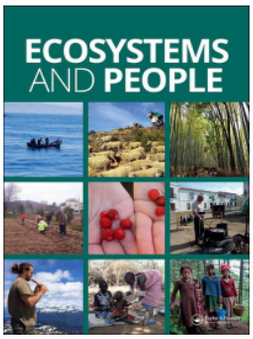

Ecosystems and People

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/tbsm22

The relationship between values and knowledge in visioning for landscape management: relevance for a collaborative approach

Andra-Ioana Horcea-Milcu, Sara Zaman, Anna Filyushkina, Maria D. López-Rodríguez, Miguel A. Cebrián-Piqueras & Christopher M. Raymond

To cite this article: Andra-Ioana Horcea-Milcu, Sara Zaman, Anna Filyushkina, Maria D. López-Rodríguez, Miguel A. Cebrián-Piqueras & Christopher M. Raymond (2022) The relationship between values and knowledge in visioning for landscape management: relevance for a collaborative approach, Ecosystems and People, 18:1, 498-513, DOI: 10.1080/26395916.2022.2108498

To link to this article: https://doi.org/10.1080/26395916.2022.2108498

ECOSYSTEMS AND PEOPLE
2022, VOL. 18, NO. 1, 498–513
https://doi.org/10.1080/26395916.2022.2108498

Taylor & Francis
Taylor & Francis Group

RESEARCH

OPEN ACCESS Check for updates

The relationship between values and knowledge in visioning for landscape management: relevance for a collaborative approach

Andra-Ioana Horcea-Milcu [a], Sara Zaman [b], Anna Filyushkina [c], Maria D. López-Rodríguez [d], Miguel A. Cebrián-Piqueras [e] and Christopher M. Raymond [b,f,g,h]

[a]Hungarian Department of Biology and Ecology, Babes-Bolyai University, Cluj-Napoca, Romania; [b]Department of Economics and Management, Faculty of Agriculture and Forestry Sciences, University of Helsinki, Helsinki, Finland; [c]Institute for Environmental Studies (IVM), Vrije Universiteit Amsterdam, Amsterdam, The Netherlands; [d]Internet Interdisciplinary Institute (IN3), Universitat Oberta de Catalunya (UOC), Castelldefels, Barcelona, Spain; [e]Department of Agricultural Economics and Rural Development, University of Göttingen, Göttingen, Germany; [f]Helsinki Institute of Sustainability Science (HELSUS), University of Helsinki, Helsinki, Finland; [g]Ecosystems and Environment Research Program, Faculty of Biological and Environmental Sciences, University of Helsinki, Helsinki, Finland; [h]Department of Landscape Architecture, Planning and Management, Swedish University of Agricultural Sciences, Alnarp, Sweden

ABSTRACT

Respecting connections between the diversity of values and forms of knowledge is essential to support a decision-making that fosters relationships between ecosystems and people. However, little theory has been developed for clarifying interactions between values and knowledge, and their relevance for environmental policy. We surfaced the overlooked relationship between values and knowledge by studying individual cognitive and emotional processes during a guided visioning exercise in the context of the multifunctional landscapes of Östergötland, Sweden. We investigated these cognitive processes using 30 semi-structured interviews and questionnaires organized around three types of relationships: vision ⇔ values, vision ⇔ knowledge, and especially values ⇔ knowledge. The analysis of the relationship between vision and values reveals that all types of values including core human values, relational, and intrinsic values are important in shaping the decision-making context in which landscape management visions arise. The relationship between vision and knowledge uncovers the mix of experiential and theoretical knowledge that informs the decision-making context. Interviews unfold three modalities in terms of how values and knowledge relate: i) linked and not necessarily connected (e.g. when individuals perceive a high conflict between their knowledge and their values leading to one construct silencing the other); ii) mutually reinforcing (e.g. when values and knowledge are seen as feeding into one another); and iii) intertwined (e.g. when individuals perceive that values and knowledge can co-exist). We discuss our findings in the context of their relevance for a collaborative decision-making process for balancing consensus and dissensus in multifunctional landscapes.

ARTICLE HISTORY
Received 20 September 2021
Accepted 26 July 2022

EDITED BY
Rosemary Hill

KEYWORDS
Human values; experiential knowledge; consensus; reflexivity; soft systems thinking; inclusivity

1. Introduction

Respecting connections between the diversity of values and forms of knowledge is essential to support a decision-making that fosters sustainable relationships between ecosystems and people. Environmental and sustainability related decision-making spaces are shaped by an interplay between rules, values and knowledge (Tengö et al. 2014; Colloff et al. 2017). There is a growing recognition of the contribution of diverse knowledge systems and of the values embodied in them to a more equitable decision-making and inclusive land management (Zafra-Calvo et al. 2020; Raymond et al. 2022), particularly in view of reaching consensus-based decision-making (Díaz-Reviriego et al. 2019). However, little theory has been developed for clarifying the interactions between values and knowledge, despite their relevance for promoting inclusive, collaborative approaches to decision-making (but see Topp et al. 2021).

Oversight of the connections between knowledge and values is likely to have consequences for sustainability science. There is a risk that pursuing value pluralism in isolation of critical knowledge enquiry could lead to situations where knowledge grounded on particular values is strategically selected to support particular policies (e.g. Rose 2018), or used to justify a specific option of sustainability solution (Soininen et al. 2021). A values-only sustainability therefore restricts knowledge to forms deemed valid according to the dominant values system, hence excluding certain stakeholder groups. Conversely, a knowledge-only perspective for pursuing sustainability excludes the inner dimensions of sustainability considered

CONTACT Andra-Ioana Horcea-Milcu andraioana.horceamilcu@ubbcluj.ro
Supplemental data for this article can be accessed online at https://doi.org/10.1080/26395916.2022.2108498

critical for transformative change (Ives et al. 2020; Woiwode et al. 2021).

Existing literature considers a few entry points into the relationships between values and knowledge. One standpoint is whether any scientific work and thus any knowledge mobilization can occur without influence from the societal values and norms which created it (Jasanoff 2004; Elliott 2017). For example, Hakkarainen et al. (2020) found that in the case of an intergovernmental methodological assessment regarding nature's values, experts' understandings of knowledge were connected to how they describe the multiple values of nature. A post-normal science standpoint espouses that values and knowledge cannot be dissociated if science is to contribute to societal change (Funtowicz and Ravetz 1993; Cornell et al. 2013). Seeing the value-laden nature of sustainability problems, solutions, and visions, the way knowledge is produced needs to engage with value-related issues (Caniglia et al. 2021).

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) sustains an interdependency standpoint between values and knowledge, where informed governance relies on knowledge production processes inclusive of diverse values and ways of knowing. An initial assumed separation between values and knowledge, and the need to combined them in innovative ways to govern complex systems is adopted by many scholars supporting value integration, although the interconnections between values and knowledge are rarely defined (Jacobs et al. 2018). For example, the recognition of relational values is pivotal for the inclusion in environmental decision-making of those knowledge systems built in close interaction with nature (Chan et al. 2016; Himes and Muraca 2018).

The relationship between values and knowledge is particularly pertinent in the context of collaborative decision-making processes. However, there is a knowledge gap in understanding how to equitably engage with the unprecedented complexity of connections between plural values and forms of knowledge with regard to collaborative process design (Musch and von Streit 2020) and conflict resolution (Stepanova et al. 2019). While deliberation and social learning have the potential to promote value shifts toward sustainability (Raymond and Kenter 2016), it remains unknown in which ways to combine values and knowledge in order to support sustainability visions (Miller et al. 2014). Moreover, investigating the various relationships between values and knowledge may assist with identifying how to activate values across different forms of knowledge (building on Chan et al. 2020).

To assess these relationships, we drew upon a visioning process requiring individual participants to critically reflect upon how their visions for integrated landscape management are informed by their values and knowledge. Reflections on the visioning process can reveal how values and knowledge underpin this theoretical process. Few authors have considered vision(ing)-knowledge or vision(ing)-values interactions, including: value-based participatory scenario building (Harmáčková et al. 2021); the role of values and visioning within transformative communities (Tschakert et al. 2016); constraints related to values and knowledge in adaptation pathways (Prober et al. 2017); values and experiential knowledge as basis for accessible scenarios that integrate management actions with nature's values (de Vries and Petersen 2009; Rawluk et al. 2018). Similarly, the IPBES (2015, 2022) sought to make visible the links between visions of sustainable futures and the values tacitly underlying these visions.

