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Published in:
Ecology and Society

DOI:
10.5751/ES-13710-270444

Publication date:
2022

Document Version
Publisher's PDF, also known as Version of record

Riechers, M., L. Betz, R. K. Gould, T. K. Loch, D. P. M. Lam, N. Lazzari, B. Martín-López, and J. E. Sala. 2022. Reviewing relational values for future research: insights from the coast. Ecology and Society 27(4):44. https://doi.org/10.5751/ES-13710-270444

Research

Reviewing relational values for future research: insights from the coast

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ABSTRACT. To create the science we need for the ocean we want in this United Nations Decade of Ocean Science for Sustainable Development and to support the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) value assessment, we systematically reviewed literature from the past 20 years (N = 375) that used conceptualizations of relational values in coastal and marine ecosystems of the Global South. We found four clusters of research highlighting specific characteristics. Cluster one (participatory and qualitative approaches) was defined by a focus on the relational value of cultural heritage and the production of qualitative social science data, often with a participatory approach. Cluster two (Indigenous and local ecological knowledges held by fishers and gatherers) linked to the explicit inclusion of Indigenous and local knowledges in research and to aspects of biodiversity and marine resources. Cluster three (ecological and environmental change) was determined by relational values of social relations and identity of residents and community members through the use of anthropological and ethnographic methods and linked to ecological and environmental change. Cluster four (recreation and quantitative data) was characterized by a variety of relational values, such as recreation and enjoyment, aesthetics and inspiration, or stewardship, and based on quantitative empirical social research methods mainly elicited from coastal users (such as tourists). We highlight (1) the most prevalent relational values; (2) the necessity to bridge dispersed research approaches; and (3) the possible negative impact of globalization, market pressure, and ecological degradation on relational values. Our lessons learnt are the challenge of conflating relational values with structures, institutions, or emotions; the necessity of accounting for dynamic influences on relational values; and finding ways to comparably quantify relational value categories. Our recommendations for future research are: (1) specificity regarding relational values and their object of value; (2) using transdisciplinary and participatory approaches; and (3) strengthening pro-environmental relational values for sustainability transformation.

Key Words: *biodiversity conservation; fishing; Indigenous and local knowledge; livelihood; sense of place; sustainability; transdisciplinary*

INTRODUCTION

Academics and practitioners increasingly articulate relational values to convey the importance of nature to decision makers, especially in biodiversity conservation (Díaz et al. 2015, Pascual et al. 2017, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services [IPBES] 2019). Relational values are "preferences, principles, and virtues associated with relationships, both interpersonal and as articulated by policies and social norms" (Chan et al. 2016:1462). The "relational" refers to the focus on the relational *content* of valuation and not to the inherently relational *process* of valuation itself (Himes and Muraca 2018). The content of valuation refers to what is valued and how the value is attributed and articulated (Himes and Muraca 2018:2): in the case of relational values, this is our relationship with nature. Relational values focus both on human-nature connections (such as aesthetic or inspirational values; e.g., Badang et al. 2017, Mozumder et al. 2018) as well as human-human connections that stem from interactions within a social-ecological system (such as social relations or social memory; e.g., Hoque et al. 2017, Rojas et al. 2017; Muraca 2011). Researchers proposed the framing of relational values as a "third type" of values, in addition to intrinsic values (i.e., the inherent value of nature as an end in itself, regardless of any human experience) and instrumental values (i.e., the importance of nature as a means to achieve human ends or satisfy human needs; Muraca 2011). Attention to relational values is said to help foster inclusive conservation by acknowledging a plurality of values and increasing options for how we discuss nature's meaning (Díaz et al. 2015, Chan et al. 2016).

Although the framing of relational values is new, the concepts of value on which this framing draws have a rich, diverse, and extensive research history. The framing of relational values builds upon decades of studies on topics such as sense of place (Trentelman 2009, Brehm et al. 2013), human-nature connection (Mayer and Frantz 2004, Dutcher et al. 2007, Nisbet et al. 2009), and experiential relations to nature (Keniger et al. 2013, Soga and Gaston 2016). Indigenous and local ecological knowledges (Berkes 1993, Bradley et al. 1999, Schultz 2001, 2002) and conceptions of humanity's place in nature (van den Born 2008, Raymond et al. 2013) are also foundational to relational values concepts. Hence, the literature about relational values is much older than the term coined by Barbara Muraca in 2011 (Muraca 2011). Yet the decades' worth of research on concepts that intertwine with relational values is dispersed across disciplines, which can make it challenging to get an overview of the

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information. A comprehensive summary of existing empirical research behind the new framing of relational values is missing. To further the concept of relational values and to learn from previous empirical research, we offer in this review an overview of 20 years of dispersed research around relational values (by other names) in coastal ecosystems in the Global South.

Advancing this knowledge is especially relevant in coastal ecosystems of the Global South. The high demand and pressure on coastal ecosystems, and resulting rapid changes, are likely to impact relational values and possibly erode pro-sustainability relational values (Riechers et al. 2020). Coasts are multi-functional spaces in which many different demands meet the increasing impacts of global change (von Schuckmann et al. 2019). They are highly impacted by overexploitation through industrial and touristic development, overfishing, and mining, threatening the livelihood and food security of local communities (Mora et al. 2011, Hughes et al. 2017). Yet many people, particularly in the Global South, are directly or indirectly dependent on coastal ecosystems through marine resources, agriculture, tourism, or recreation (Intergovernmental Panel on Climate Change [IPCC] 2019). This is especially true for Indigenous peoples and local communities (Cisneros-Montemayor et al. 2016). Combined, these pressures lead to a dramatic loss of biodiversity and ecological functions vital to the local communities (Millennium Ecosystem Assessment 2005, IPBES 2019), which is exacerbated by climatic stressors (Graham et al. 2015, IPCC 2019).

To create more sustainable livelihoods and conserve biodiversity, the complex societal challenges in coastal regions need to be researched comprehensively. To account for rapid and extreme environmental changes and to achieve Sustainable Development Goals (United Nations 2015), coastal policy and management need to move away from sectoral approaches and instead adapt to the complexity of coastal social-ecological systems. The framing of relational values can help to foster a social-ecological perspective because it refers to the meaningfulness of relationships, such as those between nature and people and among people within or fostered by nature (Chan et al. 2016, 2018). This focus on relationships and interconnections is extraordinarily relevant to social-ecological systems research, and thus for building the science we need for the ocean we want in this current UN Decade of Ocean Science for Sustainable Development (United Nations Educational, Scientific and Cultural Organization 2020).

In this paper, we present the main findings from our systematic literature review of 20 years of research on relational values (by other names) conducted in coastal ecosystems of the Global South. To our knowledge, this is the first systematic literature review on the topic of relational values in general, and specifically with a focus on the Global South. Hence, in this paper we aim to: (1) give an overview of relational values we identified in the articles (because the articles might not use the term "relational values" explicitly), (2) highlight methods used to elicit relational values, (3) identify biogeographical aspects to which relational values are linked, (4) give an overview of the research clusters that have studied relational values, and (5) present connections between the people whose values were studied and the benefits and challenges in valuation as stated by the researchers.

We end our discussion with a section on lessons learned through our literature analysis, especially through empirical research papers. To further future research in this field we address questions on the relational values concept (what are relational values?), methods (how to assess them?), and topics (what is the object of value?). On the basis of these lessons learned, we offer three recommendations for further research on relational values: (1) specificity regarding relational values and the biophysical aspects to which they are linked, (2) using transdisciplinary and participatory approaches, and (3) strengthening pro-sustainability relational values for societal transformation (Box 1). Through this, we want to foster greater cross-disciplinary fertilization of the new field of relational values and hope to enable a more comprehensive and applicable operationalization of this framing.

METHODS

Data collection

Our systematic review followed the guidelines for the "Preferred reporting items for systematic reviews and meta-analyses" (PRISMA) framework (Moher et al. 2009; Fig. A2.1). We developed a search string to encompass the diversity of relational values and coastal ecosystems in the Global South (see search string in A1). In spring 2020, we applied our search string to the databases of Scopus for publications from 2000 to 2019. The search string was restricted to articles in English, included both conceptual and empirical observations, and resulted in 1665 articles.

Articles had to address both relational values and coastal or marine ecosystems in the Global South to be included. We first screened the titles, abstracts, and keywords of these 1665 articles and omitted 924 that did not meet these criteria (when in doubt, we maintained the article for full-text analysis). The remaining 741 articles were downloaded and analyzed on the basis of their full text. Because it was difficult to decipher the use of relational values from the abstract alone, many articles were included in the full-text analysis but then eventually excluded for not using any concept that could be seen as similar to relational values (n = 366). The final set of articles was 375 (Fig. A2.1).

Data analysis

We based the coding scheme used in our systematic review partly on previous research. The categories of relational values were based on reports from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES 2016, 2019) and related scientific studies (Arias-Arévalo et al. 2017, Klain et al. 2017) but adjusted inductively to highlight the focus of the articles. We adjusted benefits and management categories on the basis of Tran et al. (2020). Finally, we tested and refined the coding scheme through 50 randomly selected articles before applying it to the full set. To ensure inter-coder reliability, tandems of two conducted preliminary coding separately. Each pair cross-checked and discussed their coding for consistency. The lead author spoke with each pair to ensure consistency between them.

We analyzed the data using SPSS 26 (IBM Deutschland GmbH, Ehningen, Germany). Data analysis consisted of qualitative and quantitative analyses. We analyzed most variables using qualitative content analysis to summarize the results into distinct

categories and groups (Mayring 2008). The overarching categories (e.g., relational values, biogeographical aspects) were used as numerical inputs into the statistical analysis. In addition to descriptive statistics, we conducted a hierarchical (agglomerative) cluster analysis (HCA) using Ward's method (Ward 1963) and squared Euclidian distance on binary presence/absence data on the following: relational values, people whose values are elicited, inclusion of Indigenous ecological knowledge, presence of transdisciplinary processes, and methods used. The HCA does not require a pre-specified number of clusters and the resulting clusters were chosen, after multiple runs that were analyzed with descriptive statistics, for their coherence and explanatory power. We used the results from the HCA and correlated them with variables such as the ecosystem in which the study took place and the biogeographical components to which the relational values were linked (Cramér's V). To visualize the connections between the social groups whose values were elicited and the benefits and challenges mentioned in the articles, we created a directed tripartite network diagram using R package "igraph" (Csardi and Nepusz 2006, R Core Team 2019).

