiversity loss. Similar divergences emerged when talking about the use and extraction of forest products, such as wild berries for local consumption versus commercialisation of the products in urban markets. Some farmers considered that the commercialisation and opening up to a market could trigger the overexploitation and the destruction of biodiversity and peoples' relational values therewith, while others wanted to explore the opportunities for income generation (Ortiz et al. 2021a).

In the Fiji case study, some people expressed sorrow and frustration at declining mangroves and their resources (i.e. mud crabs). The key threats to mangroves mentioned by participants were local clearing, sawmill companies and loss of traditional ecological knowledge related to the mangrove ecosystems (Pearson et al. 2019). For example, one interviewee of this study stated: "Before, we respect the importance of the mangroves but now, everything has changed. People make changes with their mind. It is no good. Many people have changed their mind. We used to talk about the mangroves and their uses back in the day". Like many other Indigenous communities in different geographies, intertwining impacts from Westernisation and climate change in Fiji has led to the erosion of Indigenous and local knowledge and worldviews over time (Pearson et al. 2021). When asked about whether such knowledge was being passed onto younger generations, another interviewee added: "We have been transferring it but it has not been effective…" because "…young people rely on coral reefs for a living" (Pearson et al. 2019). This implies that younger generations are more interested in learning about ecosystems that provide the most income. With the rise of urbanisation and associated socioeconomic challenges in Fiji, instrumental values of economic gain are beginning to override relational values of stewardship and care for mangrove ecosystems.

Our research also suggests that a clear identification of relational values in contrast to instrumental values can sometimes be difficult due to their interlinkages and fluid connections. In some cases, relational values changed to instrumental values over time because of the difficulties of subsisting in rural areas facing harsh environmental conditions or away from state actions that can enable social welfare (IDEA and ESTEPA 2020). For example, research involving the Nasa Indigenous people as well

as the Wayuu people in Colombia showed that commercial, monetary income generation through the extraction of natural fibres used in traditional weaving practices by Nasa women, and the possibility of gaining more income by introducing trade symbols in the Wayuu weaves, risked shifting the focus on relational values involved in the meanings and symbols of fabrics into one on marketing strategies. Results indicated that commercialisation could empty the symbols of their meanings and radically transform the traditional practices and values involved, and even erode their symbolic world (Ortiz et al. 2021b; IDEA and ESTEPA 2020). This process is linked to the commodification of culture and traditional practices by transforming their values into merely instrumental ones (Muraca and Bulgarian Academy of Sciences 2016; Rico García-Amado et al. 2013).

Conflicts between livelihood practices and relational values also emerged, especially in the German case studies in which land-use intensity was high and landscape change was rapid and widespread. Interviewees argued that the current capitalistic structure that fosters large, intensive agriculture companies instead of smaller farms forces farmers into unsustainable agricultural practices to be able to keep their farms economically viable. Many farmers had to give up their long-term family farm due to this constant need for investments and growth. If such a growth would proceed, contrasts may emerge between the smaller and larger farms, as farmland from smaller farms often was integrated into the larger growing farms. Yet, contrasts may also emerge between farmers (large and small) and conservation NGOs or inhabitants who dislike the growing monoculture landscape (Riechers et al. 2019, 2021a). However, it has been widely understood by the interviewees that the economic and political systems are forcing farmers to grow and did not always blame the farmers themselves (Lübker et al. 2021). Similar patterns were observed in South Africa, where historically, native vegetation was viewed as wasteland and converted to cropland and, more recently, farm consolidation has resulted in large-scale monocultures with few remaining natural vegetation fragments. Interviewees reflected on multiple relational values that they have with remaining renosterveld vegetation fragments while acknowledging the conflict in sustaining these values within the local agricultural economy (Topp et al. 2022). These values included fundamental and place-based values (e.g. sensing wildlife and nature, sense of place, family ties and future generations). These values were judged to be relational given their psychological, emotional and/or intellectual aspect of human–nature connection, and the fact that they could be defined by a perceived relation between the person expressing the value and the landscape or element of nature.

Relational values, instrumental values and livelihood practices can strengthen each other

The Colombian case studies showed that a close link between instrumental and relational values can also strengthen these values by re-defining, updating or reinterpreting them—mainly by a new generation of Nasa (drawing on a personal communication with a Nasa Indigenous leader). In the Nasa communities and others from Southern Colombia, relational values linked to barter trading have been used for political processes of 're-Indigenisation', i.e. the recovery of Indigenous cultures, languages and practices that have been lost through generations (Quijano 2012).