This paper aims to disentangle the relationship between values and knowledge at the individual level when informing visions of ideal landscape management using the multifunctional landscapes of Östergötland (Sweden) as a case study. We draw on the approach of visioning to surface the relationship between values and knowledge. We focused on the cognitive and emotional processes that happen at the individual level during an individual visioning exercise, by using in-depth inquiries regarding relationships between: the elicited vision ⇔ values, vision ⇔ knowledge, and values ⇔ knowledge. Building on our case study context, we address the questions of:

(A) Which values and forms of knowledge are considered when individuals reflect on their ideal vision for landscape management?
(B) How are different types of values and different forms of knowledge related when informing ideal visions for landscape management at the individual level?
(C) How could collaborative pluralistic settings take into account the relationship between values and knowledge?

We discuss our findings in the context of their relevance for a collaborative decision-making process.

2. Theoretical background

2.1. Visioning and visions

To meet our aim, we consider the examination of the visioning process can provide an entry point for understanding the relationship between values and knowledge at the individual level. Envisioning desirable futures actively engages both the values and the knowledge of the individuals building the vision (Fazey et al. 2020; Wyborn et al. 2021). The end product of the visioning process, the vision, describes a desirable future state and has a strong normative quality (Wiek and Iwaniec 2014:500). Visions for landscape management are informed by elements of

different knowledge systems such as scientific or local ecological knowledge (Cebrián-Piqueras et al. 2020), but also by place-based contextual values and transcendental core value (Tschakert et al. 2016; IPBES 2019).

2.2. Values

We drew on two value conceptualisations: core human values (otherwise referred to as transcendental values) and assigned values (otherwise referred to as contextual values). Core human values are concepts held by an individual that transcend specific situations, guide selection of behaviour and can be ordered by relative importance (Schwartz and Bilsky 1987). In contrast, assigned values relate to the worth or importance ascribed to specific places, objects or states of the world (Brown 1984), and can be divided into a triad of instrumental, intrinsic and relational values, recognising these categories are interrelated and not mutually exclusive (Chan et al. 2018). Instrumental values refer to the importance of nature as a means to an end (Pascual et al. 2017). Intrinsic values refer to the values of nature irrespective of human needs and experience (O'Connor and Kenter 2019). Relational values refer to preferences or virtues associated with human-nature relationships (Chan et al. 2016).

2.3. Knowledge

Knowledge has been referred to in various, sometimes conflicting ways in the ecosystem management literature, including scientific knowledge, local ecological knowledge, indigenous knowledge and expert knowledge. To provide some clarity, Raymond et al. (2010) proposed knowledge to be considered on a series of continua of: a) the extent of formal processes used to generate knowledge; b) whether it is locally specific or generalizable across regions; c) the extent of expertise applied to the mobilization of knowledge; d) the extent to which knowledge is articulated or accessible by others; and e) the extent to which knowledge reflects traditional cultural rules and norms. Here, we focus on the continuum between experiential and scientific knowledge. Experiential knowledge is framed with respect to local, place-based knowledge derived from concrete experiences (Fazey et al. 2006). In contrast, scientific knowledge is a systematically recorded knowledge that draws on an agreed set of principles, including reliability and validity. The knowledge co-production literature shows the limitations of viewing local experiential and scientific knowledge in isolation. Both knowledges can be hybridized through inclusive processes founded on respectful partnerships, reflexive learning, and trust building (Hill et al. 2020).

3. Methods

3.1. Study area

The research was undertaken in the county of Östergötland, Sweden (Figure 1). The county contains a patchwork of over 250 protected areas (e.g. Nature Reserves and Nature 2000 Sites) surrounded

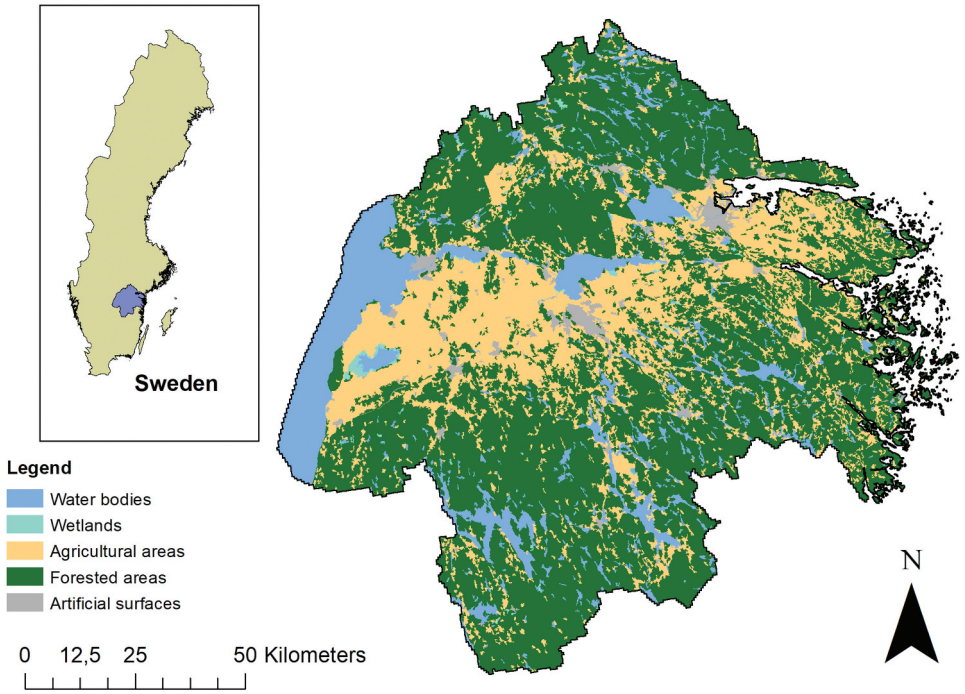

Figure 1. Map of the multifunctional landscapes in östergötland, Sweden © European Union, Copernicus Land Monitoring Service 2018, European Environment Agency (EEA).

by mixed land uses. The multifunctional landscapes include forests, arable land, pastures and urban areas that together provide multiple values of nature (Fagerholm et al. 2020). Forests include one of the country's largest oak woodlands, while wood pastures are one of the most-species rich habitats in Sweden (Garrido et al. 2017). However, the quality of these habitats is declining due to socio-economic threats such as competing land uses and the abandonment of extensive agriculture practices (Waldén and Lindborg 2018).

The inherently shared governance of the landscapes with decentralized decision-making and diverse stakeholders strives to mediate among divergent interests such as economic productivity, biodiversity conservation, and recreational needs (Andersson et al. 2020, see also Weddfelt et al. 2016). Consequently, conservation authorities are seeking to establish a variety of collaborative processes to enable stakeholders' participation in co-developing sustainable landscape strategies (e.g. Advisory Boards of nature reserves, public participatory processes). These tensions between management practices and their underlying values and knowledge make this case study illustrative for a systematic reflection on the relationship between values and knowledge.

3.2. Sample

To recruit participants for the study, we sent two rounds of e-mail invitations together with a participant information sheet to a list of 43 stakeholders recommended by the Östergötland County Administration Board. These stakeholders have been previously involved to various degrees in the management of landscapes and protected areas in Östergötland, and expressed interest in being part of future collaborative processes. We asked stakeholders who replied affirmatively (n = 12) or negatively to recommend potential interviewees with similar levels of experience in advisory roles. We also invited the first 25 interviewees to recommend other potentially suitable interviewees interested in carrying out a similar interviewing process. Snowball sampling resulted in a total of 97 invited persons and 30 exploratory interviews (lasting approximately 60 min.) with pre-interview questionnaires, conducted in English between August to October 2019. We conducted 26 face-to-face interviews and four on phone or online.

In our sample, 17 of the interviewed persons were males and 13 were females. Twenty-three of the participants were employed full- or part-time, with the rest being self-employed or retired. Interviewees had estimated their level of knowledge about Östergötland's landscapes as very high (n = 4), high (n = 14), or moderate (n = 12). Participants primarily self-identified through the pre-interview questionnaires to five stakeholder groups (Table 1).

3.3. Mixed methods technique

3.3.1. Part 1: Pre-interview questionnaire

The interviewing technique consisted of two parts: a pre-interview questionnaire and a one-on-one semi-structured exploratory interview (Flick 2014). The pre-interview questionnaire (Supplementary material A) comprised of sections on the interviewee's: 1) Background, experience and relationship

Table 1. Characteristics of participants interviewed in this study.