RESULTS

Types of relational values used

Our content analysis resulted in 13 categories of relational values (Table 1). The most mentioned category of relational values was "Indigenous and local ecological knowledges" (n = 267, 71.2%). Our classification of this concept included a collection of terms because the current literature does not give a universal definition (Berkes 1993). Our definition is partly based on the work of the IPBES (Díaz et al. 2015), which includes knowledge from Indigenous peoples and local communities, such as traditional and Indigenous knowledge (Berkes et al. 2000, Mazzocchi 2006), local knowledge (Olsson and Folke 2001), local ecological knowledge (Crona 2006), and fishers' or farmers' knowledge (Leite and Gasalla 2013). (For a broader overview on these terms related to coastal ecosystems see Loch and Riechers 2021.)

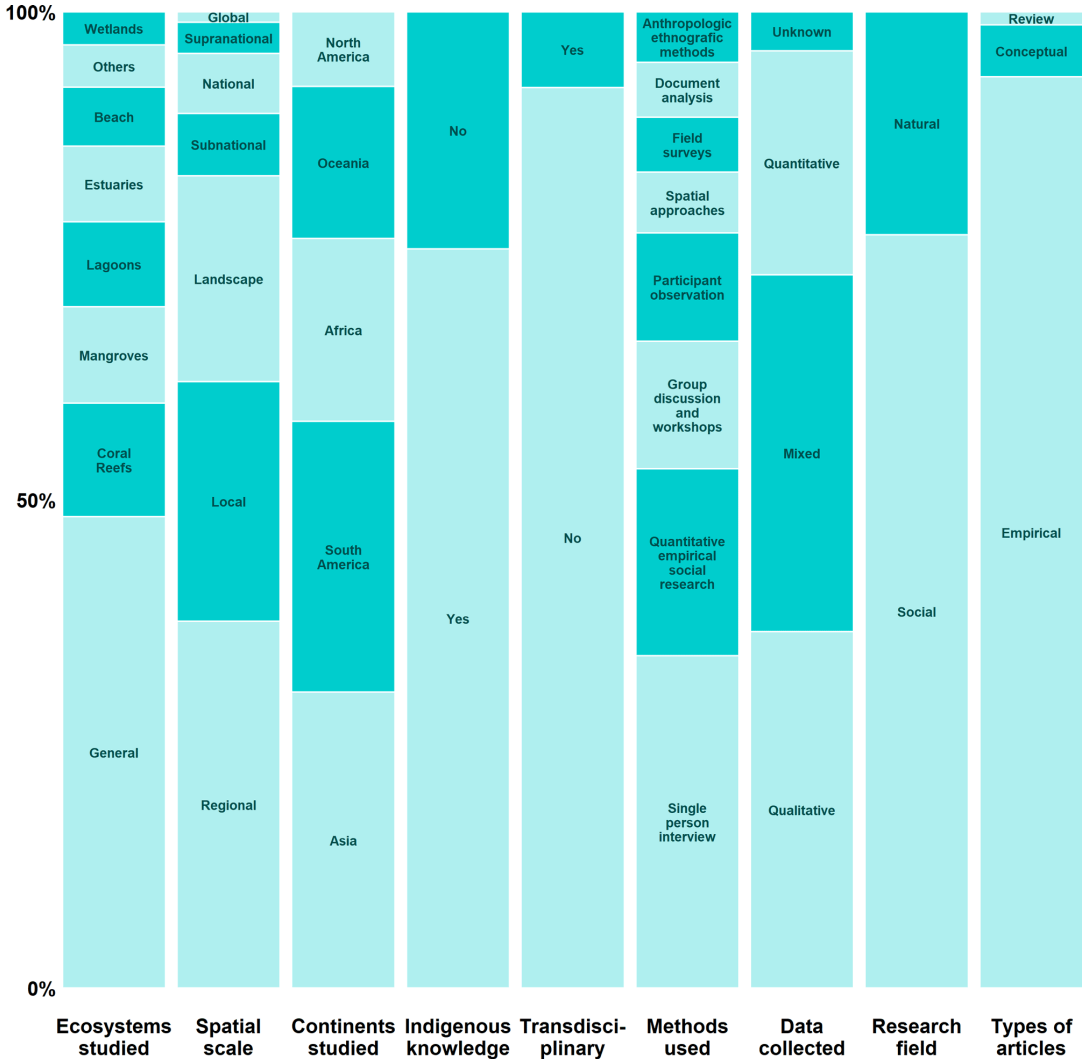
The second most mentioned relational value was "social relations" (n = 86, 22.9%), which included aspects of sense of community and social cohesion as intertwined with or mediated by nature. The third most mentioned relational value was "recreation and enjoyment" (n = 74, 19.7%), which comprised the sub-categories of recreation, enjoyment, and nature-based tourism. This was followed by the category "identity" (n = 70), which was made up of the sub-categories of cultural identity, individual identity, social and collective identity, and social learning (Table 1). Other categories of relational values that appeared less frequently include "stewardship," "culture and heritage," "spiritual," "aesthetic and inspiration," "sense of place," "empowerment and autonomy," "environmental awareness," "educational," "psychological," and "well-being" (Table 1).

Regarding the people whose values were elicited, studies most often focused on artisanal fishers (n = 182, 48.5% of all 375 articles) and residents or community members in general (n = 138, 36.8%). Other articles focused on "coastal users" (n = 37, 9.9%), Indigenous or Aboriginal Peoples (n = 33, 8.8%), or government representatives (n = 20, 5.3%).

Table 1. Overview of the relational values categories resulting from the qualitative content analysis of N = 375 articles. The table shows the main category of relational values, their sub-categories (if existing), and the amount of articles in which these categories and sub-categories were mentioned (with the percentage of all papers, N = 375).

Value category	No. of papers (% of all N = 375)	Values sub-category	No. of papers (% of all N = 375)
Indigenous/local ecological knowledge	267 (71.2%)		
Social relations	86 (22.9%)		
		Sense of community	23 (6.1%)
		Social cohesion	20 (5.3%)
		Social relations	18 (4.8%)
		Social memory	11 (2.9%)
		Kinship	6 (1.6%)
		Bequest	4 (1.1%)
		Sense of belonging	2 (0.5%)
		Conviviality	1 (0.3%)
		Reciprocity	1 (0.3%)
Recreation and enjoyment	74 (19.7%)		
		Recreation	65 (17.3%)
		Enjoyment	6 (1.6%)
		Nature-based tourism	3 (0.8%)
Identity	70 (18.7%)		
		Cultural identity	38 (10.1%)
		Individual identity	21 (5.6%)
		Social and collective identity	8 (2.1%)
		Social learning	3 (0.8%)
Stewardship	68 (18.1%)		
		Stewardship values	49 (6.1%)
		Social responsibility	13 (6.1%)
		Ethical values	4 (6.1%)
		Values of respect	2 (6.1%)
Culture and heritage	62 (16.5%)		
		Heritage values	27 (7.2%)
		Customary law	18 (4.8%)
		Traditional values	13 (3.5%)
		Cultural continuity	4 (1.1%)
Spiritual	62 (16.5%)		
		Spiritual values	49 (13.1%)
		Sacred values	7 (1.9%)
		Religious values	6 (1.6%)
Aesthetic and inspiration	37 (9.9%)		
		Aesthetic values	35 (9.3%)
		Inspirational values	2 (0.5%)
Sense of place	36 (9.6%)		
		Sense of place	25 (6.7%)
		Connectedness	11 (2.9%)
Empowerment and autonomy	17 (4.5%)		
		Security	12 (3.2%)
		Sense of agency	4 (1.1%)
		Social entrepreneurship	1 (0.3%)
Environmental awareness	10 (2.7%)		
Educational	7 (1.9%)		
Psychological	6 (1.6%)		
		Value of quietness	4 (1.1%)
		Therapeutic values	2 (0.5%)
Well-being	3 (0.8%)		

Fig. 1. Descriptive proportion of selected variables indicating geographical, ecological, and methods-related characteristics of research on relational values in coastal and marine ecosystems in the Global South, based on the qualitative content analysis of 375 articles.



Types of articles and methods used

Of the 375 articles included in our literature review, 93.3% (n = 350) undertook an empirical, 5.3% (n = 20) a conceptual, and 1.3% (n = 5) a review research approach (Fig. 1). Social science research methods dominated, with 90.1% (n = 338) of the articles using at least one method within this broad field (Fig. 1). At least one natural science method was used by 26.7% (n = 100) of the articles. Data collected were qualitative in 36.1% (n = 137) of articles, mixed in 36.1% (n = 137), and quantitative in 22.7% (n = 86). Over half of studies conducted interviews (59.7%, n = 224), and roughly a third used surveys and questionnaires (33.6%, n = 126). About a fifth of studies involved group discussions and workshops (22.9%, n = 86); another fifth, participant observation (19.5%, n = 73). About a tenth of articles used spatial approaches (natural science methods such as GIS, geological mapping, and aerial photography; 10.9%, n = 41). Transdisciplinary aspects, approaches, and processes were used in 7.7% (n = 29) of articles (Fig. 1).

Biogeographical aspects

In this section, we focus on empirical studies to highlight the biogeographical aspects to which relational values were linked (Fig. 1). Geographically, the study areas of the analyzed articles were most often located in Asia (30.7%, n = 115), South America (28.0%, n = 105), and Africa (18.9%, n = 71). Countries with the largest numbers of studies were Brazil (14.9%, n = 56), Solomon Islands (6.9%, n = 26), Indonesia (6.9%, n = 26), Mexico (5.9%, n = 22), and Bangladesh (5.3%, n = 20). The most common scale was regional (37.6%, n = 141), followed by local (24.5%, n = 92) and landscape (20.8%, n = 79) scales. Most empirical studies did not name a specific coastal ecosystem in which the study took place but referenced coastal and marine systems in general (53.3%, n = 200). The most commonly named ecosystems studied were coral reefs (12.8%, n = 48), mangroves (10.9%, n = 41), and lagoons (9.6%, n = 36).

We further assessed biophysical aspects linked to the relational values studied (Fig. 1). Many relational values were linked to

Table 2. Results of cluster analysis and the cluster's determining variables. Cramér's V shows the strength of the relationship in parenthesis. All coefficients shown are significant at $p < 0.009$. ILK = Indigenous and local knowledge.