From the study with Wayuu Indigenous communities (IDEA and ESTEPA 2020; Diaz Cruz 2019), we found that the instrumental and relational values of water and rain in the area are strongly interlinked and support each other. Wayuus value water instrumentally because it allows them to hydrate in extremely dry conditions, as well as to grow food and feed their cattle: "water is the fundamental basis of every daily activity by the community. So, when it rains, we are happy" (Machonutchi's Wayuu woman). Simultaneously, water and rain are valued relationally because their dynamics reflect the well-being and flourishing of the human–nature community as a whole including soil, plants, people, animals and forests. Nowadays, increasing water shortages are recognised as a threat to the Wayuu's cultural identity and traditional way of life. For instance, some adults communicated a lack of confidence in passing on their local knowledges and values to the younger generation because of the rapid changes of the hydrological cycles: "it is no longer possible to trust the seasons, which is why we have increased dependency on water brought by tanker trucks" (personal communication with a Wayuu women Indigenous leader for the study by Diaz Cruz 2019). They also acknowledge that biodiversity is at risk, including cactus forests associated with the health of the territory, dry forests with medicinal and ornamental shrubs, and sacred plants with the power to drive away illness and bad spirits. The Wayuu way of living exists because of their different uses of water (instrumental values), and because water mediates the relationship with the forests and soils, which are fundamental for their identity (relational values). These intertwinements of relational and instrumental values of water mutually support the achievement of interrelated human and non-human well-being. In this sense, the relevance of water and biodiversity to satisfy human needs in the Wayuu territory goes hand in hand with its importance to keep the cultural identity, stewardship principles and social cohesion of this Indigenous group and its future survival as a nation.

The Arhuaco people in Northern Colombia state that all practices that involve the use of the land's elements must be guided by their common principle of a general

interconnectedness of life (Ortiz et al. 2021b). Such an equilibrium depends on the exchanges between spiritual leaders and the different beings and spirits that inhabit the territory, including material and immaterial offerings and communication processes undertaken in specific places of their land (Ortiz et al. 2021b). Decisions on land management and livelihood practices, such as cropping or using forest resources, hence, rely on the guidance of spiritual leaders (personal communication during fieldwork for the study by Ortiz et al. 2021b). In this case, instrumental values, such as the value of the seeds and crops offered to the land, and relational values, such as the values of the places where the offerings are made, reinforce each other. The instrumental values of land and of forests emerge as collective values from the decisions about the permitted uses of the ecosystems, guided by the notion that all human and non-human beings are interconnected and have a single origin. The combination of the relational values, expressed in the immateriality of exchanges and the stewardship of the land, and instrumental values guiding the materiality of practices is key for taking decisions on land management and on livelihood practices supporting the community's well-being and cultural identity. In South Africa in the Cape Floristic Region, another example of where economic practices may create relational values was with ecotourism. By looking for alternative means of income from the native renosterveld habitat, land managers may create opportunities for learning, family ties, inspiration and various other relational values with nature (Topp et al. 2022). It may be surmised that both an awareness of the elements of nature, such as wildlife and climate, and a recognition of a role of care were thus perceived as key to productivity.

In the case study of Fiji, relational and instrumental values of mangrove ecosystems were found to be closely linked through collectively gathering resources and therewith strengthening knowledge and social relations. Mangrove ecosystems provide an array of beneficial contributions to the iTaukei people, which they depend on heavily to maintain their semi-subsistence livelihoods (Pearson et al. 2019). Mangrove resources such as mud crabs, fish and other marine resources are a large part of the traditional iTaukei diet and provide a main source of income for local fishers. iTaukei women often spend time together in mangrove environments, collecting resources and sharing knowledge, contributing to social relations and cultural values. Other important materials gained from mangroves include firewood, building materials, herbal medicine, traditional garlands and dye (often used for purposes such as traditional art, furniture varnish and hair dye). The instrumental value of the material contributions of mangrove ecosystems expressed by iTaukei people forms the basis of their relationship with mangroves and associated relational values. Drawing on these instrumental-relational values, traditional ecosystem management strategies have been put in place by iTaukei people for countless generations. Mangrove replantation, protected *tabu* areas and knowledge sharing through oral traditions are some of the key techniques used by iTaukei people to conserve mangroves and their resources (Pearson et al. 2020).