Variable	Category	Participants no. and %
Age	18–39 years	4 (13.3%)
	40–49 years	6 (20%)
	50–59 years	9 (30%)
	60–69 years	6 (20%)
	>70 years	5 (16.7%)
Education	University	28 (93.3%)
	Secondary school	2 (6.7%)
Self-identified stakeholder group	Forestry and agriculture	4 (13.3%)
	Conservation/Protected area management (at municipality and regional level)	6 (20%)
	Public administration (at municipality and regional level)	8 (26.7%)
	Recreation and other (environmental activism)	2 (6.7%)
	Residency/Land-owner	10 (33.3%)
Level of experience in relation to landscape management	High and very high	11 (36.7%)
	Moderate	12 (40%)
	Low and very low	7 (23.3%)
Years lived in the region	0–9 years	5 (16.7%)
	10–29 years	4 (13.3%)
	30–39 years	4 (13.3%)
	40–49 years	8 (26.7%)
	>50 years	8 (26.7%)
	Not applicable	1 (3.3%)

with the region; 2) Succinct description of the vision for the ideal landscape management of the Östergötland region; 3) Core human values; 4) Assigned values; 5) Knowledge sources and knowledge types; 6) Views towards working in groups; 7) Socio-demographic characteristics.

To initiate discussion about their ideal vision, participants were initially asked to sketch their vision in five words that were later used as prompts for a longer visioning exercise. We also asked participants to self-report their core human values using a 16 items scale (Schwartz 2012). The description of the core human values was based on De Vries Lentsch and Metzger (2018). To elicit assigned values, we asked questions about instrumental (10 items), intrinsic (3 items) and relational (8 items) values to be rated according to a Likert scale from "not important" to "very important". The importance of the knowledge sources was rated on a Likert scale from "not important" to "very important".

3.3.2. Part 2: Interview

The interview script (Supplementary material B) included sections analogous to the questionnaire about the participant's: 1) Background and experience; 2) Perception of the current management; 3) Values; 4) Visioning the ideal landscape management; 5) Knowledge sources; 6) Perceptions on the vision ⇔ values, vision ⇔ knowledge, values ⇔ knowledge relationships; 7) Views towards consensus and expectations from a collaborative process. During the interview, participants were asked to explain and reflect on their responses from the questionnaires, i.e. the importance of assigned and core human values, vision elements and knowledge background. The interview script probed the reasoning behind participant's choices and the relationship between these choices. Using a pre-interview questionnaire encouraged reflexivity by first introducing values and knowledge types to the participant, eliciting individual preferences in relation to the presented types, then guiding participants towards a self-inquiry about their answers' rationales with in-depth reflexive questions.

Although the interview included elements of visioning, this section was less intended to produce visions, but rather used as a prompting to spur reflections about the vision ⇔ values, vision ⇔ knowledge, and values ⇔ knowledge relationships. Therefore, this paper focuses mainly on the questions from sections 6) and 7) (Supplementary material B), but also draws on summaries of the other sections. Interviews were audio recorded and verbatim transcribed. The University of Helsinki social sciences and humanities ethics committee did not require a full ethics review because this study was deemed low risk. A prior voluntary informed consent form was handed to each of the participants allowing them to withdraw at any time during the interview or decline to answer questions. Consent was asked for the participation in and for the recording of the interview.

Transcripts of the 30 interviews and field notes were analysed following a grounded theory approach (Strauss and Corbin 1990; Suddaby 2006) using NVivo 12 software. We applied two rounds of iterative coding (open and axial) within each of the seven aforementioned sections of the interviews. Open coding was performed inductively close to the data with particular attention to those portions of text explaining participants' understanding of the relationships between vision and values, vision and knowledge, and values and knowledge. These codes were aggregated into themes, and further refined into categories. Axial coding focused on identifying connections among categories. Here, axial coding generated patterns of relating between values and knowledge which informed the three modalities presented in the Results. Our code book guided the interpretation of the qualitative data. We drew on phrasing indications such as: i) "restricted", "objective" or "difference" for the linked modality; ii) "connected" or "effect" for the reinforcing modality; iii) "intertwined", "very close relationship" or "real interaction" for the intertwined modality. Response categories were not mutually exclusive. For example, the same individual throughout the interview may have expressed ideas linked to one or more of the modalities. From the most abstract theoretical constructs (the modalities) to the least abstract ones (the codes) there were three to five levels of abstraction. The codes were then revised by collating more data from the original interview transcripts. Presence or absence was then recorded for each code, together with the number of all respondents who mentioned that theme. In keeping with qualitative analysis, significance was also attributed to minority viewpoints expressed less frequently. Theoretical saturation related to the development of values-knowledge relationship patterns was reached after 25 interviews (Saunders et al. 2018), i.e. no new patterns emerged from the data of the remaining five interviews. Seeing the highly abstract and philosophical nature of the questions and results, validity was not sought through participant reviewing. However, preliminary results were presented during a transdisciplinary meeting with representatives of the region, and feedback was encouraged. Reliability was ensured by checking transcripts and codes from interview transcripts through coding to grouping of the data. During the interviews and the analysis of transcripts we also noted the comments and feedback the participants gave in relation to the interview questions and interviewing technique. Although these comments were not prompted, we included them in the analysis.

4. Results

4.1. Which values and forms of knowledge are considered when individuals reflect on their ideal vision for landscape management?

When prompted to reflect on the values they took into account when creating visions, all types of values were to different extents considered by participants: core human values (by n = 18 participants), relational values (n = 13), instrumental values (n = 11), and intrinsic values (n = 7). In terms of core human values, freedom, social justice and fairness were most frequently mentioned. In reference to relational values, participants emphasized their place-based contextual nature and the importance of social interactions and identity in the context of the local landscape. Interestingly, sustainability arose as an important value feeding ideal visions (n = 8). In this case, the meaning of sustainability was centred on notions of "sustainable use of nature", continuity and care. Biodiversity values, understood as the values assigned by the interviewees to the diversity of ecosystems in the Östergötland landscapes, were mobilised when building ideal visions of landscape management for four participants. Interviewees ascribed to biodiversity values attributes pertaining to instrumental, relational or intrinsic values, as they were derived through using, experiencing or through the intrinsic worth of biodiversity. Finally, three participants recognised that a mix of multiple values is shaping their visioning process.

However, which values matter the most when informing visions of ideal landscape management cannot be fully disentangled as the interview could not fully simulate a situation of forced prioritisation. For example, as respondents developed their thinking, they sometimes modified their initial answers such as shifting from prioritising instrumental to intrinsic values. When probed to choose the value(s) they would represent in case of group situations of competing or conflicting visions, biodiversity values were the most frequently defended (n = 13). Participants would also be prepared to stand up for socially-oriented values (n = 8), such as social justice, freedom of speech or inclusivity, as well as a balanced valuation of productivity, biodiversity and people-focus (n = 5).

When reflecting on the knowledge they drew upon when creating their vision, interviewees reported they relied mainly on a hybrid of formal training, education and their experience in the region (n = 21). "Of course it's a mix of experience and listening to people, empirical evidence and also theory" (Interviewee1). "It's a mix of [...] all the feelings and knowledge and moods and wishes maybe" (I19). "So, the education was just an entry ticket to get a working place" (I14). For n = 18 primarily experiential knowledge informed their thinking. Interestingly, under this category, experience comes from one's practice (n = 8), but also through "the other", from contact, exposure, relating to others and their experiences and knowledge (n = 7). "I think a mix between things that I learned when I study, and things I learned when I was a small child, and things I learned almost every day when I spoke to landowners and to other people" (I16). For only n = 4 primarily theoretical knowledge mattered when envisioning ideal landscape management.

When asked which knowledge is needed for attaining the vision, participants mostly regarded knowledge about nature as necessary (n = 14), referring to knowledge about how species are interconnected (n = 7) and how humans are connected to nature (n = 7). Participants mentioned that knowledge concerning the farming and food system ("knowing where food comes from" I21) and the ability to recognise and trace the environmental impact of humans is urgently needed. The logic that permeated these responses was the focus on connectedness and interdependence in nature, rather than knowledge about its disparate elements. Some respondents also explained that evidence-based knowledge (e.g. scientific knowledge about human health, technological) is required in order to advance landscape management in the desired direction (n = 9). Others argued primarily for forms of experiential knowledge (n = 9), referring more specifically to grounded knowledge about social relationships being vital for implementing management visions. "I would like it to be treated as a social issue first because it's about conflict, it's about relationships, it's about people feeling safe or unsafe" (I9).

4.2. How are different types of values and different forms of knowledge related when informing ideal visions for landscape management at the individual level?

We specifically looked at how interviews unfold the relationships between values and knowledge at the individual level. To organise the inductive exploration of values-knowledge relationships, we abstract three modes of relating between values and knowledge in their order of interconnection (Figure 2 and Table 2).