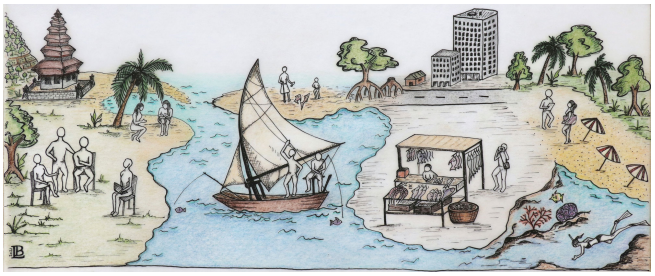
	Cluster 1: Participatory and qualitative approaches n = 110 (29.3%)	Cluster 2: ILK held by fishers and gatherers n = 93 (24.8%)	Cluster 3: Ecological and environmental change n = 98 (26.1%)	Cluster 4: Recreation and quantitative data n = 74 (19.7%)
Relational values	Cultural and heritage (.24)	Indigenous/local ecological knowledges (.54)	Social relations (.32) Identity (.25)	Recreation and enjoyment (.59) Aesthetic and Inspiration (.50) Stewardship (.38) Educational (.23) Environmental awareness (.22)
People whose values were elicited		Artisanal fishers and gatherers (.48)	Residents and community members (.51)	Costal users (.53) other local experts (.19)
Methods used	Group discussions and workshops (.33) Single person interviews (.27) Participatory mapping (.25) Participatory approaches (.23)	Inclusion of ILK (.61)	Anthropological and ethnographical methods (.22)	Quantitative empirical social research methods (.23) Economic approaches (.20)
Biophysical objects of value (.45)		Biodiversity, Marine resources	Terrestrial, Ecological change	Ecosystems, Geodiversity
Ecosystem studied	Lagoons (.35) Estuaries (.22)	General (.55)		Beaches (.39) Coral reefs (.30)

marine resources in general and to their protection (38.9%, n = 146). A nearly equal proportion of relational values were linked to specific species (fish, marine mammals, invertebrates) and aspects of biodiversity (such as species abundance or diversity; 37.9%, n = 142). Other relational values were linked to specific ecosystems (e.g., values related to mangroves or coral reefs) or nature in general (31.5%, n = 118). Almost 17% of studies linked relational values to ecological changes (16.8%, n = 63), which included climate change, environmental degradation, and natural disasters.

Clusters of studies on relational values

On the basis of our analysis of specific study characteristics (whose values were elicited, methods used, biophysical aspects, and ecosystems studied in), we found four clusters of research on relational values (Table 2, Fig. 2). Cluster one (29.3%, n = 110), named "participatory and qualitative approaches," was defined as a focus on the relational value of cultural heritage and the production of qualitative social science data, often with a participatory approach and often in lagoons and estuaries (Table 2, Fig. 2). Cluster two (24.8%) was named "Indigenous and local ecological knowledges held by fishers and gatherers" because it was linked to the relational values of Indigenous and local ecological knowledges (and related concepts such as traditional/environmental knowledges) of artisanal fishers and gatherers. Instead of being defined by specific research methods or data types, this cluster was linked by the explicit inclusion of Indigenous and local knowledges and aspects of biodiversity (e.g., species assemblages or links to specific fish, invertebrates, or marine mammals) and marine resources (e.g., ecosystem services, fishing, and marine conservation). Cluster three (26.1%), named "ecological and environmental change," was determined by relational values of social relations and identity. The relational values were often elicited from residents and community members through the use of anthropological and ethnographic methods. The relational values were linked to aspects of ecological and environmental change (such as climate change, disasters, coastal erosion, or degradation) and terrestrial aspects of coastal systems (such as farming, forestry, or land cover). Cluster four (19.7%), named "recreation and quantitative data," was characterized by studies eliciting a variety of relational values, such as recreation and enjoyment, aesthetics and inspiration, or stewardship. Research in this cluster was based on quantitative empirical social research methods, including economic approaches, often elicited from coastal users (such as tourists) and carried out in ecosystems of sandy beaches and coral reefs. The objects of value were whole ecosystems and nature in general (such as mentioning nature, scenery, or seascapes).

Fig. 2. Representation of the four clusters based on Table 2.



Benefits and challenges of researching relational values

The most commonly noted benefit of studying relational values was the complementarity between scientific and Indigenous and local ecological knowledge (54.4%, n = 204 of all 375 papers). Researchers also noted benefits of a more inclusive, informed government and management (35.5%, n = 133) and advantages for the local economy and livelihoods (23.7%, n = 89; Table A2.1). Yet research on relational values also involved challenges. The most commonly mentioned challenges in working with relational values were external influences that challenged, eroded, or changed local values. These influences came from globalization, development, and market pressure (22.9%, n = 86), and from multi-scale environmental threats (13.3%, n = 50), such as environmental hazards or ecological degradation. Another challenge often named was the difficulty of cross-cultural work in eliciting locally explicit relational values (10.1%, n = 38).

Our tripartite network shows linkages, and strength thereof, between mentioned benefits and challenges in relation to the people whose values were elicited (Fig. 3). The line thickness in Figure 3 is proportional to the number of articles involved in each link. These thicknesses convey a suite of interesting relationships. For instance, the connection between farmers, residents, and community members and the experienced challenge of the impact of multi-scale environmental threats is most prevalent in the reviewed articles. Further, research revealing relational values of artisanal fishers and gatherers was often linked to the complementing ecological knowledge as well as to the support of local governance and management processes (Fig. 3). Interestingly, we did not find connections between Indigenous and aboriginal peoples and complementing ecological knowledge.

DISCUSSION

Here we discuss (1) the most prevalent relational value categories in past research, (2) the necessity to bridge dispersed research approaches, and (3) the possible negative impact of globalization, market pressure, and ecological degradation on relational values. On the basis of these specific findings, we highlight our general lessons learned from the research articles. These lessons are centered on conceptual and methodological aspects.

Prevalent relational values in past research

The vast majority of relational values in coastal ecosystems in the Global South fell within the category of "Indigenous and local ecological knowledges" (71.2%; Table 1), which included knowledge from Indigenous peoples and local communities (i.e., traditional and Indigenous knowledge [Berkes et al. 2000, Mazzocchi 2006], local knowledge [Olsson and Folke 2001], local ecological knowledge [Crona 2006], and fishers' or farmers' knowledge [Leite and Gasalla 2013]). The coding of this category was nuanced and broad, the rationale being that traditional knowledge systems are almost always multifaceted: they often involve an intertwined mix of knowledges, practices, and values (Berkes 2017). The importance of Indigenous and local ecological knowledge as a virtue of a human-nature relationship in the assessed research articles thus likely stems from the myriad interlinkages to other relational values and institutions (e.g., norms, management approaches; Sheremata 2018). Scholars have noted that Indigenous and local ecological knowledges have great potential to inform governance and management processes (Pellowe and Leslie 2021) as well as to complement existing scientific knowledge (Aswani and Lauer 2006, Silvano et al. 2006; Fig. 3). This suggests the importance of continuing to understand Indigenous and local knowledge through relational values and other frames.

The second most commonly named category of relational values was "social relations" (22.9%; Table 1). This category had many sub-categories and reflects human-human connections mediated through nature (Chan et al. 2016). Within this category, the most common sub-categories were sense of community and social memory. The sense of community could be strengthened through locally specific work with nature (Fröcklin et al. 2018) or through acknowledging traditions and local ecological knowledges (Outeiro et al. 2015). Another sub-category, valuing social memory, explicitly connects identity (social, collective, or individual) and historical memory of a land- and seascape (often mediated through traditional practices and cultural heritage). In many of the assessed articles, this value category was linked to environmental and cultural changes (Gordon and Hale 2003) caused by, for example, globalization (Lauer and Aswani 2010).

Bridging dispersed research approaches on relational values

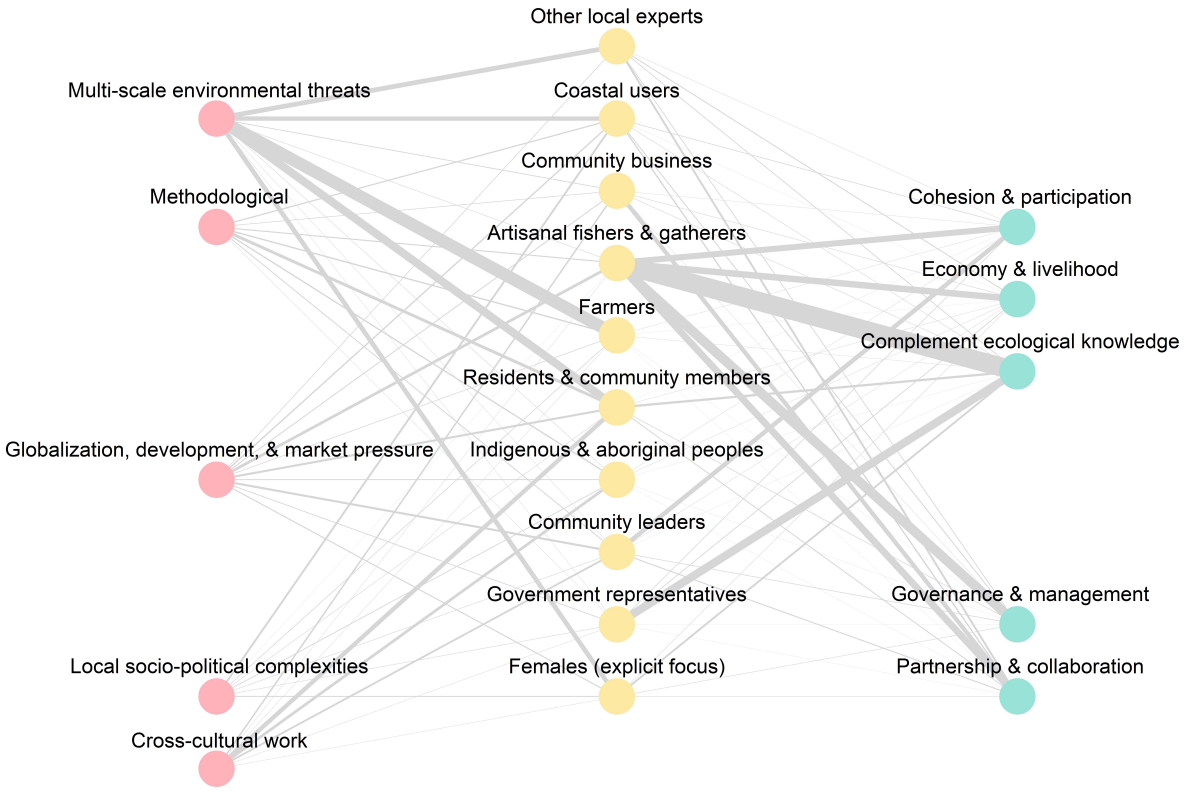
Our results showed that research explicitly using transdisciplinary methods was scarce (6.9%, n = 29). Additionally, our results highlighted a rather distinct subdivision of research approaches in eliciting relational values based on research methods and disciplinary fields. Although about a third of the studies had a mixed-method approach, our cluster analysis highlighted methods-based distinctions. As an example, cluster one (participatory and qualitative approaches) showed a strong use of methods (primarily interviews) that produce qualitative data; cluster three (ecological and environmental change) highlighted anthropological and ethnographic approaches; and cluster four (recreation and quantitative data) mainly applied social science research methods, producing quantitative data gathered with surveys and questionnaires. In addition, clusters differed by which and how many relational values were assessed. Cluster one used social science research methods to analyze mainly cultural heritage, cluster two studied Indigenous and local knowledges, whereas cluster three primarily assessed social relations and identity. Cluster 4, in contrast, analyzed a broader range of relational values through surveys and questionnaires. Instead of reinforcing disciplinary methodological boundaries, we deem it important to combine a multitude of research methods, drawing on different disciplines and data types to capture and elicit a comprehensive set of relational values (Gould 2021).