Relational values, instrumental values and their interplay with power relations

Power relations are at the centre of most environmental conflicts, often influencing valuation and decision-making practices by determining which and whose values are articulated and acknowledged and which are overlooked (Jacobs et al. 2020). Our research experiences highlight the fluidity of relational and instrumental values in practice by showing how power relations operate through relational values in situations of gendered asymmetries and grassroots movements' political struggles. This, in parts, relates to a process called "co-production"—i.e. the process by which humans manage resources to co-produce relational and instrumental values, amongst others, which support people's quality of life (Palomo et al. 2016).

Relational values are veiled by gendered power asymmetries

The study in South Africa highlights the impacts of colonial and apartheid legacies throughout land decision-making. In this case study, landowners were mostly white male commercial farmers and land managers with predominantly instrumental values on farmland (Topp et al. 2022, 2021). Other farm dwellers and labourers may have different relational values for nature on farmland, possibly reflecting pre-colonial or alternative social–ecological relations. For instance, farm dwellers may value unfarmed areas of veld for hunting opportunities of specialty meat (Topp et al. 2021). However, these stakeholders currently have very little influence in farming decision-making that includes decisions for biodiversity conservation (Crane 2006). Similarly, in Fiji, gendered asymmetries within power dynamics were found to be a key issue in mangrove ecosystem management (Thomas et al. 2021; Yang et al. 2018). Women are often seen as subordinate in society, which means their vital role in ecosystem management guided by relational values is often undervalued. Despite their inherent role in collecting mangrove resources, iTaukei women were not involved in key decision-making processes around mangrove ecosystem management at a village level (Pearson et al. 2019). This power imbalance means that the strong relational values of stewardship and care held by iTaukei women are often left out of the discussion.

Relational values can be strengthened by grassroots movements and the empowerment of local communities

In our case study with the Nasa Indigenous people in Colombia, results showed that relational values of the Nasa people were strongly involved in political actions regarding the defence of their collective land rights and demands for land. The Nasa see themselves and their culture as inseparable from the elements of the unity of life—territory and land—which include all elements of biodiversity. These relational values are also part of the Nasa's narratives of political resistance in face of multiple threats of land dispossession and cultural erosion. Nasa people understand that it is through their worldviews (and the relational values that derivate from them) that they can exist as a community, find cohesion and coordinate collective action to defend their rights to territory from land grabbing, agro-industrial expansion, drug trafficking and large-scale mining-energy projects in their land.

In this line, the Wayuu Indigenous people in the Caribbean region of Colombia have advocated for their right to clean water sources in their territory on the basis of the value of water as part of their cultural identity. Our research shows how the Wayuu have connected with academia, private sector and international organisations to find temporary solutions to obtain a better access to water amidst the scarcity triggered not only by the arid conditions, but also by the intensive use of water by coal mining companies. Moreover, stressing the relational values of water and ecosystems, the Wayuu have pushed governments and mining companies to be held accountable for the environmental degradation that is seriously threatening the communities' livelihoods and cultural rights (Interview with the traditional authority from Machonutchi, IDEA and ESTEPA 2020). The Wayuu nation's struggle has become a wider claim to recognise the role of Indigenous people in preserving the tropical dry forest, including its relational values, in face of the threats of overexploitation.

These examples imply that, for instrumental values and livelihood practices to strengthen and work with relational values, the adequate political and infrastructural environment must be built by the governing forces. For this, decision-making processes need to give space for the expression of relational values, especially those held by women and diverse collectives in their relationship with the environment, which have shown to enhance pathways for sustainability and well-being (Harcourt 2023). Additionally, the strong interplays between access to resources and property rights and relational values need to be recognised in environmental policies. This is especially important when there are policy or regime changes that can hinder the expression of relational values and their inclusion in land and resource management. Finally, our research experiences suggest that bottom-up initiatives and collective action can use relational values as a lever for moving transformative action forward by stressing the inextricable links between people and their land.

Lessons learnt and ways forward

Our synthesis from four continents showed how relational values can help us disentangle complex social–ecological systems and highlighted challenges and aspects for further research. The fluid nature of relational values was one of the most remarkable aspects that we experienced throughout our case studies. Relational values can be transformed by livelihood practices, by political paradigms and landscape changes. Depending on the inhabitants' perception of nature, relational values can differ between social groups and can often be limited by socio-political constraints such as unequal access or land ownership. Worldviews are not static, and neither are relational values. Economic needs (income generation and market opportunities, or livelihood activities) or political struggles (e.g. women fighting for empowerment) can influence the preference or creation of relational values. Such changes may bring conflicts over the interpretation of worldviews, linked to changing agricultural and handcraft (weaving, textiles) practices. Many of our case studies experienced an expansion of monocultures or exploitation (e.g. *Furcraea cabuya*, coffee, Maize, cereals, mining) with subsequent soil erosion and water pollution. This may lead to conflicts and contrasts involving relational and instrumental values, especially when traditional economic practices are given up or changed into environmentally detrimental ones (while still creating similar relational values, such as the Nasa Indigenous practices of weaving and sewing with new plastic material or fibres from monoculture).