4.2.1. Values and knowledge may be linked

This linked modality suggests that values and knowledge may operate as two stand-alone, even rigid constructs that could be treated as separate, as observed for six out of the 30 participants (n = 6). Here, the individuals perceive situations where only one construct may be active, while the other is silenced. At this lower level of interconnection

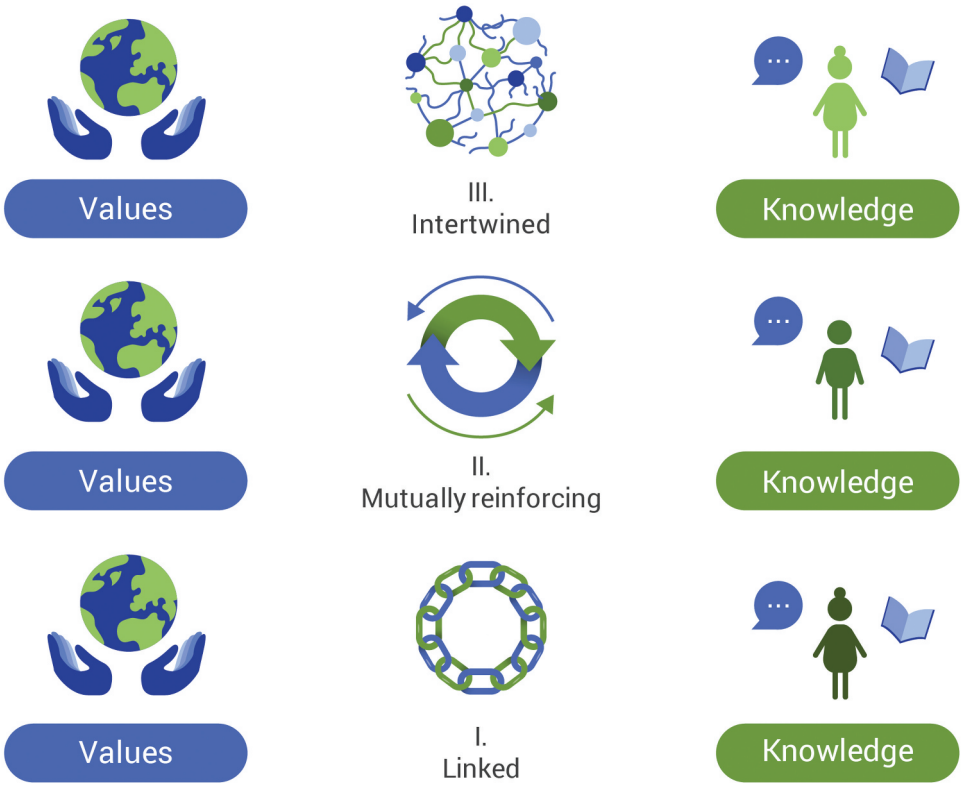

Figure 2. Three modalities for the relationship between values and knowledge when creating visions for landscape management.

Table 2. Three modalities for the relationship between values and knowledge compared along attributes explored in the description of the modalities.

Attribute	Linked	Mutually reinforcing	Intertwined
Level of interconnection between values and knowledge	Low; values and knowledge are considered sometimes linked, but not always connected	Medium; a bidirectional relationship where sometimes knowledge influences the values or values influence the knowledge is recognised	High; Values and knowledge are viewed as indivisibly connected to the same whole
Level of conflict between values and knowledge	High; conflict can exist as values and knowledge are thought of as separate entities that may be potentially linked	Low; values and knowledge are perceived as synergistic	Varying; coexistence of conflicting values and knowledge is possible, but the 'fit' between values and knowledge is iteratively adjusted in the direction of minimising conflicts and creating coherence
Views on the motivation to act towards a desired vision		Fosters the motivation to act from a place of deeper understanding of one's motivation	Fosters the motivation to act from a place of attunement to one's motivation and of value embodiment
Views on learning	A change in understanding is possible by means of keeping values and knowledge separate	A change in understanding is possible, but not actively sought	Learning is activated and necessary to build coherence between values and knowledge
Coding categories	Potentially conflicting values and knowledge (n = 4) Parallel separate concepts, but potentially bridged through experience (n = 2)	The knowledge primarily influences the values (n = 17) The values primarily influence the knowledge (n = 12) Bidirectional and mutually enforcing (n = 7)	Socialisation, exposure and life-long learning processes (n = 19) Individual coherence building as permanent interplay between values and knowledge (n = 7)

(Table 2), participants acknowledged their values and knowledge may be linked, and not always connected. Without developing on their specific points of connection, most respondents eluded towards experience as a bridge between values and knowledge.

Within this modality participants were more likely to report situations of values and knowledge being conflicting, with knowledge perceived as predominantly outside the individual, through e.g. day to day social interactions. One respondent who chose to move from an urban area to a rural one noted: "I think for me it's more of a difference. I think my values come from older times so to speak" (I6), whereas her knowledge has been shaped by current land management practices which she might not agree with. Some interviewees even mentioned that according to their professional aspirations,

values and knowledge are disconnected to keep the objectivity of their knowledge intact. "In a perfect world there would be perfect information – that is not subjective, but I don't think that's the case" (I27). Although interviewees here also question if values and knowledge can be realistically separated, they seem to be familiar with situations (especially professional ones) where this is the case. "In my profession I have to be objective, but as a human I know that my values will impact on my knowledge. So, when I work I have to be a person from the agriculture domain, but when I am home, I have my own values" (I28). Furthermore, when associations between values and knowledge are possible, they are not necessarily based on communalities or a sense of directionality.

4.2.2. Values and knowledge may be mutually reinforcing

Unlike when they are linked, within this modality values and knowledge are seen as dynamically coupled (n = 21) (Table 2) with interactions between values and knowledge sometimes acquiring a synergistic character (n = 7): "The more knowledge you have about something, [...] then you create your own opinions and values from that I would say. I think it goes hand in hand somehow" (I23). At this level of interconnection, some participants acknowledged a bidirectional relationship between values and knowledge, but with different starting points. Some participants reflected that primarily their knowledge influences their values (n = 17), while others considered that their values come before their knowledge and influence the decision-making context in which landscape management visions arise (n = 12).

Interviewees contemplated that knowledge without values lacks motivation and depth, and that becoming aware of the values underlying their knowledge strengthens their motivation to act towards the desired vision " ... the more you know, the more you have to accept this being not efficient enough" (I19). The mutually reinforcing mode allows participants to understand their engagement in caring for the landscape not only from the perspective of towards "what", but from a standpoint of "why?, why we are doing what we are doing"; "that could be giving a little more depth to our activities" (I13). Others indicated that values need to be supported by knowledge, to differentiate them from mere opinions or to ground them in a real-world context: " ... my personal values getting the answer when I studied. [...] For example if I think it's important to have big areas where animals live in the summer and they go feeding in the grass; before I studied, I thought it's beautiful and it's good, but when I study I get the knowledge on why [...] and what are the consequences" (I16).

4.2.3. Values and knowledge may be intertwined

In this modality values and knowledge become intertwined through continuous entangled interactions (n = 23). Unlike when they are mutually reinforcing and co-exist harmoniously, here values and knowledge are mutually building each other as the individual perpetually navigates and resolves minor tensions between the two (Table 2). At this highest level of interconnection, values and knowledge are viewed by participants as inseparable, intertwined in a mental model, which the individual adjusts following a coherence building process (n = 7) and an external socialization process (n = 19). "First, you need to collect a lot of knowledge; you have values already and then you need to test them if you need to change them" (I20). Because disagreement between values and knowledge is perceived as uncomfortable, at individual level, values and knowledge are in a permanent internal dialogue, co-creating each other more or less consciously. We refer to this iterative learning and reciprocal shaping as individual coherence building. Values and knowledge tend to be consolidated into conviction if validated by life experiences, including professional ones. "I think you can sometimes be surprised that you have a picture about values, then you get new perspectives, surveys are coming up, new knowledge [...]. What we think was higher value in the 70's, I think we think very differently about in these days" (I29). This process of re-actualisation and confirmation at individual level where knowledge is tested against values and vice-versa seems to be subject to continuous learning. "I have to learn more about the different values in an area before the meeting, and then I have to build up my knowledge in a broader way than I may have had at the beginning" (I29).

The internal individual coherence building is in interplay with a more external process of long-term socialisation starting from early life (see also Kenter et al. 2019). Interviewees describe how socialisation develops in three stages: childhood, formal training, and acting upon one's values and knowledge. It typically debuts in childhood with being exposed to an emotional event in relation to nature or to the constant care and interest shown by the family for the environment as something greater than oneself. "I have a basic feeling for the forest [...]; when I was a child I had that without any knowledge, other than living there. So that's very emotional and it has never gone away" (I1). " ... when the forest I have played with my friends all my life [...] was cut and it was [...] more like a war place [...] that created a disappointment. [...] For me it is against all rules that you should have as a human" (I2). Such an experience triggers feelings of empathy for nature or teaches the individual about human-nature

relationships. "I think my parents have been interested in showing us and teaching us about [...] how to act and how to be and also to enjoy being outdoors. And I think it affects your, at least my way of thinking about it a lot, such, maybe not so much connected to Östergötland. It would have been the same if I were somewhere else" (I17). The early life experience and consequent building of values is followed by the individual being socialised in theoretical knowledge and formal education often aligned to the early life values. The further acting upon one's situated knowledge and education is what accelerates the individual coherence building between values and knowledge.