To further the concept of relational values and to gain a more comprehensive understanding of the role they play in social-ecological systems, a broad range of different relational values should be assessed (Klain et al. 2017, Chapman et al. 2019, Mattijssen et al. 2020). Collaborations, both between disciplines and with non-academic actors who hold Indigenous and local knowledge, will greatly facilitate this broader approach. As one example of what can be learned from working with non-academic actors, the IPBES Regional Assessment of Europe and Central Asia found interlinkages between the relational values of identity, security, and stewardship in narratives of Indigenous peoples and local communities (Schröter et al. 2020). Moreover, progress on relational values within the field of transformations and social-ecological research (Horcea-Milcu et al. 2019, Scoones et al. 2020) has the potential to inherently promote interdisciplinary research and unravel the relevance of relational values to foster sustainability transformation (Riechers et al. 2022). To advance the field of relational values, future research should focus on multiple relational value categories, their synergies and trade-offs, as expressed by individuals but also between social groups.

Globalization, market pressure, and ecological degradation affect relational values

This review shows that global environmental change can impact relational values. In our review, 16.8% of the relational values were negatively affected by biophysical aspects of climate change, ecological degradation, or environmental changes in general (Marikandia 2001, Ratter et al. 2019, Wiederkehr et al. 2019). Additionally, globalization, development, and market pressure as well as multi-level environmental threats were the most prevalent challenges regarding research on relational values in coastal and

Fig. 3. Tripartite network showing the number of articles (N = 375) linking each node of "challenge" (left, red dots) and "benefit" (right, blue dots) of studying relational values to the groups of people whose values were elicited (middle, yellow dots). Line thickness is proportional to the number of articles involved in each link. Only the five most often named challenges and benefits and the ten most often named value-holders are included to increase graphical simplification. The spacing between the nodes is used for readability and has no statistical meaning.



marine ecosystems of the Global South. Indeed, research on relational values, especially in the Global South, shows that the adherence to Global North development paradigms (Dacks et al. 2018) and the power dynamics inherent in a Western conservation ethic (Berkes 2004, Almudi and Kalikoski 2010) can endanger some relational values (Topp et al. 2021).

Global environmental change that leads to land use management intensity can negatively impact inhabitants' sense of place and simultaneously foster contrasting ideologies that can diminish social cohesion and social relations (Riechers et al. 2020). Rapid simplification of ecosystems, in particular, can weaken or change certain relational values and, in turn, lead to starkly contrasting value priorities between groups (Okunoye 2008, Riechers et al. 2022), which can possibly lead to social conflicts (Chapman et al. 2019, Topp et al. 2021). For example, resource scarcity can negatively affect social relations of small-scale fishers: scarcity hampers information sharing in response to resource fluctuations or uncertainties, which can lead to the erosion of relational values related to social capital (Ramirez-Sanchez and Pinkerton 2009). However, more research is needed to understand how land use intensification may impact different relational values, in particular those related to social cohesion, cultural identity, and heritage. It is also interesting to consider whether intensification will lead to formation of new relational values, and whether those new values will be more or less sustainability aligned than previous values (Hoelle et al. 2022). This is of special relevance in coastal ecosystems of the Global South, where global environmental change disproportionally impacts biodiversity and people's quality of life (IPBES 2019, IPCC 2019).

The global decline of Indigenous and local ecological knowledges is also intertwined with trends toward ecosystem simplification. The decline is mainly attributed to (1) the transition from subsistence-oriented economies to a market-oriented economy, (2) changes in culture by which younger generations consider traditional practices to be a symbol of poverty, (3) rural abandonment, and (4) land grabbing (Schröter et al. 2020), all trends that often intersect with the intensification of land use for commercial purposes. When Indigenous peoples and local communities are displaced from their customary territories, it jeopardizes knowledge acquired through their relation with the land-/seascape and other relational values such as sense of place, identity, heritage, and stewardship (Gordon and Hale 2003, Dixon

and Durrheim 2004, Sheremata 2018, Gladkikh et al. 2019). In addition, the loss of Indigenous and local ecological knowledges can lead to shifting baselines (Soga and Gaston 2018), which gradually increase tolerance of environmental degradation. That is, ongoing environmental degradation can change people's perception of desirable states and thus influence further management and conservation efforts (Papworth et al. 2009, Soga and Gaston 2018) and impact local strategies of adaptation and resilience (IPBES 2019).

Knowing and strengthening people's pro-sustainability relational values, and more broadly human-nature and human-human connections (mediated through nature), may halt the current global environmental crisis (Nisbet et al. 2009, Folke et al. 2011). Articles in our review often stated that working with relational values can benefit governance and management of resources as well as strengthen partnerships and collaboration within and between communities, especially when including artisanal fishers and gatherers (see line thickness in Fig. 3). Further, a strong sense of community as a virtue of a human-nature relationship could foster ecological restoration (Trialfhianty and Suadi 2017, Hein et al. 2019) and highlight power dynamics in land use changes (Gasalla and Gandini 2016) and risk assessment (Hak et al. 2016).

That being said, two aspects of relational values need to be further considered: the fluid nature of relational values and the connections between relational values and sustainability-supportive behavior. More research is needed to understand how relational values may change or possibly erode in response to globalization, market pressure, and ecological degradation. Further, relational values may be transformed both intentionally and unintentionally. Intentional environmental education efforts can change values that are, like those in our review, closely related to relational values (Britto dos Santos and Gould 2018). Relational values can also change along with shifting economic practices, political paradigms, or landscapes (Balázsi et al. 2019).

Moreover, relational values are not necessarily linked with sustainable or pro-environmental behavior (Hoelle et al. 2022). Strong relational values may be used to argue for the maintenance of unsustainable practices through claiming the value of tradition, heritage, or continuity (Chapman et al. 2019, Hoelle et al. 2022). Relational values of stewardship or social responsibility may be used to support conservation actions and policies that could disenfranchise others who use and value nature differently (Klain et al. 2014a, Sowman and Sunde 2018, Bennett et al. 2020). One example is marine-protected areas that allow access for touristic purposes, including fishing, but not for local, often subsistence, uses (Lopes et al. 2017, Bennett and Dearden 2018, Lopes and Villasante 2018). Hence, relational values may or may not be associated with sustainable action, and we encourage future research to explore these interactions with ample attention to the local context (Hoelle et al. 2022).

Important considerations for empirical research

In our analysis of 375 articles, of which 350 were empirical studies, we noted several challenges that emerge when working empirically with relational values and related concepts. These challenges are based on study authors' own observations as stated in the reviewed articles as well as our own discussions during the coding process. Here, we build on these challenges to highlight important considerations for future relational values research. These considerations center on conceptual concerns (what are relational values?) and methods (how to assess them?). In Box 1, we distill these considerations into recommendations for future research on relational values.

Relational values versus structures and institutions

In our effort to determine if research was using what we today classify as relational values, we noticed the importance of distinguishing what relational values are not. In particular, we determined that social structures or other informal institutions are not relational values, although they are connected and could be conflated. Social structures and institutions are complex and multifaceted. They are interlinked with behaviors, practices, and values; these phenomena all shape and create each other (Mattijssen et al. 2020). A study in Zanzibar, for example, found that institutions that regulate small-scale fisheries and seaweed farming affect social cohesion (de la Torre-Castro and Lindström 2010). In future research, it will likely be helpful to draw differences between social structures and institutions that enable, support, or manifest relational values but are not relational values in themselves. These distinctions can be nuanced, because the same term may refer to different things: for example, the term "cultural heritage" can relate to buildings, traditions, norms, or relational values. Physical structures (e.g., traditional edifices or religious buildings) or informal institutions (e.g., traditions or norms) are not relational values, but may enable relational values.

Relational values versus emotions

The same logic applies to links between emotions and relational values. Especially when ecological degradation, biodiversity loss, or rapid change is part of the study, findings might highlight the feelings of loss, pain, and nostalgia (Riechers et al. 2019). Emotions, positive and negative, can indicate the existence of relational values and are strongly connected to them, but are not values themselves. A strong emotional attachment to nature could be further analyzed to disentangle what relational value(s) might foster such emotional connections (Perkins 2010). Further, negative emotions such as expressed hurt, anger, loss, frustration, or pain, among others, might indicate a recent degradation of a social-ecological system because of, for example, ecological and environmental change. Here it also might be worthwhile to try to decipher when missing or changed relational values may cause these emotional responses. We emphasize that the lines between emotions and relational values may be quite imprecise (and possibly discipline dependent) and see this topic as important for further exploration, especially concerning interdisciplinary understandings of both emotions and values (Hagen and Gould 2022).

Dynamism of relational values and their impact on human well-being

Individual and shared relational values can change because of ecological change or human migration, and these changes can impact human well-being. First, many coastal ecosystems are changing rapidly, and this dynamism has at least two important effects associated with relational values. First, coastal degradation causes many relational values to erode because biophysical aspects to which the relational value is linked are degrading or missing (Riechers et al. 2020). Second, erosion of relational values can decrease human well-being because the loss of something valued has a negative impact (Ross et al. 2018). As an example, research on coastal degradation can detect a feeling of alienation

in inhabitants, which may have replaced their relational values of sense of place (e.g., Okunoye 2008). Second, human migration can dramatically change relational values. Migration, both forced and voluntary, climate-related and otherwise, is likely to rise in the coming decades (IPBES 2019). This migration may lead to lost relational values, as people leave familiar landscapes and endure the trauma of change (Gordon and Hale 2003). Migration may also, however, create new relational values (Gladkikh et al. 2019). These complex dynamics are ripe for future research.