We further learnt that the perspective brought by a relational values framing can help researchers to understand that people's engagement with land is guided by multiple thoughts, feelings, perceptions and representations. One example was in the work with the Arhuacos and the Nasa Indigenous communities in Colombia, when working on a project funded by rural development institutions, as researchers we realised that we had to bridge between different ways of being (e.g. ontologies). The institutions were drawing on economic logic to shape the project's objectives towards the commercialisation of agricultural products, whereas Indigenous communities had a wider and more social–ecological understanding of their relations with land. While for institutions, agriculture was only about producing food for the markets, for the Arhuacos and the Nasa, it was also about strengthening the relations with their culture, the ecosystems and their land. Recognising relational values allowed us, as

researchers, to bridge these different perspectives and suggest an integrative approach (Ortiz et al. 2021b).

Our case studies show attempts to describe the meanings that people attach to and build with ecosystems, thereby widening the scope of what can be considered 'value' in an ecosystem. Ecosystem service valuation is often based on utilitarian preferences expressed in monetary terms rather than multiple meanings (Muradian and Gómez-Baggethun 2021). Identifying these meanings can enable the researcher to understand people's inner worlds, how these are tied to their landscapes and what this may mean for landscape and livelihood decision-making, and, from there, introduce a pluralistic valuation of nature (Pascual et al. 2023). For example, in South Africa, renosterveld habitat was linked to the concept of family, both as a relational value, in the sense that the habitat is part of family history and is important heritage for future generations, and in the practical sense that it provides a place for family livelihood activities and bonding.

Relational values can be useful to make that bridge between the researchers and the involved project actors in an open and clear way. The communities with which we worked were conscious about differences in worldviews between them and the development agencies leading the decision-making processes, while the latter usually were not aware and did not acknowledge those differences. This misunderstanding reflected the limitations of having too rigid categories of values and not being able to establish an open dialogue about it (e.g. Feola et al. 2021). Similar problems were described by Blaser (2009) in a case study with Indigenous communities in Northern Paraguay, in which rural development agencies misunderstood the complexity of underlying values guiding people's hunting practices. These reflections show how relational values can effectively become a boundary object to promote dialogue between differing ways of being and knowing in research and action and provide more comprehensive visions of human–nature relationships (Stålhammar and Thorén 2019). Put simply, focusing on people's relationships and connections to and within nature can enhance processes of co-managing our land- and seascapes.

In light of our discussions, we call for future studies that aim to critically examine the interplays between instrumental and relational values and to what extent such values are influenced by power relations. Such insights would help to create a more comprehensive understanding on the fluidity of values and how they can be shaped over time. Given the global disconnection between humans and non-human entities, there is a growing need for solutions that lead to stronger human–nature relationships (Riechers et al. 2021b). Empirical studies on the constraints that inhibit relational values and the enablers that nurture relational values offer a crucial step to achieving this outcome. In turn, this information could be utilised by policymakers, practitioners and other decision-makers to develop strategies that reduce unsustainable human behaviour and promote human–nature connectedness.

Concluding remarks

Drawing upon diverse case studies from different social–ecological contexts around the world, we were able to derive common themes from our experiences as researchers working with relational values. We found that instrumental values can sometimes erode, but in other cases, strengthen relational values (and vice versa). Similarly, livelihood practices have the potential to erode or foster relational values depending on the context. Finally, power and politics play a key role in the influence of instrumental values and livelihood practices on relational values. We hereby argue that a just and fair socio-political environment is essential for creating, maintaining and/or strengthening relational values. This paper illustrates the complexity behind relational values by critically analysing their interplays with instrumental values, livelihood practices and power. With these discussions, we hope to contribute insights into the field of relational values and inspire future research that investigates the nuanced and intricate dynamics between instrumental and relational values, and the factors that drive them.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s11625-024-01559-6.

Acknowledgements We thank Berta Martín-López for the inspiration of this collaboration. We also thank all the communities and people who shared with us their thoughts and ways of living with us. During the co-authoring of this paper, Stefan Ortiz-Przychodzka was funded by the German Ministry for Education and Research (BMBF, Grant Number 01UU1903).