According to the interviews' narratives, values and knowledge tend to be the most difficult to discriminate at the level of personal emotional reactions. However, it is from this place that the ability to act towards the desired vision rises. "Plain knowledge is not enough, you also have to have a connection, an emotional moment from something that is a bit deeper and it's very hard to pinpoint what that is" (I26). "I've always been angry when you must destroy nature and it has been more and more painful the older you get when you understand [...] how hard it is to influence this" (I2).

4.3. How could collaborative pluralistic settings take into account the relationship between values and knowledge?

he interview script and pre-interview questionnaire also sought to elicit expectations of stakeholders from a collaborative process, taking into account their relevance for multi-actor landscape management, and in view of organising one such process in the medium term. Expectations wise, participants regard a collaborative knowledge co-creation process as either: i) an informative tool with educational or consultative role (n = 13), ii) a transformative tool with a concrete output that could be followed-up (n = 13), such as improving the visibility of the region, iii) an inclusivity tool fostering participation and ownership regarding the management of the multifunctional landscape (n = 10). For a successful collaboration, respondents enumerated expectations in relation to the inclusivity (n = 15), the practical transformative side (n = 11) and the informative nature of the process (n = 5). Similar requirements were noted when eliciting factors that would build trust in a collaborative process, with additional emphasis on quality of interactions (n = 13), transparency (n = 5), and balancing of power relationships (n = 3). "I don't feel we reached sustainable solutions if it's not inclusive. [...] everyone should feel that their needs are met" (I9).

While some participants mentioned that during these collaborations, consensus would be desirable or even needed (n = 10), others stressed the importance of an open dialogue, respect, and equal chances for the expression of all viewpoints (n = 8). Some respondents with a high level of experience shed light on the hidden perils of consensus. "I think it's important to try new things and not be afraid of conflicts. See it more as something good and transparent. I think it's good to [...] stand up for what you think and [...] talk with others directly [...] Otherwise, there is a bigger chance for creating a conflict instead of meeting and talking it through and being transparent" (I20). Some of the participants explicitly did not favour agreement over the expression of value plurality. In their opinion agreement derives from listening. "That you train yourself in [...] capability of listening to others. And you can look upon that person with a friendly face, friendly eyes and you might think that he's an idiot, but you 100% respect his points or her points" (I19). "That it doesn't mean that you are friends forever, but you could be listening to each other without going in defence position" (I14). The importance of plurality was also confirmed when respondents reflected on which principles should guide the collaborative process: being open to everybody's ideas (n = 18) and being solution minded (n = 8).

Finally, during our investigation, we observed that following the guided individual reflection, interviewee's own understanding of the relationship between their constructed values and knowledge deepened. For example: "We don't discuss why we are members of the environmental movement [...] I think it could make us conscious about why we are doing what we are doing, conscious about motivation" (I13). Twenty-three stakeholders spontaneously expressed that the interview questions were difficult, especially that the relationships they raise are not something they commonly think about. Twelve participants recognised the questions are worthy of being asked, while some mentioned that being requested to articulate their thinking around values and visions can stimulate their motivation to engage in landscape management.

5. Discussion

This study was an original attempt at making the intangible relationship between values and knowledge more tangible by using visions as an interface for exploring this relationship through one-on-one interviews and questionnaires. Our research revealed that all types of values including core human values, and assigned relational, instrumental and intrinsic values matter when visioning human-nature relationships. Analysis also showed that a mix of evidence-based and experiential subjective forms of knowledge inform ideal landscape management visions. Below,

we outline three propositions for a deeper consideration of the relationships between values and knowledge in sustainability science and practice.

Proposition 1: *In situations of collaborative decision-making it is more suitable to adopt a soft systems thinking perspective that recognises values and knowledge are intertwined and mutually co-creating each other*

In terms of how values and knowledge relate in order to construct visions, we introduced three modalities depending on their level of interconnection: linked (modality I), mutually reinforcing (modality II), and intertwined (modality III) (Table 2 and Figure 2). These modalities raise questions about their suitability to the different purposes and contexts of sustainability science. The descriptive-analytical branch of sustainability science appears to be better served by the first modality, whereas the transformative purpose of sustainability science may be better supported by the third modality (Wiek and Lang 2016). Although models similar to the first modality have the merit of providing a necessary simplification of the interdependencies between values and knowledge, this abstraction remains valid only for a clearly delineated purpose. The third modality suggests treating these interdependencies following a logic of soft systems thinking, moving the attention from elements to relationships, and shifting the belief that the observed system can be engineered, to considering the system through the observer's interaction with the real world (Cundill et al. 2012). A soft systems thinking perspective creates a model of a system based on the inquirer's own understanding of how the world is, and sees this model as a learning tool to organize the inquiry (Nagatsu and Thoren 2020).

Many environmental studies operate within the boundaries set by the first modality, which seems fit for the purpose of assessing values and knowledge in isolation. For example, ecosystem services assessments are often illustrative of the first or second modality (Lamarque et al. 2014; Dunford et al. 2018), together with many studies which explore to what extent ecological knowledge supports the valuation of nature or is aligned with land management policies (Huambachano and Cooper 2020). Yet, the evolution of the literature on human-nature relationships is moving from the first and second modality towards broader framings of human-nature interactions that include local and indigenous values-knowledge systems, as per the concept of "nature's contribution to people" (Colloff et al. 2020) and the more relational understandings of conservation (Raymond et al. 2022). Especially when engaging with problems that are characterised by low agreement on values and knowledge (Jahn et al. 2012), the third modality seems more appropriate, particularly to "organise" the participation and deliberation that is inherent to addressing these wicked sustainability problems. Moreover, the third modality supports recent literature recognising that values and knowledge stemming from different epistemologies, such as the indigenous or scientific ways of knowing, cannot and need not be fully integrated (Klenk and Meehan 2015). Drawing upon soft systems thinking (Checkland 1993; Cundill et al. 2012), the third modality would more readily allow the expression of multiple voices (Hill et al. 2020; Turnhout et al. 2020).

Especially in the case of place-based values-knowledge systems operating outside of the dominant Western models of the world, such as indigenous worldviews, values and knowledge are intertwined and enmeshed in how indigenous peoples and local communities understand and reflect human-nature relationships (Berkes 2018; Hill et al. 2020). Looking at individuals not as merely knowledge and value holders, but as bearers of complex values-knowledge systems may entail expanding values assessments to encompass not only assigned values, but also core human values orientations. Due to their tacit nature, values, especially transcendental values, are often overlooked. Yet, in comparison to knowledge, they are more likely to play as stronger predictors of environmental risk perceptions (Steel and Soden 1990), or as constraining factors in decisions concerning multifunctional landscapes (Prober et al. 2017).

Proposition 2: *To navigate inclusivity in multifunctional landscapes it is useful to plan for a collaborative process that alternates between consensus building and plurality recognition*

The three modalities speak about an increasing importance of process design for multi-actor landscape management or other pluralistic decision-making spaces, as we move from modality I to modality III. According to the third modality, the relationship between values and knowledge cannot be fully elucidated and the two concepts cannot be completely disentangled. In this case and in line with the relational trend in sustainability science (Cockburn et al. 2019; West et al. 2020), the relationship itself becomes more valuable than its constituting elements. Procedural elements become equally important to govern complexity by organizing the negotiation inherent to including diverse values and ecosystem management (Múnera-Roldán et al. 2020). Explicitly considering values ⇔ knowledge relationships as part of process flows within collaborative decision-making may help move towards more integrative solution strategies for multifunctional

landscapes. Specifically, the planning and designing needs to effectively consider the dynamism emphasized by the third modality, i.e. allowing space for dissensus and consensus to coexist. Hence, it is useful to plan for a process that at a first stage is as conducive to plurality and divergence as it is to consensus building (Matulis and Moyer 2017; Díaz-Reviriego et al. 2019). Such processes face numerous barriers which partly explain the resistance to establish them: closed academic institutional structures, the risk to lose directionality leading to process paralysis, and the need to mobilise extensive financial, human, emotional resources and commitment (Cvitanovic et al. 2019; Rebelo et al. 2020; Laursen et al. 2021). Conversely, recent critiques to the imperative of consensus have highlighted the generative side of tensions created by different ways of knowing and valuing (Klenk and Meehan 2015; Turnhout et al. 2020).