Quantifying relational values and their loss

Another aspect that needs further research is the quantification of relational values and the loss thereof. To date no generally accepted quantitative relational value scale exists. Related research from multiple fields, however, suggests that understanding relational values with quantitative data is well within the realm of possibility (Schulz and Martin-Ortega 2018). Examples of scales with similar framing include nature relatedness, connectedness to nature, and love and care for nature (Mayer and Frantz 2004, Nisbet et al. 2009, Perrin and Benassi 2009, Perkins 2010). Measuring relational values with quantitative data presents multiple important challenges. One is the underlying assumption that all respondents have the same understanding of questionnaire items. For relational values, this might be difficult, especially across social groups, cultures, or those who have been affected by environmental change in different ways. We do not see this challenge as insurmountable; research, however, needs to clarify what exactly was asked and address multiple possible interpretations (e.g., rather than reporting only that spirituality is important, reporting exactly the language used to attempt to assess spirituality and what it likely meant in the study context). A second, related challenge is that it may be difficult to parse relational values into separate, distinct units, given that suites of relational values (and closely related concepts such as cultural ecosystem services) are often connected in complex ways (Klain et al. 2014b, Gould et al. 2015). A third challenge is that the lack of relational values (i.e., "losing something") may need to be assessed differently than "intact" values. Research suggests that this approach of asking about what is lost, in a hypothetical case in which an ecosystem or access to it changes, is an effective way to understand relational values that can be so ingrained in life as to be otherwise difficult to articulate. Understanding how questions about loss interact with actual biophysical change and consequent changing values, and determining how these phenomena may be assessed quantitatively, is a promising area for future research (Gould and Schultz 2021, Riechers et al. 2021).

Conceptual and empirical clarity

Further, it is important to highlight that values, valued objects, benefits, and actions are often closely connected and can be difficult to disentangle (Schulz and Martin-Ortega 2018). Recreation provides an obvious and well-studied example. Many studies include recreation as a relational value, but it can also be considered a valued object (e.g., I value recreation in nature), a benefit that nature provides, or an action that allows the fulfilment of values (see a similar discussion around recreation as landscape value [Biedenweg et al. 2019] or as ecosystem service [Satz et al. 2013, Gould et al. 2015]). Concepts that confront similar complexity include "well-being" and "cultural" and "symbolic" values. This complexity highlights that researchers need to be clear about why and how focal topics are relational values.

Box 1: **Three recommendations for further research on relational values**

Specificity regarding relational values and the biophysical aspects to which they are linked

With a broad concept such as relational values, it is important to be conceptually explicit about what relational values are and which and whose relational values are being researched. Equally important is to specify to which biophysical aspects (element, structure, process of nature) the relational value is linked (Chan et al. 2018, Gould et al. 2020) in a way that can inform management. This broadens the approach to include those who need to change places (e.g., refugees, migrants, or victims of segregation [Gordon and Hale 2003, Dixon and Durrheim 2004, Gladkikh et al. 2019] or whose places are changing [Sheremata 2018]). This information can assist interdisciplinary work between social and natural scientists and enable a clearer formulation of environmental conservation measures with practitioners.

Use of transdisciplinary and participatory approaches

Transdisciplinary and participatory approaches can co-create new insights on relational values for research and practice through collaboration with diverse practitioners and researchers from different disciplines (Lang et al. 2012). Most of the research studies assessed did not explicitly acknowledge transdisciplinary and participatory approaches. Yet the few transdisciplinary and participatory studies we analyzed made clear that these approaches can generate additional insights on how relational values can be understood and strengthened and how they can be applied in conservation management and policy making. Especially if conducted in tandem with Indigenous peoples and local communities, such research can enhance social learning processes, empower actors, and legitimize their knowledges or practices. Transdisciplinary approaches are particularly likely to foster arts- and design-based approaches (Muhr 2020, Raatikainen et al. 2020), the assessment of poetry (Okunoye 2008), and other creative approaches, which may emphasize a different set of relational values and their connections to nature (Gould 2021).

Strengthening relational values for sustainability transformation

Relational values research has the potential to contribute to sustainability transformations. First, relational values may be linked to pro-environmental attitudes and behavior and may influence policy interventions that aim to strengthen biodiversity and support citizens' contributions to environmental/biodiversity conservation (Mattijssen et al. 2020). Strengthening certain relational values might foster sustainability, so transforming social-ecological systems to allow pro-sustainability relational values to flourish might be a valuable goal for sustainability scientists (Folke et al. 2011, Abson et al. 2017). Second, eliciting how different relational values are interlinked and how they interact could help to find important nodes (i.e., relational values that are connected to many other relational values and could have synergizing effects when strengthened). These nodes might act as enhancers and create stronger relational values overall through ripple effects in the value system.

CONCLUDING REMARKS

With the IPBES value assessment approved in July 2022 (IPBES 2022), understanding and operationalizing relational values (in contrast to instrumental and intrinsic ones) will become increasingly crucial. Our paper presents a comprehensive systematic literature review of concepts related to relational values from coastal ecosystems of the Global South. We show how research over the last 20 years has used concepts closely related to relational values even before the term was widely in use in environmental spheres. Our lessons learned for empirical research are (1) specificity regarding relational values and the biophysical aspects to which they are linked, (2) the use of transdisciplinary and participatory approaches for value assessment, and (3) strengthening pro-sustainability relational values to foster sustainability transformation. With this article, we hope to contribute to strengthening empirical research on relational values across disciplines.

Author Contributions:

All authors contributed equally to the conceptualization, data curation, review, and editing; Maraja Riechers led the writing of the original draft.

Acknowledgments:

We thank Stefan Hilser and Julius Rathgens for their methodological advice. NL was supported by the EQUALSEA (Transformative adaptation towards ocean equity) project, under the European Horizon 2020 Program, ERC Consolidator Grant Agreement n°101002784 funded by the European Research Council, and Grupo de Referencia Competitiva GI-2060 AEMI, under Grant ED431C2019/11.

Data Availability:

The data (codebook for qualitative data and SPSS files for quantitative data) can be made fully available.

LITERATURE CITED

Abson, D. J., J. Fischer, J. Leventon, J. Newig, T. Schomerus, U. Vilsmaier, H. von Wehrden, P. Abernethy, C. D. Ives, N. W. Jager, and D. J. Lang. 2017. Leverage points for sustainability transformation. Ambio 46:30-39. https://doi.org/10.1007/s13280-016-0800-y

Almudi, T., and D. C. Kalikoski. 2010. Traditional fisherfolk and no-take protected areas: the Peixe Lagoon National Park dilemma. Ocean & Coastal Management 53(5-6):225-233. https://doi.org/10.1016/j.ocecoaman.2010.04.005

Arias-Arévalo, P., B. Martín-López, and E. Gómez-Baggethun. 2017. Exploring intrinsic, instrumental, and relational values for sustainable management of social-ecological systems. Ecology and Society 22(4):43. https://doi.org/10.5751/ES-09812-220443

Aswani, S., and M. Lauer. 2006. Incorporating fishermen's local knowledge and behavior into geographical information systems (GIS) for designing marine protected areas in Oceania. Human Organization 65(1):81–102. https://doi.org/10.17730/humo.65.1.4y2q0vhe4l30n0uj

Badang, D., C. A. Ali, I. Komoo, and M. S. Leman. 2017. Sustainable geological heritage development approach in Sarawak Delta, Sarawak, Malaysia. Geoheritage 9:443–462. https://doi.org/10.1007/s12371-016-0189-9

Balázsi, Á., M. Riechers, T. Hartel, J. Leventon, and J. Fischer. 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

Bennett, N. J., A. Calò, A. Di Franco, F. Niccolini, D. Marzo, I. Domina, C. Dimitriadis, F. Sobrado, M.-C. Santoni, E. Charbonnel, M. Trujillo, J. Garcia-Charton, L. Seddiki, V. Cappanera, J. Grbin, L. Kastelic, M. Milazzo, and P. Guidetti. 2020. Social equity and marine protected areas: perceptions of small-scale fishermen in the Mediterranean Sea. Biological Conservation 244:108531. https://doi.org/10.1016/j.biocon.2020.108531

Bennett, N. J., and P. Dearden. 2018. Why local people do not support conservation: community perceptions of marine protected area livelihood impacts, governance and management in Thailand. Marine Policy 44:107-116. https://doi.org/10.1016/j.marpol.2013.08.017

Berkes, F. 1993. Traditional ecological knowledge in perspective. Pages 1-10 in J. Inglis, editor. Traditional ecological knowledge: concepts and cases. International Development Research Centre, Ottawa, Ontario, Canada.

Berkes, F. 2004. Rethinking community-based conservation. Conservation Biology 18(3):621-630. https://doi.org/10.1111/j.1523-1739.2004.00077.x

Berkes, F. 2017. Sacred ecology. Routledge, New York, New York, USA. https://doi.org/10.4324/9781315114644

Berkes, F., J. Colding, and C. Folke. 2000. Rediscovery of traditional ecological knowledge as adaptive management. Ecological Applications 10(5):1251-1262. https://doi.org/10.1890/1051-0761(2000)010[1251:ROTEKA]2.0.CO;2

Biedenweg, K., K. Williams, L. Cerveny, and D. Styers. 2019. Is recreation a landscape value?: exploring underlying values in landscape values mapping. Landscape and Urban Planning 185:24-27. https://doi.org/10.1016/j.landurbplan.2018.12.005

Bradley, J. C., T. M. Waliczek, and J. M. Zajicek. 1999. Relationship between environmental knowledge and environmental attitude of high school students. Journal of Environmental Education 30(3):17-21. https://doi.org/10.1080/00958969909601873

Brehm, J. M., B. W. Eisenhauer, and R. C. Stedman. 2013. Environmental concern: examining the role of place meaning and place attachment. Society & Natural Resources 26(5):522-538. https://doi.org/10.1080/08941920.2012.715726

Britto dos Santos, N., and R. K. Gould. 2018. Can relational values be developed and changed? Investigating relational values in the environmental education literature. Current Opinion in Environmental Sustainability 35:124–131. https://doi.org/10.1016/j.cosust.2018.10.019

Chan, K. M. A., P. Balvanera, K. Benessaiah, M. Chapman, S. Díaz, E. Gómez-Baggethun, R. Gould, N. Hannahs, K. Jax, S. Klain, G. W. Luck, B. Martín-López, B. Muraca, B. Norton, K. Ott, U. Pascual, T. Satterfield, M. Tadaki, J. Taggart, and N. Turner. 2016. Opinion: why protect nature? Rethinking values and the environment. Proceedings of the National Academy of Sciences 113(6):1462-1465. https://doi.org/10.1073/pnas.1525002113

Chan, K. M., R. K. Gould, and U. Pascual. 2018. Editorial overview: relational values: what are they, and what's the fuss about? Current Opinion in Environmental Sustainability 35:A1-A7. https://doi.org/10.1016/j.cosust.2018.11.003

Chapman, M., T. Satterfield, and K. M. A. Chan. 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

Cisneros-Montemayor, A. M., D. Pauly, L. V. Weatherdon, and Y. Ota. 2016. A global estimate of seafood consumption by coastal Indigenous peoples. PLoS ONE 11(12):e0166681. https://doi.org/10.1371/journal.pone.0166681

Crona, B. I. 2006. Supporting and enhancing development of heterogeneous ecological knowledge among resource users in a Kenyan seascape. Ecology and Society 11(1): 32. https://doi.org/10.5751/ES-01712-110132

Csardi, G., and T. Nepusz. 2006. The igraph software package for complex network research. InterJournal, Complex Systems 1695 (5):1-9.