Author contributions MR contributed to the manuscript conception and design. Material preparation, data collection and coding were performed by all authors. MR led to the analysis and interpretation of the results. The first draft of the manuscript was written by MR and all authors commented on previous versions of the manuscript. JP led the editing and coordination of the manuscript structure. All authors read and approved the final manuscript.

Funding Open Access funding enabled and organized by CAUL and its Member Institutions.

Data availability Due to the collaborative nature of this paper, each co-author contributed their experiences and empirical insights from separate projects. Therefore, we are not able to share our collective datasets due to conflicting data management and ethical procedures across research projects.

Declarations

Conflict of interest None.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, 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 licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence 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. To view a copy of this licence, visit http://creativecommons.org/licenses/by/4.0/.

References

Abson DJ, Fischer J, Leventon J, Newig J, Schomerus T, Vilsmaier U, von Wehrden H, Abernethy P, Ives CD, Jager NW, Lang DJ (2017) Leverage points for sustainability transformation. Ambio 46:30–39. https://doi.org/10.1007/s13280-016-0800-y

Arias-Arévalo P, Gómez-Baggethun E, Martín-López B, Pérez-Rincón M (2018) Widening the evaluative space for ecosystem services: a taxonomy of plural values and valuation methods. Environ Val 27:29–53. https://doi.org/10.3197/096327118X15144698637513

Balázsi 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. https://doi.org/10.1016/j.landusepol.2019.104232

Blaser M (2009) The threat of the yrmo: the political ontology of a sustainable hunting program. Am Anthropol 111:10–20. https://doi.org/10.1111/j.1548-1433.2009.01073.x

Chan KMA, Satterfield T, Goldstein J (2012) Rethinking ecosystem services to better address and navigate cultural values. Ecol Econ 74:8–18. https://doi.org/10.1016/j.ecolecon.2011.11.011

Chan KMA, Balvanera P, Benessaiah K, Chapman M, Díaz S, Gómez-Baggethun E, Gould R, Hannahs N, Jax K, Klain S, Luck GW, Martín-López B, Muraca B, Norton B, Ott K, Pascual U, Satterfield T, Tadaki M, Taggart J, Turner N (2016) Opinion: why protect nature? Rethinking values and the environment. Proc Natl Acad Sci USA 113:1462–1465. https://doi.org/10.1073/pnas.1525002113

Chan KM, Gould RK, Pascual U (2018) Editorial overview: relational values: what are they, and what's the fuss about? Curr Opin Environ Sustain 35:A1–A7. https://doi.org/10.1016/j.cosust.2018.11.003

Chaplin-Kramer R, Sharp RP, Weil C, Bennett EM, Pascual U, Arkema KK, Brauman KA, Bryant BP, Guerry AD, Haddad NM, Hamann M, Hamel P, Johnson JA, Mandle L, Pereira HM, Polasky S, Ruckelshaus M, Shaw MR, Silver JM, Vogl AL, Daily GC (2019) Global modeling of nature's contributions to people. Science 366:255–258. https://doi.org/10.1126/science.aaw3372

Chapman M, Satterfield T, Chan KMA (2019) When value conflicts are barriers: can relational values help explain farmer participation in conservation incentive programs? Land Use Policy 82:464–475. https://doi.org/10.1016/j.landusepol.2018.11.017

Consuegra C, Ortiz S, Cely Santos M, Van der Hammen MC, Pérez D (2021) Plantas que toda la vida han estado": una co-investigación alrededor de la cocina y las relaciones bioculturales asociadas a plantas alimenticias locales en la ruralidad de Bogotá. RASV 23:163–185. https://doi.org/10.17151/rasv.2021.23.2.8

Crane W (2006) Biodiversity conservation and land rights in South Africa: whither the farm dwellers? Geoforum 37:1035–1045. https://doi.org/10.1016/j.geoforum.2006.07.002

Deplazes-Zemp A, Chapman M (2021) The abcs of relational values: environmental values that include aspects of both intrinsic and instrumental valuing. Environ Val 30:669–693. https://doi.org/10.3197/096327120X15973379803726

Díaz S, Demissew S, Carabias J, Joly C, Lonsdale M et al (2015) The IPBES Conceptual Framework—connecting nature and people. Curr Opin Environ Sustain 14:1–16. https://doi.org/10.1016/j.cosust.2014.11.002