Questioning the supremacy of consensus is grounded in the elicited opinions and experience of our participants in relation to collaborative landscape management. According to some of these, a sole emphasis on consensus is counterproductive. Expectations from collaboration seem to delineate inclusive spaces that allow for different values and knowledge systems to co-exist through reflexivity. Similarly, participants stressed the importance of active listening and transparency when organizing plural knowledge exchanges with the aim of improving landscape management. These elicited factors align with previous literature reviews of participatory conservation projects which detected that continuous stakeholder engagement, transparency and the integration of knowledge and values are significant variables for attitudinal change (Reed et al. 2017; Sterling et al. 2017). Some interviewees reflected that the failure to reach consensus can override any progress made, and that the attitude towards dissensus may partly explain non-productive collaborations. Although it was also revealed by other recent problematisations of collaborations across knowledge systems (Hakkarainen et al. 2020), future research may test if the attitude to disagreement could play the role of a predictor for the success of managing for inclusivity and diversity. Process elements that clarify individuals' expectations from their participation, as well as their understanding and attitude towards consensus and dissensus may reveal how to constructively bridge the gap between the two.

Proposition 3: *Operationalizing reflexivity in relation to both values and knowledge at the individual level may function as a useful baseline for collaborative knowledge production or decision-making*

Our research shines a spotlight on the potential of reflexivity to address the values ⇔ knowledge relationship within collaborative processes for landscape management. Feedback from our interviewees revealed the untapped potential of reflexivity to surface and activate one's values and knowledge and echoes recent calls in the sustainability transformations literature (Hazard et al. 2019). Indeed, scholars increasingly argue for a more reflexive practice in conservation science (Montana et al. 2020), in the management of protected areas (Múnera-Roldán et al. 2020), of natural resources (Wolff et al. 2019), or at the science-policy interface (Crouzat et al. 2018).

Based on participants' feedback and the repeated literature calls for reflexivity, we propose operationalizing reflexivity in relation to both values and knowledge at the individual level as a baseline for collaborative processes in knowledge co-creation or pluralistic decision-making. Prior to group discussions and broader deliberative processes, such a reflexive diagnosis might prepare participants with a clearer grasp of which values and knowledge are initially represented in a group and equip them with a common starting point for dialogue. The pre-interview questionnaire (aligned with the first modality) is one possible example of interrogations this diagnosis may entail, centred around values, knowledge and expectations from place-based collaborations. Recognising that following-up with facilitated collaborative knowledge production fell outside the scope of this prospective study, future research may assess *Proposition 3* further. For example, the baseline questionnaire may be repeated for a longitudinal analysis of changes in values, visions and knowledge in response to deliberative or co-creation processes.

5.1. Policy and planning implications

Our study can support decision-makers in designing context-specific strategies to foster social engagement in landscape management in three different ways. First, planning an individual-based inquiry of values and knowledge (e.g. Proposition 3, Supplementary material A) can be a relevant part of a multistage collaborative process towards sustainability outcomes. A reflexive diagnosis prior to deliberation, centred around individual values and knowledge increases the chances for a fair representability of different value orientations or knowledge systems in participatory mechanisms, such as the advisory boards of nature reserves in Östergötland. Second, using the same individual-based inquiry, identifying views and expectations towards involvement in decision-making by stakeholders (e.g. informative or cooperative roles) could provide a better estimate of

the necessary time and resources investment (Bennett et al. 2015). Calibrating efforts to achieve the desired operative conditions in a collaborative partnership improves the links between knowledge and action for environmental governance (Dedeurwaerdere et al. 2016). Third, the three modalities provide a way of customising collaborative processes to align with different views on learning, and on the motivation to act towards the desired management vision (Table 2). Learning is actively sought by participants sharing the intertwined modality, but less so in the case of modalities I-II. Individuals perceiving a high conflict between their knowledge and values (modality I) require different engagement and conflict management techniques to those who view that values and knowledge can co-exist (modality III). To this end, processes incorporating reflexive techniques and dissensus-friendly tools are increasingly suggested to build socially inclusive spaces preventing marginal views (Matulis and Moyer 2017).

Suggested process elements such as individual-based reflexive inquiries and constructively engaging with dissensus are more achievable at the local levels of landscape management. Additionally, applications in local decision-making, as opposed to the global one, present conditions necessary for representativeness and inclusiveness of diverse values held by different communities (Rosa et al. 2017), which nevertheless require navigating "the politics of doing inclusion" and balancing representation with deliberation locally (Kok et al. 2021). Therefore, the implications of informed decision-making using a values-knowledge perspective guided by one or more of the three modalities becomes relevant for the local governance of place, its equity and justice.

5.2. Limitations and future directions

As typical per inquiries about human values, a response bias in self-reported choices of guiding principles in life is possible (Bryman 2012). Most likely individuals who already had an interest in landscape management and were already inclined towards being reflexive responded to our participation invitation. Terminology posed certain difficulties to a few interviewees, but not to the majority. Cultural factors such as Sweden's highly gender equal and educated society (UNDP, 2013, 2018) may have enabled the elicitation of perceptions on such an intangible topic as the relationship between values and knowledge. Interviews were conducted in English, although a native Swedish speaker was present to assist for the first 13 interviews. Although in terms of theory development our study advances the idea of values and knowledge being related in a soft system thinking model, the structures this model provides might not be fit or sufficient for certain purposes. In addition, translating this model into practice remains a crucial next step.

6. Conclusion

Can and should the relationship between values and knowledge be disentangled, and if so, how? It depends on the purpose of the research and upon the modality through which individuals conceive of the values ⇔ knowledge relationship. In initial stages of empirical assessments for informative goals, treating values and knowledge as independent fully formed constructs (linked modality) seems more effective, recognizing that this simplification is valid within the defined boundaries of a mostly mono-faceted problematic. In complex situations of values plurality and participatory decision-making, as implied by relational and transdisciplinary settings such as collaborative landscape management, it is more appropriate to view knowledge as "mutually reinforcing" or "intertwined". For individuals conceiving of values and knowledge as linked or as mutually reinforcing, organising science-policy endeavours, such as scenario planning, around the first two modalities has its merits. Conversely, for individuals perceiving values and knowledge as intertwined, the relationship between values and knowledge generates new material that challenges pre-established categories. In this case, a soft systems thinking approach, where space and time are set for "organised" dissensus and reflexivity in relation to one's values and knowledge, seems more apt.

Acknowledgement

The authors would like to thank the 30 interviewees who engaged with these self-reflexive questions for their patience and hospitality. We are also thankful to two anonymous reviewers for comments that improved the manuscript. We thank Aron Larsson for invaluable assistance in the field and Monica Ungureanu. Slavena Peneva (Pensoft) provided graphical assistance on Figure 2.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This research received HELSUS funding (2019). AIHM acknowledges funding through the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement number 840207. SZ, AF, MDLR, MACP were funded through the ENVISION project, funded through the 2017-2018 Belmont Forum and BiodivERsA joint call for research proposals, under the BiodivScen ERA-Net COFUND

programme, and with the support of the following national funders: Swedish Research Council for Sustainable Development (FORMAS), German Federal Ministry of Education and Research (BMBF) (Grant Number: 01LC18064), Netherlands Organisation for Scientific Research (NWO), National Science Foundation, United States (NSF), National Park Service, United States (NPS) and the Ministerio de Ciencia e Innovación, Spain. CMR's time was supported by both the ENVISION (grant number 2018-02429) and VIVA-PLAN (grant number 2018-00175) projects supported by FORMAS (Sweden).

ORCID

Andra-Ioana Horcea-Milcu http://orcid.org/0000-0003-1757-6615
Sara Zaman http://orcid.org/0000-0001-5010-5888
Anna Filyushkina http://orcid.org/0000-0002-3586-2028
Christopher M. Raymond http://orcid.org/0000-0002-7165-885X

References

Andersson E, Kuiper J, Sellberg M. 2020. Fact sheet ENVISION : promoting inclusive conservation in protected areas. From a shared understanding of problems and solutions toward resilient landscape strategies for Västra Hargs Lövskogar nature reserve and its surrounding cultural landscape in Mjöl. Zenodo. doi:10.5281/zenodo.4304053.

Bennett EM, Cramer W, Begossi A, Cundill G, Díaz S, Egoh BN, Geijzendorffer IR, Krug CB, Lavorel S, Lazos E, et al. 2015. Linking biodiversity, ecosystem services, and human well-being: three challenges for designing research for sustainability. Curr Opin Environ Sustain. 14:76–85. doi:10.1016/j.cosust.2015.03.007.