Dacks, R., T. Ticktin, S. D. Jupiter, and A. Friedlander. 2018. Drivers of fishing at the household scale in Fiji. Ecology and Society 23(1):37. https://doi.org/10.5751/ES-09989-230137

de la Torre-Castro, M., and L. Lindström. 2010. Fishing institutions: addressing regulative, normative and cultural-cognitive elements to enhance fisheries management. Marine Policy 34(1):77-84. https://doi.org/10.1016/j.marpol.2009.04.012

Díaz, S., S. Demissew, J. Carabias, C. Joly, M. Lonsdale, N. Ash, A. Larigauderie, J. R. Adjikari, S. Arico, A. Báldi, et al. 2015. The IPBES conceptual framework—connecting nature and people. Current Opinion in Environmental Sustainability 14:1-16. https://doi.org/10.1016/j.cosust.2014.11.002

Dixon, J., and K. Durrheim. 2004. Dislocating identity: desegregation and the transformation of place. Journal of Environmental Psychology 24(4):455-473. https://doi.org/10.1016/j.jenvp.2004.09.004

Dutcher, D. D., J. C. Finley, A. E. Luloff, and J. B. Johnson. 2007. Connectivity with nature as a measure of environmental values. Environment and Behavior 39(4):474-493. https://doi.org/10.1177/0013916506298794

Folke, C., Å. Jansson, J. Rockström, P. Olsson, S. R. Carpenter, F. S. Chapin III, A.-S. Crépin, G. Daily, K. Danell, J. Ebbesson, T. Elmqvist, V. Galaz, F. Moberg, M. Nilsson, H. Österblom, E. Ostrom, Å. Persson, G. Peterson, S. Polasky, W. Steffen, B. Walker, and F. Westley. 2011. Reconnecting to the biosphere. AMBIO 40:719. https://doi.org/10.1007/s13280-011-0184-y

Fröcklin, S., N. S. Jiddawi, and M. de la Torre-Castro. 2018. Small-scale innovations in coastal communities: shell-handicraft as a way to empower women and decrease poverty. Ecology and Society 23(2):34. https://doi.org/10.5751/ES-10136-230234

Gasalla, M. A., and F. C. Gandini. 2016. The loss of fishing territories in coastal areas: the case of seabob-shrimp small-scale fisheries in São Paulo, Brazil. Maritime Studies 15:9. https://doi.org/10.1186/s40152-016-0044-2

Gladkikh, T. M., R. K. Gould, and K. J. Coleman. 2019. Cultural ecosystem services and the well-being of refugee communities. Ecosystem Services 40:101036. https://doi.org/10.1016/j.ecoser.2019.101036

Gordon, E. T., and C. R. Hale. 2003. Rights, resources, and the social memory of struggle: reflections and Black community land rights on Nicaragua's Atlantic Coast. Human Organization 62 (4):369–381. https://doi.org/10.17730/humo.62.4.7ca3b00qhkv955t2

Gould, R. K. 2021. How creativity can help research on the multiple values of nature become more innovative and inclusive. People and Nature 00: 1–14. https://doi.org/10.1002/pan3.10204

Gould, R. K., L. L. Bremer, P. Pascua, and K. Meza-Prado. 2020. Frontiers in cultural ecosystem services: toward greater equity and justice in ecosystem services research and practice. Bioscience 70(12):1093–1107. https://doi.org/10.1093/biosci/biaa112

Gould, R. K., S. C. Klain, N. M. Ardoin, T. Satterfield, U. Woodside, N. Hannahs, G. C. Daily, and K. M. Chan. 2015. A protocol for eliciting nonmaterial values through a cultural ecosystem services frame. Conservation Biology 29(2):575-586. https://doi.org/10.1111/cobi.12407

Gould, R. K., and P. W. Schultz. 2021. Challenges to understanding nonmaterial dimensions of human-nature connections, and how to address them. Ecology and Society 26 (3):14. https://doi.org/10.5751/ES-12604-260314

Graham, N. A. J., S. Jennings, M. A. MacNeil, D. Mouillot, and S. K. Wilson. 2015. Predicting climate-driven regime shifts versus rebound potential in coral reefs. Nature 518:94-97. https://doi.org/10.1038/nature14140

Hagen, E. J., and R. K. Gould. 2022. Relational values and empathy are closely connected: a study of residents of Vermont's Winooski River watershed. Ecology and Society 27(3):19. https://doi.org/10.5751/ES-13406-270319

Hak, D., K. Nadaoka, and V. Le Phu. 2016. Socioeconomic conditions and perceptions of environmental risks in the Mekong Delta, Vietnam. Coastal Management 44(6):585-605. https://doi.org/10.1080/08920753.2016.1233796

Hein, M. Y., A. Birtles, B. L. Willis, N. Gardiner, R. Beeden, and N. A. Marshall. 2019. Coral restoration: socio-ecological perspectives of benefits and limitations. Biological Conservation 229:14-25. https://doi.org/10.1016/j.biocon.2018.11.014

Himes, A., and B. Muraca. 2018. Relational values: the key to pluralistic valuation of ecosystem services. Current Opinion in Environmental Sustainability 35:1–7. https://doi.org/10.1016/j.cosust.2018.09.005

Hoelle, J., R. K. Gould, and A. Tauro. 2022. Beyond "desirable" values: expanding relational values research to reflect the diversity of human-nature relationships. People and Nature 00:1– 12. https://doi.org/10.1002/pan3.10316

Hoque, S. F., C. H. Quinn, and S. M. Sallu. 2017. Resilience, political ecology, and well-being: an interdisciplinary approach to understanding social-ecological change in coastal Bangladesh. Ecology and Society 22(2):45. https://doi.org/10.5751/ES-09422-220245

Horcea-Milcu, A. I., D. J. Abson, C. I. Apetrei, I. A. Duse, R. Freeth, M. Riechers, D. P. M. Lam, C. Dorninger, and D. J. Lang. 2019. Values in transformational sustainability science: four perspectives for change. Sustainability Science 14:1425-1437. https://doi.org/10.1007/s11625-019-00656-1

Hughes, T. P., M. L. Barnes, D. R. Bellwood, J. E. Cinner, G. S. Cumming, J. B. C. Jackson, J. Kleypas, I. A. van de Leemput, J. M. Lough, T. H. Morrison, S. R. Palumbi, E. H. van Nes, and M. Scheffer. 2017. Coral reefs in the Anthropocene. Nature 546:82-90. https://doi.org/10.1038/nature22901

Intergovernmental Panel on Climate Change (IPCC). 2019. Summary for policymakers. Pages 3-35 in H. O. Pörtner, D. C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, and N. M. Weyer, editors. IPCC special report on the ocean and cryosphere in a changing climate. Cambridge University Press, Cambridge, UK. https://doi.org/10.1017/9781009157964.001

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (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). IPBES secretariat, Bonn, Germany.

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (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.

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). 2022. Methodological assessment report on the diverse values and valuation of nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES secretariat, Bonn, Germany. https://doi.org/10.5281/zenodo.6522522

Keniger, L. E., K. J. Gaston, K. N. Irvine, and R. A. Fuller. 2013. What are the benefits of interacting with nature? International Journal of Environmental Research and Public Health 10 (3):913-935. https://doi.org/10.3390/ijerph10030913

Klain, S. C., R. Beveridge, and N. Bennett. 2014a. Ecologically sustainable but unjust? Negotiating equity and authority in common-pool marine resource management. Ecology and Society 19(4):52. https://doi.org/10.5751/ES-07123-190452

Klain, S. C., P. Olmsted, K. M. A. Chan, and T. Satterfield. 2017. Relational values resonate broadly and differently than intrinsic or instrumental values, or the New Ecological Paradigm. PLoS ONE 12(8):e0183962. https://doi.org/10.1371/journal.pone.0183962

Klain, S. C., T. A. Satterfield, and K. M. A. Chan. 2014b. What matters and why? Ecosystem services and their bundled qualities. Ecological Economics 107:310-320. https://doi.org/10.1016/j.ecolecon.2014.09.003

Lang, D. J., A. Wiek, M. Bergmann, M. Stauffacher, P. Martens, P. Moll, M. Swilling, and C. J. Thomas. 2012. Transdisciplinary research in sustainability science: practice, principles, and challenges. Sustainability Science 7(Supp 1):25-43. https://doi.org/10.1007/s11625-011-0149-x

Lauer, M., and S. Aswani. 2010. Indigenous knowledge and long-term ecological change: detection, interpretation, and responses to changing ecological conditions in Pacific Island Communities. Environmental Management 45:985–997. https://doi.org/10.1007/s00267-010-9471-9

Leite, M. C. F., and M. A. Gasalla. 2013. A method for assessing fishers' ecological knowledge as a practical tool for ecosystem-based fisheries management: seeking consensus in Southeastern Brazil. Fisheries Research 145:43-53. https://doi.org/10.1016/j.fishres.2013.02.013

Loch, T. K., and M. Riechers. 2021. Integrating indigenous and local knowledge in management and research on coastal ecosystems in the Global South: a literature review. Ocean & Coastal Management 212:105821. https://doi.org/10.1016/j.ocecoaman.2021.105821

Lopes, P. F. M., L. Mendes, V. Fonseca, and S. Villasante. 2017. Tourism as a driver of conflicts and changes in fisheries value chains in Marine Protected Areas. Journal of Environmental Management 200:123-134. https://doi.org/10.1016/j.jenvman.2017.05.080

Lopes, P. F. M., and S. Villasante. 2018. Paying the price to solve fisheries conflicts in Brazil's Marine Protected Areas. Marine Policy 93:1-8. https://doi.org/10.1016/j.marpol.2018.03.016

Marikandia, M. 2001. The vezo of the fihereña coast, southwest Madagascar: yesterday and today. Ethnohistory 48(1-2):157-170. https://doi.org/10.1215/00141801-48-1-2-157

Mattijssen, T. J. M., W. Ganzevoort, R. J. G. van den Born, B. J. M. Arts, B. C. Breman, A. E. Buijs, R. I. van Dam, B. H. M. Elands, W. T. de Groot, and L. W. J. Knippenberg. 2020. Relational values of nature: leverage points for nature policy in Europe. Ecosystems and People 16(1):402-410. https://doi.org/10.1080/26395916.2020.1848926

Mayer, F. S., and C. M. Frantz. 2004. The connectedness to nature scale: a measure of individuals' feeling in community with nature. Journal of Environmental Psychology 24(4):503-515. https://doi.org/10.1016/j.jenvp.2004.10.001

Mayring, P. 2008. Qualitative inhaltsanalyse. Grundlagen und Techniken. 10th edition. Beltz Verlag, Weinheim/Basel, Germany.