Díaz S, Pascual U, Stenseke M, Martín-López B, Watson RT, Molnár Z, Hill R, Chan KMA, Baste IA, Brauman KA, Polasky S, Church A, Lonsdale M, Larigauderie A, Leadley PW, van Oudenhoven APE, van der Plaat F, Schröter M, Lavorel S, Aumeeruddy-Thomas Y, Bukvareva E, Davies K, Demissew S, Erpul G, Failler P, Guerra CA, Hewitt CL, Keune H, Lindley S, Shirayama Y (2018) Assessing nature's contributions to people. Science 359:270–272. https://doi.org/10.1126/science.aap8826

Díaz Cruz N (2019) J'ALEJE KUAT TÜ WUINKAT: De dónde viene y hacia dónde va el agua en Machonutchi y Mashalerrain. Working paper for UN Women Colombia

Feola G, Koretskaya O, Moore D (2021) (Un)making in sustainability transformation beyond capitalism. Glob Environ Change 69:102290. https://doi.org/10.1016/j.gloenvcha.2021.102290

Gibson-Graham JK, Miller E (2015) Economy as ecological livelihood. In: Gibson K, Rose DB, Fincher R (eds) Manifesto for living in the Anthropocene. Punctum Books, pp 7–16. https://doi.org/10.2307/j.ctv1r787bz.6

Gould RK, Muraca B, Himes A, Hackenburg D (2023) Biodiversity and relational values. Reference module in life sciences. Elsevier, New York. https://doi.org/10.1016/B978-0-12-822562-2.00091-8

Harcourt W (2023) The ethics and politics of care: reshaping economic thinking and practice. Rev Polit Econ. https://doi.org/10.1080/09538259.2023.2241395

Himes A, Muraca B (2018) Relational values: the key to pluralistic valuation of ecosystem services. Curr Opin Environ Sustain 35:1–7. https://doi.org/10.1016/j.cosust.2018.09.005

Himes A, Muraca B, Anderson CB, Athayde S, Beery T, Cantú-Fernández M, González-Jiménez D, Gould RK, Hejnowicz AP, Kenter J, Lenzi D, Murali R, Pascual U, Raymond C, Ring A, Russo K, Samakov A, Stålhammar S, Thorén H, Zent E (2024) Why nature matters: a systematic review of intrinsic, instrumental, and relational values. Bioscience 74:25–43. https://doi.org/10.1093/biosci/biad109

Horcea-Milcu A-I, Koessler A-K, Martin A, Rode J, Moreno Soares T (2023) Modes of mobilizing values for sustainability transformation. Curr Opin Environ Sustain 64:101357. https://doi.org/10.1016/j.cosust.2023.101357

IDEA and ESTEPA (2020) Caracterización socioambiental de la comunidad indígena Wayuu Machonutchi. Laboratorio de Soluciones Sistémicas para la igualdad territorial de ONU Mujeres. Producto 1. Instituto de Estudios Ambientales IDEA- Universidad Nacional de Colombia. Grupo ESTEPA

IPBES (2016) Preliminary guide regarding diverse conceptualization of multiple values of nature and its benefits, including biodiversity and ecosystem functions and services (deliverable 3 (d)). United Nations

IPBES (2022) Summary for policymakers of the methodological assessment of the diverse values and valuation of nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Zenodo. https://doi.org/10.5281/zenodo.7410287

Jacobs S, Zafra-Calvo N, Gonzalez-Jimenez D, Guibrunet L, Benessaiah K, Berghöfer A, Chaves-Chaparro J, Díaz S, Gomez-Baggethun E, Lele S, Martín-López B, Masterson VA, Merçon J, Moersberger H, Muraca B, Norström A, O'Farrell P, Ordonez JC, Prieur-Richard A-H, Rincón-Ruiz A, Sitas N, Subramanian SM, Tadesse W, van Noordwijk M, Pascual U, Balvanera P (2020) Use your power for good: plural valuation of nature—the Oaxaca statement. Glob Sustain. https://doi.org/10.1017/sus.2020.2

Lehnen L, Arbieu U, Böhning-Gaese K, Díaz S, Glikman JA, Mueller T (2022) Rethinking individual relationships with entities of nature. People Nat. https://doi.org/10.1002/pan3.10296

Lübker HM, Abson DJ, Riechers M (2021) Discourses for deep transformation: perceptions of economic growth in two rural communities in Lower Saxony, Germany. Sustain Sci 16:1827–1840. https://doi.org/10.1007/s11625-021-01039-1

Manlosa AO, Partelow S, Jiren TS, Riechers M, Paramita AO (2023) The role of institutions in food system transformations: lessons learned from transdisciplinary engagements in Ethiopia, the Philippines, and Indonesia. Ecosyst People. https://doi.org/10.1080/26395916.2022.2146753

Marquina T, Gould RK, Murdoch D (2022) Hey, tree. You are my friend': assessing multiple values of nature through letters to trees. People Nat. https://doi.org/10.1002/pan3.10334

Mayring P (2008) Qualitative inhaltsanalyse. grundlagen und techniken, 10th edn. Beltz, Weinheim/Basel

Millennium Ecosystem Assessment (2005) Ecosystems and human well-being: Synthesis. Island Press, Washington, D.C.