Berkes F. 2018. Sacred ecology. 4th ed. London: Routdledge.

Brown TC. 1984. The concept of value in resource allocation. Land Econ. 60:231–246. doi:10.2307/3146184.

Bryman A. 2012. Social research methods. 4th ed. Oxford: Oxford University Press.

Caniglia G, Luederitz C, Wirth TV, Fazey I, Martín-López B, Hondrila K, König A, Wehrden HV, Schäpke NA, Laubichler MD, et al. 2021. A pluralistic and integrated approach to action-oriented knowledge for sustainability. Nat Sustain. 4:93–100. doi:10.1038/s41893-020-00616-z.

Cebrián-Piqueras MA, Filyushkina A, Johnson DN, Lo VB, Lopez-Rodrıguez MD, March H, Oteros-Rozas E, Peppler-Lisbach C, Quintas-Soriano C, Raymond CM, et al. 2020. Scientific and local knowledge, shaping perceptions towards protected areas and related ecosystem services. Landsc Ecol. 35:2549–2567. doi:10.1007/s10980-020-01107-4.

Chan KMA, Balvanera P, Benessaiah K, Chapman M, Díaz S, Gómez-Baggethun E, Gould R, Hannahs N, Jax K, Klain S, et al. 2016. Why protect nature? Rethinking values and the environment. Proc Natl Acad Sci. 113:1462–1465. doi:10.1073/pnas.1525002113.

Chan KMA, Boyd DR, Gould RK, Jetzkowitz J, Liu J, Muraca B, Naidoo R, Olmsted P, Satterfield T, Selomane O. 2020. Levers and leverage points for pathways to sustainability. People Nat. 2:693–717. doi:10.1002/pan3.10124.

Chan KMA, 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. doi:10.1016/j.cosust.2018.11.003.

Checkland P. 1993. Systems thinking, systems practice. West Susses: John Wiley & Sons.

Cockburn J, Cundill G, Shackleton S, Rouget M, Zwinkels M, Cornelius SA. 2019. Collaborative stewardship in multifunctional landscapes: toward relational, pluralistic approaches. 24:32. https://doi.org/10.5751/ES-11085-240432.

Colloff MJ, Martín-López B, Lavorel S, Locatelli B, Gorddard R, Longaretti PY, Walters G, van Kerkhoff L, Wyborn C, Coreau A, et al. 2017. An integrative research framework for enabling transformative adaptation. Environ Sci Policy. 68:87–96. doi:10.1016/j.envsci.2016.11.007.

Colloff MJ, Wise RM, Palomo I, Lavorel S, Pascual U. 2020. Nature's contribution to adaptation: insights from examples of the transformation of social-ecological systems. Ecosyst People. 16:137–150. doi:10.1080/26395916.2020.1754919.

Cornell S, Berkhout F, Tuinstra W, Tàbara JD, Jäger J, Chabay I, de Wit B, Langlais R, Mills D, Moll P, et al. 2013. Opening up knowledge systems for better responses to global environmental change. Environ Sci Policy. 28:60–70. doi:10.1016/j.envsci.2012.11.008.

Crouzat E, Arpin I, Brunet L, Colloff MJ, Turkelboom F, Lavorel S. 2018. Researchers must be aware of their roles at the interface of ecosystem services science and policy. Ambio. 47:97–105. doi:10.1007/s13280-017-0939-1.

Cundill G, Cumming GS, Biggs D, Fabricius C. 2012. Soft systems thinking and social learning for adaptive management. Conserv Biol. 26:13–20. doi:10.1111/j.1523-1739.2011.01755.x.

Cvitanovic C, Howden M, Colvin RM, Norström A, Meadow AM, Addison PF. 2019. Maximising the benefits of participatory climate adaptation research by understanding and managing the associated challenges and risks. Environ Sci Policy. 94:20–31. doi:10.1016/J.ENVSCI.2018.12.028.

De Vries Lentsch A, Metzger MJ. 2018. STREAMLINE - a visual interview methodology that makes semi-structured interviews, focus groups and stakeholder workshops more fun and accessible. The University of Edinburgh. https://doi.org/10.7488/ds/2437.

de Vries BJM, Petersen AC. 2009. Conceptualizing sustainable development. An assessment methodology connecting values, knowledge, worldviews and scenarios. Ecol Econ. 68:1006–1019. doi:10.1016/j.ecolecon.2008.11.015.

Dedeurwaerdere T, Admiraal J, Beringer A, Bonaiuto F, Cicero L, Fernandez-Wulff P, Hagens J, Hiedanpää J, Knights P, Molinario E, et al. 2016. Combining internal and external motivations in multi-actor governance arrangements for biodiversity and ecosystem services. Environ Sci Policy. 58:1–10. doi:10.1016/j.envsci.2015.12.003.

Díaz-Reviriego I, Turnhout E, Beck S. 2019. Participation and inclusiveness in the intergovernmental science–policy platform on biodiversity and ecosystem services. Nat Sustain. 2:457–464. doi:10.1038/s41893-019-0290-6.

Dunford R, Harrison P, Smith A, Dick J, Barton DN, Martin-Lopez B, Kelemen E, Jacobs S, Saarikoski H, Turkelboom F, et al. 2018. Integrating methods for ecosystem service assessment: experiences from real world

situations. Ecosyst Serv. 29(29):499–514. doi:10.1016/j.ecoser.2017.10.014

Elliott KC. 2017. A tapestry of values: an introduction to values in science. New York: Oxford University Press. doi:10.1093/acprof:oso/9780190260804.001.0001.

Fagerholm N, Martín-López B, Torralba M, Oteros-rozas E, Lechner AM, Bieling C, Stahl Olafsson A, Albert C, Raymond CM, Garcia-martin M. 2020. Perceived contributions of multifunctional landscapes to human well-being: Evidence from 13 European sites. People Nat. 2:217–234. doi:10.1002/pan3.10067.

Fazey I, Fazey JA, Salisbury JG, Lindenmayer DB, Dovers S. 2006. The nature and role of experiential knowledge for environmental conservation. 33:1–10. doi:10.1017/S037689290600275X.

Fazey I, Schäpke N, Caniglia G, Hodgson A, Kendrick I, Lyon C, Page G, Patterson J, Riedy C, Strasser T, et al. 2020. Transforming knowledge systems for life on Earth: Visions of future systems and how to get there. Energy Res Soc Sci. 70:101724. doi:10.1016/j.erss.2020.101724.

Flick U. 2014. An introduction to qualitative research. 5th ed. London: Sage Publications Ltd.

Funtowicz SO, Ravetz JR. 1993. Science for the post-normal age. Futures. 25:739–755. doi:10.1016/0016-3287(93)90022-L.

Garrido P, Elbakidze M, Angelstam P. 2017. Stakeholders' perceptions on ecosystem services in östergötland's (Sweden) threatened oak wood-pasture landscapes. Landsc Urban Plan. 158:96–104. doi:10.1016/j.landurbplan.2016.08.018.

Hakkarainen V, Anderson CB, Eriksson M, van Riper CJ, Horcea-Milcu A, Raymond CM. 2020. Grounding IPBES experts' views on the multiple values of nature in epistemology, knowledge and collaborative science. Environ Sci Policy. 105:11–18. doi:10.1016/j.envsci.2019.12.003.

Harmáčková ZV, Blättler L, Aguiar APD, Daněk J, Krpec P, Vačkářová D. 2021. Linking multiple values of nature with future impacts : value-based participatory governance scenario development for sustainable landscape Keywords. Sustain Sci. doi:10.1007/s11625-021-00953-8.

Hazard L, Cerf M, Lamine C, Magda D, Steyaert P. 2019. A tool for reflecting on research stances to support sustainability transitions. Nat Sustain. doi:10.1038/s41893-019-0440-x.

Hill R, Adem Ç, Alangui WV, Molnár Z, Aumeeruddy-Thomas Y, Bridgewater P, Tengö M, Thaman R, Adou Yao CY, Berkes F, et al. 2020. Working with indigenous, local and scientific knowledge in assessments of nature and nature's linkages with people. Curr Opin Environ Sustain. 43:8–20. doi:10.1016/j.cosust.2019.12.006.

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

Huambachano M, Cooper L. 2020. Values, knowledge, and rights shaping land use in the Peruvian AmazonThe Shimaa and Diamante case studies. Case Stud Environ. 4:1234945. doi:10.1525/CSE.2020.1234945.1.

IPBES. 2015. Intergovernmental Platform on Biodiversity and Ecosystem Services, Preliminary guide regarding diverse conceptualization of multiple values of nature and its benefits, including biodiversity and ecosystem functions and services (deliverable 3 (d)). Nairobi.