Mazzocchi, F. 2006. Western science and traditional knowledge. Despite their variations, different forms of knowledge can learn from each other. EMBO Reports 7(5):463-466. https://doi.org/10.1038/sj.embor.7400693

Millennium Ecosystem Assessment. 2005. Ecosystems and human well-being: synthesis. Island, Washington, D.C., USA.

Moher, D., A. Liberati, J. Tetzlaff, D. G. Altman, and the PRISMA Group. 2009. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Medicine 6(7):e1000097. https://doi.org/10.1371/journal.pmed.1000097

Mora, C., O. Aburto-Oropeza, A. Ayala Bocos, P. M. Ayotte, S. Banks, S. G. Bauman, M. Beger, S. Bessudo, D. J. Booth, E. Brokovich, et al. 2011. Global human footprint on the linkage between biodiversity and ecosystem functioning in reef fishes. PLoS Biology 9(4):e1000606. https://doi.org/10.1371/journal.pbio.1000606

Mozumder, M. M. H., M. M. Uddin, P. Schneider, M. M. Islam, and M. M. Shamsuzzaman. 2018. Fisheries-based ecotourism in Bangladesh: potentials and challenges. Resources 7(4):61. https://doi.org/10.3390/resources7040061

Muhr, M. M. 2020. Beyond words - the potential of arts-based research on human-nature connectedness. Ecosystems and People 16(1):249-257. https://doi.org/10.1080/26395916.2020.1811379

Muraca, B. 2011. The map of moral significance: a new axiological matrix for environmental ethics. Environmental Values 20(3):375-396. https://doi.org/10.3197/096327111X13077055166063

Nisbet, E. K., J. M. Zelenski, and S. A. Murphy. 2009. The nature relatedness scale: linking individuals' connection with nature to environmental concern and Behavior. Environment and behavior 41(5):715-740. https://doi.org/10.1177/0013916508318748

Okunoye, O. 2008. Alterity, marginality and the national question in the poetry of the Niger Delta. Cahiers d'Études Africaines 48 (191):413-436. https://doi.org/10.4000/etudesafricaines.11742

Olsson, P., and C. Folke. 2001. Local ecological knowledge and institutional dynamics for ecosystem management: a study of Lake Racken watershed, Sweden. Ecosystems 4:85-104. https://doi.org/10.1007/s100210000061

Outeiro, L., C. Gajardo, H. Oyarzo, F. Ther, P. Cornejo, S. Villasante, and L. B. Ventine. 2015. Framing local ecological knowledge to value marine ecosystem services for the customary sea tenure of aboriginal communities in southern Chile. Ecosystem Services 16:354-364. https://doi.org/10.1016/j.ecoser.2015.04.004

Papworth, S. K., J. Rist, L. Coad, and E. J. Milner-Gulland. 2009. Evidence for shifting baseline syndrome in conservation. Conservation Letters 2(2):93-100. https://doi.org/10.1111/j.1755-263X.2009.00049.x

Pascual, U., P. Balvanera, S. Díaz, G. Pataki, E. Roth, M. Stenseke, R. T. Watson, E. B. Dessane, M. Islar, E. Kelemen, et al. 2017. Valuing nature's contributions to people: the IPBES approach. Current Opinion in Environmental Sustainability 26-27:7-16. https://doi.org/10.1016/j.cosust.2016.12.006

Pellowe, K. E., and H. M. Leslie. 2021. Ecosystem service lens reveals diverse community values of small-scale fisheries. Ambio 50:586-600. https://doi.org/10.1007/s13280-020-01405-w

Perkins, H. E. 2010. Measuring love and care for nature. Journal of Environmental Psychology 30(4):455-463. https://doi.org/10.1016/j.jenvp.2010.05.004

Perrin, J. L., and V. A. Benassi. 2009. The connectedness to nature scale: a measure of emotional connection to nature? Journal of Environmental Psychology 29(4):434-440. https://doi.org/10.1016/j.jenvp.2009.03.003

R Core Team. 2019. R: a language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

Raatikainen, K. J., K. Juhola, M. Huhmarniemi, and H. Peña-Lagos. 2020. "Face the cow": reconnecting to nature and increasing capacities for pro-environmental agency. Ecosystems and People 16(1):273-289. https://doi.org/10.1080/26395916.2020.1817151

Ramirez-Sanchez, S., and E. Pinkerton. 2009. The impact of resource scarcity on bonding and bridging social capital: the case of fishers' information-sharing networks in Loreto, BCS, Mexico. Ecology and Society 14(1):22. https://doi.org/10.5751/ES-02841-140122

Ratter, B., A. Hennig, and Zahid. 2019. Challenges for shared responsibility — political and social framing of coastal protection transformation in the Maldives. DIE ERDE - Journal of the Geographical Society of Berlin 150(3):169-183. https://doi.org/10.12854/erde-2019-426

Raymond, C. M., G. G. Singh, K. Benessaiah, J. R. Bernhardt, J. Levine, H. Nelson, N. J. Turner, B. Norton, J. Tam, and K. M. A. Chan. 2013. Ecosystem services and beyond: using multiple metaphors to understand human-environment relationships. Bioscience 63(7):536-546. https://doi.org/10.1525/bio.2013.63.7.7

Riechers, M., Á. Balázsi, L. Betz, T. S. Jiren, and J. Fischer. 2020. The erosion of relational values resulting from landscape simplification. Landscape Ecology 35:2601–2612. https://doi.org/10.1007/s10980-020-01012-w

Riechers, M., Á. Balázsi, J.-O. Engler, G. Shumi, and J. Fischer. 2021. Understanding relational values in cultural landscapes in Romania and Germany. People and Nature 3:1036–1046. https://doi.org/10.1002/pan3.10246

Riechers, M., W. Henkel, M. Engbers, and J. Fischer. 2019. Stories of favourite places in public spaces: emotional responses to landscape change. Sustainability 11(14):3851. https://doi.org/10.3390/su11143851

Riechers, M., B. Martín-López, and J. Fischer. 2022. Human-nature connectedness and other relational values are negatively affected by landscape simplification: insights from Lower Saxony, Germany. Sustainability Science 17:865–877. https://doi.org/10.1007/s11625-021-00928-9

Rojas, O., M. Zamorano, K. Saez, C. Rojas, C. Vega, L. Arriagada, and C. Basnou. 2017. Social perception of ecosystem services in a coastal wetland post-earthquake: a case study in Chile. Sustainability 9(11):1983. https://doi.org/10.3390/su9111983

Ross, H., K. Witt, and N. A. Jones. 2018. Stephen Kellert's development and contribution of relational values in social-ecological systems. Current Opinion in Environmental Sustainability 35:46-53. https://doi.org/10.1016/j.cosust.2018.10.007

Satz, D., R. K. Gould, K. M. A. Chan, A. Guerry, B. Norton, T. Satterfield, B. S. Halpern, J. Levine, U. Woodside, N. Hannahs, X. Basurto, and S. Klain. 2013. The challenges of incorporating cultural ecosystem services into environmental assessment. AMBIO 42:675-684. https://doi.org/10.1007/s13280-013-0386-6

Schröter, M., E. Başak, M. Christie, A. Church, H. Keune, E. Osipova, E. Oteros-Rozas, S. Sievers-Glotzbach, A. P. E. van Oudenhoven, P. Balvanera, D. González, S. Jacobs, Z. Molnár, U. Pascual, and B. Martín-López. 2020. Indicators for relational values of nature's contributions to good quality of life: the IPBES approach for Europe and Central Asia. Ecosystems and People 16(1):50-69. https://doi.org/10.1080/26395916.2019.1703039

Schultz, P. W. 2001. The structure of environmental concern: concern for self, other people, and the biosphere. Journal of Environmental Psychology 21(4):327-339. https://doi.org/10.1006/jevp.2001.0227

Schultz, P. W. 2002. Inclusion with nature: the psychology of human-nature relations. Pages 61-78 in P. Schmuck and W. P. Schultz, editors. Psychology of sustainable development. Springer US, Boston, Massachusetts, USA. https://doi.org/10.1007/978-1-4615-0995-0_4

Schulz, C., and J. Martin-Ortega. 2018. Quantifying relational values—why not? Current Opinion in Environmental Sustainability 35:15-21. https://doi.org/10.1016/j.cosust.2018.10.015

Scoones, I., A. Stirling, D. Abrol, J. Atela, L. Charli-Joseph, H. Eakin, A. Ely, P. Olsson, L. Pereira, R. Priya, P. van Zwanenberg, and L. Yang. 2020. Transformations to sustainability: combining structural, systemic and enabling approaches. Current Opinion in Environmental Sustainability 42:65-75. https://doi.org/10.1016/j.cosust.2019.12.004

Sheremata, M. 2018. Listening to relational values in the era of rapid environmental change in the Inuit Nunangat. Current Opinion in Environmental Sustainability 35:75-81. https://doi.org/10.1016/j.cosust.2018.10.017

Silvano, R. A. M., P. F. L. MacCord, R. V. Lima, and A. Begossi. 2006. When does this fish spawn? Fishermen's local knowledge of migration and reproduction of Brazilian coastal fishes. Environmental Biology of Fishes 76:371-386. https://doi.org/10.1007/s10641-006-9043-2

Soga, M., and K. J. Gaston. 2016. Extinction of experience: the loss of human-nature interactions. Frontiers in Ecology and the Environment 14(2):94-101. https://doi.org/10.1002/fee.1225

Soga, M., and K. J. Gaston. 2018. Shifting baseline syndrome: causes, consequences, and implications. Frontiers in Ecology and the Environment 16(4):222-230. https://doi.org/10.1002/fee.1794