Muraca B (2011) The map of moral significance: a new axiological matrix for environmental ethics. Environ Val 20:375–396. https://doi.org/10.3197/096327111X13077055166063

Muraca B, Bulgarian Academy of Sciences (2016) Relational values. Balkan J Philos 8:19–38. https://doi.org/10.5840/bjp2016813

Muradian R, Gómez-Baggethun E (2021) Beyond ecosystem services and nature's contributions: is it time to leave utilitarian environmentalism behind? Ecol Econ 185:107038. https://doi.org/10.1016/j.ecolecon.2021.107038

Ortiz S, Consuegra C, van der Hammen MC, Pérez D (2021a) Perspectivas urbano-rurales sobre la circulación de dos frutos silvestres del Bosque Altoandino en sistemas agroalimentarios de Bogotá, Colombia. Rev Etnobiol 19:81–95

Ortiz S, Rodriguez-Fazzone M, Dueñas JD, Hernández F, Hernández C (2021b) Los activos intangibles de la agricultura familiar en los sistemas agroalimentarios. Marco conceptual y consideraciones metodológicas. FAO, Bogotá

Ortiz-Przychodzka S, Benavides-Frías C, Raymond CM, Díaz-Reviriego I, Hanspach J (2023) Rethinking economic practices and values as assemblages of more-than-human relations. Ecol Econ 211(2):107866. https://doi.org/10.1016/j.ecolecon.2023.107866

Palomo I, Felipe-Lucia MR, Bennett EM, Martín-López B, Pascual U (2016) Disentangling the pathways and effects of ecosystem service co-production. Ecosystem services: from biodiversity to society, part 2, advances in ecological research. Elsevier, New York, pp 245–283. https://doi.org/10.1016/bs.aecr.2015.09.003

Pascual U, Balvanera P, Díaz S, Pataki G, Roth E, Stenseke M, Watson RT, Başak Dessane E, Islar M, Kelemen E, Maris V, Quaas M, Subramanian SM, Wittmer H, Adlan A, Ahn S, Al-Hafedh YS, Amankwah E, Asah ST, Berry P, Bilgin A, Breslow SJ, Bullock C, Cáceres D, Daly-Hassen H, Figueroa E, Golden CD, Gómez-Baggethun E, González-Jiménez D, Houdet J, Keune H, Kumar R, Ma K, May PH, Mead A, O'Farrell P, Pandit R, Pengue W, Pichis-Madruga R, Popa F, Preston S, Pacheco-Balanza D, Saarikoski H, Strassburg BB, van den Belt M, Verma M, Wickson F, Yagi N (2017) Valuing nature's contributions to people: the IPBES approach. Curr Opin Environ Sustain 26–27:7–16. https://doi.org/10.1016/j.cosust.2016.12.006

Pascual U, Balvanera P, Anderson CB, Chaplin-Kramer R, Christie M et al (2023) Diverse values of nature for sustainability. Nature 620:813–823. https://doi.org/10.1038/s41586-023-06406-9

Pearson J, McNamara KE, Nunn PD (2019) Gender-specific perspectives of mangrove ecosystem services: Case study from Bua Province, Fiji Islands. Ecosyst Serv 38:100970. https://doi.org/10.1016/j.ecoser.2019.100970

Pearson J, McNamara KE, Nunn PD (2020) iTaukei ways of knowing and managing mangroves for ecosystem-based adaptation. In: Leal Filho W (ed) Managing climate change adaptation in the pacific region, climate change management. Springer, Cham, pp 105–127. https://doi.org/10.1007/978-3-030-40552-6_6

Pearson J, Jackson G, McNamara KE (2021) Climate-driven losses to Indigenous and local knowledge and cultural heritage. Anthropocene Rev. https://doi.org/10.1177/20530196211005482

Quijano O (2012) Ecosimías. Visiones y prácticas de diferencia económico/cultural en contextos de multiplicidad. Universidad del Cauca, Popayán

Rico García-Amado L, Ruiz Pérez M, Barrasa García S (2013) Motivation for conservation: assessing integrated conservation and development projects and payments for environmental services in La Sepultura Biosphere Reserve, Chiapas, Mexico. Ecol Econ 89:92–100. https://doi.org/10.1016/j.ecolecon.2013.02.002

Riechers M, Henkel W, Engbers M, Fischer J (2019) Stories of favourite places in public spaces: emotional responses to landscape change. Sustainability 11:3851. https://doi.org/10.3390/su11143851

Riechers M, Balázsi Á, Engler J, Shumi G, Fischer J (2021a) Understanding relational values in cultural landscapes in Romania and Germany. People Nat. https://doi.org/10.1002/pan3.10246

Riechers M, Martín-López B, Fischer J (2021b) Human–nature connectedness and other relational values are negatively affected by landscape simplification: insights from Lower Saxony, Germany. Sustain Sci. https://doi.org/10.1007/s11625-021-00928-9

Riechers M, Betz L, Gould R, Loch T, Lam D, Lazzari N, Martín-López B, Sala J (2022) Reviewing relational values for future research: insights from the coast. E&S. https://doi.org/10.5751/ES-13710-270444

Rockström J, Gupta J, Qin D, Lade SJ, Abrams JF et al (2023) Safe and just Earth system boundaries. Nature 619:102–111. https://doi.org/10.1038/s41586-023-06083-8

Schmitt TM, Riebl R, Martín-López B, Hänsel M, Koellner T (2022) Plural valuation in space: mapping values of grasslands and their ecosystem services. Ecosyst People 18:258–274. https://doi.org/10.1080/26395916.2022.2065361

Schröter M, Başak E, Christie M, Church A, Keune H, Osipova E, Oteros-Rozas E, Sievers-Glotzbach S, van Oudenhoven APE, Balvanera P, González D, Jacobs S, Molnár Z, Pascual U, Martín-López B (2020) Indicators for relational values of nature's contributions to good quality of life: the IPBES approach for Europe and Central Asia. Ecosyst People 16:50–69. https://doi.org/10.1080/26395916.2019.1703039

See SC, Shaikh SFEA, Jaung W, Carrasco LR (2020) Are relational values different in practice to instrumental values? Ecosyst Serv 44:101132. https://doi.org/10.1016/j.ecoser.2020.101132

Skubel RA, Shriver-Rice M, Maranto GM (2019) Introducing relational values as a tool for shark conservation, science, and management. Front Mar Sci. https://doi.org/10.3389/fmars.2019.00053

Stålhammar S, Thorén H (2019) Three perspectives on relational values of nature. Sustain Sci 14:1201–1212. https://doi.org/10.1007/s11625-019-00718-4

TEEB (2010) The economics of ecosystems and biodiversity: ecological and economic foundations. Earthscan, London

Thomas A, Mangubhai S, Fox M, Meo S, Miller K, Naisilisili W, Veitayaki J, Waqairatu S (2021) Why they must be counted: Significant contributions of Fijian women fishers to food security and livelihoods. Ocean Coast Manag 205:105571. https://doi.org/10.1016/j.ocecoaman.2021.105571

Topp EN, Tscharntke T, Loos J (2021) Fire and landscape context shape plant and butterfly diversity in a South African shrubland. Divers Distrib. https://doi.org/10.1111/ddi.13257

Topp EN, Loos J, Martín-López B (2022) Decision-making for nature's contributions to people in the Cape Floristic Region: the role of values, rules and knowledge. Sustain Sci 17:739–760. https://doi.org/10.1007/s11625-020-00896-6

WMO (2024) State of the global climate 2023. World Meteorological Organization, Geneva

Yang YCE, Passarelli S, Lovell RJ, Ringler C (2018) Gendered perspectives of ecosystem services: a systematic review. Ecosyst Serv 31:58–67. https://doi.org/10.1016/j.ecoser.2018.03.015

Zafra-Calvo N, Balvanera P, Pascual U, Merçon J, Martín-López B, van Noordwijk M, Mwampamba TH, Lele S, Ifejika Speranza C, Arias-Arévalo P, Cabrol D, Cáceres DM, O'Farrell P, Subramanian SM, Devy S, Krishnan S, Carmenta R, Guibrunet L, Kraus-Elsin Y, Moersberger H, Cariño J, Díaz S (2020) Plural valuation of nature for equity and sustainability: insights from the global south. Glob Environ Change 63:102115. https://doi.org/10.1016/j.gloenvcha.2020.102115

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.