Sowman, M., and J. Sunde. 2018. Social impacts of marine protected areas in South Africa on coastal fishing communities. Ocean & Coastal Management 157:168-179. https://doi.org/10.1016/j.ocecoaman.2018.02.013

Topp, E. N., J. Loos, and B. Martín-López. 2021. Decision-making for nature's contributions to people in the Cape Floristic Region: the role of values, rules and knowledge. Sustainability Science 17:739–760. https://doi.org/10.1007/s11625-020-00896-6

Tran, T. C., N. C. Ban, and J. Bhattacharyya. 2020. A review of successes, challenges, and lessons from Indigenous protected and conserved areas. Biological Conservation 241:108271. https://doi.org/10.1016/j.biocon.2019.108271

Trentelman, C. K. 2009. Place attachment and community attachment: a primer grounded in the lived experience of a community sociologist. Society & Natural Resources 22 (3):191-210. https://doi.org/10.1080/08941920802191712

Trialfhianty, T. I., and Suadi. 2017. The role of the community in supporting coral reef restoration in Pemuteran, Bali, Indonesia. Journal of Coastal Conservation 21:873–882. https://doi.org/10.1007/s11852-017-0553-1

United Nations (UN). 2015. Transforming our world: the 2030 agenda for sustainable development. UN General Assembly. https://sdgs.un.org/2030agenda

United Nations Educational, Scientific and Cultural Organization (UNESCO). 2020. The science we need for the ocean we want. UNESCO, Paris, France. https://unesdoc.unesco.org/ark:/48223/pf0000265198

van den Born, R. J. G. 2008. Rethinking nature: public visions in the Netherlands. Environmental Values 17(1):83-109. https://doi.org/10.3197/096327108X271969

von Schuckmann, K., P.-Y. Le Traon, N. Smith, A. Pascual, S. Djavidnia, J.-P. Gattuso, M. Grégoire, G. Nolan, S. Aaboe, E. Aguiar, et al. 2019. Copernicus marine service ocean state report, issue 3. Journal of Operational Oceanography 12(Supp 1):S1-S123. https://doi.org/10.1080/1755876X.2019.1633075

Ward, J. H., Jr. 1963. Hierarchical grouping to optimize an objective function. Journal of the American Statistical Association 58(301):236-244. https://doi.org/10.1080/01621459.-1963.10500845

Wiederkehr, C., M. Schröter, H. Adams, R. Seppelt, and K. Hermans. 2019. How does nature contribute to human mobility? A conceptual framework and qualitative analysis. Ecology and Society 24(4):31. https://doi.org/10.5751/ES-11318-240431

APPENDIX A1

Search String

Regarding coastal areas:
TITLE-ABS-KEY ("Coast*"
- Marine

OR “coral reef*” OR “seagrass” OR “kelp forest” OR “rocky shore*” OR “rocky reef*” OR “sandy shore” OR “Shell reef*” OR “algal bed*” OR “seaweed bed*” OR
- transition

“*marsh*” OR “salt pond” OR “Beach*” OR “mangroves” OR “mudflat” OR “intertidal*” OR “tide pool” OR “soft bottom” OR “estuary*” OR “lagoons” OR “delta”)

Regarding relational values
AND TITLE-ABS-KEY (“relational values” OR

Regarding fundamental relational values:
- Security

AND TITLE-ABS-KEY (“livelihood securit*” OR
- Identity & autonomy

“Cultural identit*" OR "Individual identit*" OR “local identit*” OR "Social Memory" OR "Sense of place" OR "Place attachment" OR “stewardship” OR “local attachment” OR
- Social cohesion

“social cohesion” OR “sense of community” OR “conviviality” OR “kinship” OR
- Cultural Heritage

“cultural heritage” OR “inspiration” OR

Regarding eudaimonic relational values:
- Cognitive development

OR "Ecological literacy" OR "environmental learning*" OR “experiential knowledge” OR “environmental education” OR "indigenous knowledge" OR "indigenous ecological knowledge" OR "indigenous environmental knowledge" OR "indigenous local knowledge" OR "local knowledge" OR "local ecological knowledge" OR "local environmental knowledge" OR "traditional knowledge" "traditional ecological knowledge" OR "traditional environmental knowledge" OR "local indigenous knowledge" OR "local traditional knowledge" OR "indigenous traditional knowledge" OR "traditional indigenous knowledge" OR "traditional local knowledge" OR
- Aesthetics

“aesthetic*” OR “recreation*” OR “leisure” OR
- Sacredness

“religious*” OR "Spiritu* value*" OR "Sacred*" OR “totem*”

Regarding (“global South”
OR "China" OR "India" OR "Brazil" OR “South Africa" OR "Mexico" OR "Nigeria" OR "Malaysia" OR "Egypt" OR "Chile" OR "Iran" OR "Argentina" OR "Indonesia" OR "Viet Nam" OR "Bangladesh" OR "Philippines" OR "Kenya" OR "Thailand" OR "Ghana" OR "Saudi Arabia" OR "Colombia" OR "Tanzania" OR "Tunisia" OR "New Caledonia" OR "Botswana" OR "Pakistan" OR "Peru" OR "Fiji" OR "Sri Lanka" OR "United Arab Emirates" OR "Puerto

Rico" OR "Algeria" OR "Ecuador" OR "Uruguay" OR "Venezuela" OR "Kuwait" OR "Morocco" OR "Solomon Islands" OR "Oman" OR "Senegal" OR "Trinidad and Tobago" OR "Ukraine" OR "Cote d'Ivoire" OR "French Polynesia" OR "Costa Rica" OR "Jordan" OR "Panama" OR "Papua New Guinea" OR "Lebanon" OR "Cambodia" OR "Iraq" OR "Mauritius" OR "Qatar" OR "Cameroon" OR "Cuba" OR "Madagascar" OR "Belize" OR "Barbados" OR "Guam" OR "Mozambique" OR "Vanuatu" OR "Benin" OR "Bermuda" OR "Togo" OR "Yemen" OR "Federated States of Micronesia" OR "Libyan Arab Jamahiriya" OR "Marshall Islands" OR "Montenegro" OR "Namibia" OR "Nepal" OR "Nicaragua" OR "Timor-Leste" OR "American Samoa" OR "Bahamas" OR "Bahrain" OR "Gibraltar" OR "Jamaica" OR "Maldives" OR "Palau" OR "Virgin Islands (U.S.)" OR "Comoros" OR "Eritrea" OR "Gabon" OR "Honduras" OR "Mali" OR "Netherlands Antilles" OR "Niger" OR "Reunion" OR "Saint Lucia" OR "Zimbabwe" OR "Azerbaijan" OR "Bolivia" OR "Brunei Darussalam" OR "Congo" OR "Ethiopia" OR "Gambia" OR "Guinea" OR "Guinea-Bissau" OR "Guyana" OR "Haiti" OR "Laos" OR "Malawi" OR "Mauritania" OR "Myanmar" OR "Samoa" OR "Sudan" OR "Uganda" OR "Angola" OR "Aruba" OR "Belarus" OR "Burkina Faso")

Regarding publication year 2000 – 2018

AND PUBYEAR > 1999 AND PUBYEAR < 2019 AND

Regarding subject areas:

- (LIMIT-TO (DOCTYPE , "ar")) AND
- Excluding medical, and natural science and business subject areas

(EXCLUDE (SUBJAREA , "MEDI") OR EXCLUDE (SUBJAREA , "BIOC") OR EXCLUDE (SUBJAREA , "ENGI") OR EXCLUDE (SUBJAREA , "IMMU") OR EXCLUDE (SUBJAREA , "PHAR") OR EXCLUDE (SUBJAREA , "CHEM") OR EXCLUDE (SUBJAREA , "BUSI") OR EXCLUDE (SUBJAREA , "NURS") OR EXCLUDE (SUBJAREA , "VETE") OR EXCLUDE (SUBJAREA , "COMP") OR EXCLUDE (SUBJAREA , "CENG") OR EXCLUDE (SUBJAREA , "MATE") OR EXCLUDE (SUBJAREA , "HEAL") OR EXCLUDE (SUBJAREA , "PHYS") OR EXCLUDE (SUBJAREA , "NEUR") OR EXCLUDE (SUBJAREA , "MATH") OR EXCLUDE (SUBJAREA , "DENT")) AND (LIMIT-TO (LANGUAGE , "English"))

APPENDIX A2

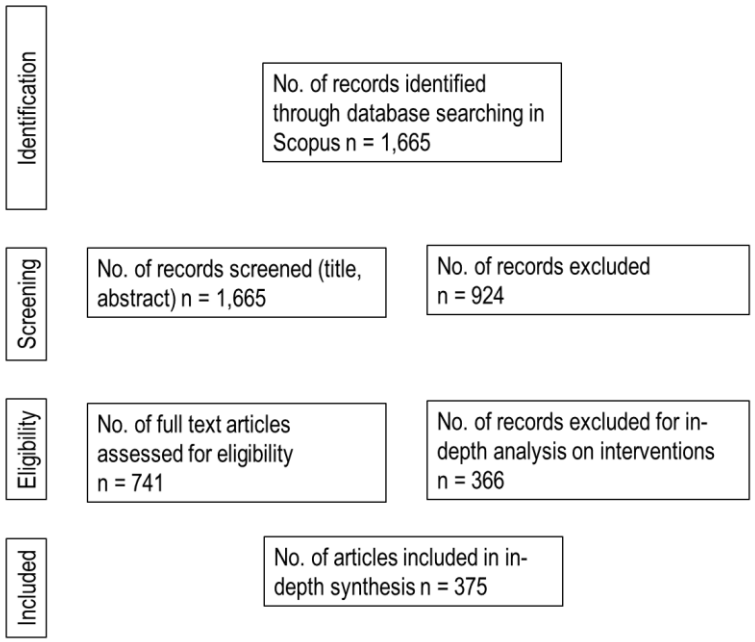


Figure A2.1 PRISMA flow diagram of the selection process of the systematic literature review

Table A2.1 Most often named benefits and challenges in regard to studying relational values

Benefits	**Frequency**	**%**
Complement Ecological (historical) Knowledge	204	54.4
Governance & Management	133	35.5
Economy & livelihood	89	23.7
Partnership & collaboration	85	22.6
Cohesion & Participation	78	20.8
Cultural maintenance	59	15.7
Conservation capacity	59	15.7
Challenges		
Globalization, Development & Market pressure	86	22.9
Mulit-Scale environmental threats	50	13.3
Cross-cultural work	38	10.1
Local socio-political complexities	37	9.7
Methodological	33	8.8
Scale	31	8.2
Mistrust of in TEK/ILK	27	7.2