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. Bonn, Germany: IPBES secretariat. doi:10.5281/zenodo.3553579.

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. Pascual U, Balvanera P, Christie M, Baptiste B, González-Jiménez D, Anderson CB, Athayde S, Chaplin-Kramer R, Jacobs R, Kelemen E, Kumar R, Lazos E, Martin A, Mwampamba TH, Nakangu B, O'Farrell P, Raymond CM, Subramanian SM, Termansen M, Van Noordwijk M, Vatn A, (eds.). IPBES secretariat, Bonn, Germany. 37 pp. https://doi.org/10.5281/zenodo.6522392.

Ives CD, Freeth R, Fischer J. 2020. Inside-Out sustainability: the neglect of inner worlds. Ambio. 49:208–217. doi:10.1007/s13280-019-01187-w.

Jacobs S, Martín-López B, Barton DN, Dunford R, Harrison PA, Kelemen E, Saarikoski H, Termansen M, García-Llorente M, Gómez-Baggethun E, et al. 2018. The means determine the end – Pursuing integrated valuation in practice. Ecosyst Serv. 29:515–528. doi:10.1016/j.ecoser.2017.07.011.

Jahn T, Bergmann M, Keil F. 2012. Transdisciplinarity: between mainstreaming and marginalization. Ecol Econ. 79:1–10. doi:10.1016/j.ecolecon.2012.04.017.

Jasanoff S. 2004. States of knowledge: the co-production of science and social order. London: Routledge.

Kenter J, Raymond CM, van Riper CJ, Azzopardi E, Brear MR, Calcagni F, Christie I, Christie M, Fordham A, Gould RK, et al. 2019. Loving the mess: navigating diversity and conflict in social values for sustainability. Sustain Sci. 14:1439–1461. doi:10.1007/s11625-019-00726-4.

Klenk N, Meehan K. 2015. Climate change and transdisciplinary science: problematizing the integration imperative. Environ Sci Policy. 54:160–167. doi:10.1016/j.envsci.2015.05.017.

Kok KPW, Gjefsen MD, Regeer BJ, Broerse JEW. 2021. Unraveling the politics of 'doing inclusion' in transdisciplinarity for sustainable transformation. Sustain Sci. 16:1811–1826. doi:10.1007/S11625-021-01033-7.

Lamarque P, Meyfroidt P, Nettier B, Lavorel S. 2014. How ecosystem services knowledge and values influence farmers' decision-making. PLoS One. 9:e107572. doi:10.1371/journal.pone.0107572.

Laursen BK, Gonnerman C, Crowley SJ. 2021. Improving philosophical dialogue interventions to better resolve problematic value pluralism in collaborative environmental science. Stud Hist Philos Sci. 87:54–71. doi:10.1016/j.shpsa.2021.02.004.

Matulis BS, Moyer JR. 2017. Beyond inclusive conservation: the value of pluralism, the need for agonism, and the case for social instrumentalism. 10:279–287. doi:10.1111/conl.12281.

Miller TR, Wiek A, Sarewitz D, Robinson J, Olsson L, Kriebel D, Loorbach D. 2014. The future of sustainability science: a solutions-oriented research agenda. Sustain Sci. 9:239–246. doi:10.1007/s11625-013-0224-6.

Montana J, Elliott L, Ryan M, Wyborn C. 2020. The need for improved reflexivity in conservation science. Environ Conserv. 47:217–219. doi:10.1017/S0376892920000326.

Múnera-Roldán C, Roux DJ, Colloff MJ, Kerkhoff LV. 2020. Beyond calendars and maps: rethinking time and space for effective knowledge governance in protected areas. Land. 9(9):293. doi:10.3390/land9090293.

Musch AK, von Streit A. 2020. (Un)intended effects of participation in sustainability science: a criteria-guided comparative case study. Environ Sci Policy. 104:55–66. doi:10.1016/j.envsci.2019.10.004.

Nagatsu M, Thoren H. 2020. Sustainability science as a management science: Beyond the natural-social divide. In: Ludwig D, Koskinen I, Mncube Z, Poliseli L, Reyes-Garcia L, editors. Global Epistemologies and Philosophies of Science. London: Routledge; p. 105–119.

O'Connor S, Kenter JO. 2019. Making intrinsic values work; integrating intrinsic values of the more-than-human world through the Life Framework of Values. Sustain Sci. 14:1247–1265. doi:10.1007/s11625-019-00715-7.

Pascual U, Balvanera P, Díaz S, Pataki G, Roth E, Stenseke M, Watson RT, Başak Dessane E, Islar M, Kelemen E, et al. 2017. Valuing nature's contributions to people: the IPBES approach. Curr Opin Environ Sustain. 26–27:7–16. doi:10.1016/j.cosust.2016.12.006.

Prober SM, Colloff MJ, Abel N, Crimp S, Doherty MD, Dunlop M, Eldridge DJ, Gorddard R, Lavorel S, Metcalfe DJ, et al. 2017. Informing climate adaptation pathways in multi-use woodland landscapes using the values-rules-knowledge framework. Agric Ecosyst Environ. 241:39–53. doi:10.1016/j.agee.2017.02.021.

Rawluk A, Ford R, Anderson N, Williams K. 2018. Exploring multiple dimensions of values and valuing: a conceptual framework for mapping and translating values for social-ecological research and practice. Sustain Sci. doi:10.1007/s11625-018-0639-1.

Raymond CM, Cebrian-Piqueras MA, Andersson E, Andrade R, Raymond CM, Cebria MA, Schnell AA, Romanelli BB, Filyushkina A, Goodson DJ, et al. 2022. Inclusive conservation and the Post-2020 Global Biodiversity Framework: tensions and prospects. One Earth. 5:252–264. doi:10.1016/j.oneear.2022.02.008.

Raymond CM, Fazey I, Reed MS, Stringer LC, Robinson GM, Evely AC. 2010. Integrating local and scientific knowledge for environmental management. J Environ Manage. 91:1766–1777. doi:10.1016/j.jenvman.2010.03.023.

Raymond CM, Kenter JO. 2016. Transcendental values and the valuation and management of ecosystem services. Ecosyst Serv. 21:241–257. doi:10.1016/j.ecoser.2016.07.018.

Rebelo C, Mehmood A, Marsden T. 2020. Co-Created visual narratives and inclusive place branding: a socially responsible approach to residents' participation and engagement. Sustain Sci. 15:423–435. doi:10.1007/s11625-019-00760-2.

Reed MS, Vella S, Challies E, de Vente J, Frewer L, Hohenwallner-Ries D, Huber T, Neumann RK, Oughton EA, Sidoli Del Ceno J, et al. 2017. A theory of participation: what makes stakeholder and public engagement in environmental management work? Restor Ecol. 1–11. doi:10.1111/rec.12541.

Rosa IMD, Pereira HM, Ferrier S, Alkemade R, Acosta LA, Akcakaya HR, Den Belder E, Fazel AM, Fujimori S, Harfoot M, et al. 2017. Multiscale scenarios for nature futures. Nat Ecol Evol. 1:1416–1419. doi:10.1038/s41559-017-0273-9.

Rose DC. 2018. Avoiding a Post-truth World: embracing Post-normal conservation. Conserv Soc. 16:518–524. doi:10.4103/cs.cs_17_131.

Saunders B, Sim J, Kingstone T, Baker S, Waterfield J, Bartlam B, Burroughs H, Jinks C. 2018. Saturation in qualitative research: exploring its conceptualization and operationalization. Qual Quant. 52:1893–1907. doi:10.1007/s11135-017-0574-8.

Schwartz SH. 2012. An-Overview-Of-The-Schwartz-Theory-Of-Basic-Values. Online Readings Psychol Cult. 2:1–20. doi:10.9707/2307-0919.1116.

Schwartz SH, Bilsky W. 1987. Toward a Universal psychological structure of human values. J Pers Soc Psychol. 53:550–562. doi:10.1037/0022-3514.53.3.550.

Soininen N, Raymond CM, Tuomisto H, Ruotsalainen L, Thoren H, Horcea-milcu A, Stojanovic M, Lehtinen S, Mazac R, Lamuela C, et al. 2021. Bridge over troubled water: managing compatibility and conflict among thought collectives in sustainability science. Sustain Sci. doi:10.1007/s11625-021-01068-w.

Steel BS, Soden DL. 1990. The impact of knowledge and values on perceptions of environmental risk to the great lakes. Soc Nat Resour A Int J. 3:331–348. doi:10.1080/08941929009380730.

Stepanova O, Polk M, Saldert H. 2019. Understanding mechanisms of conflict resolution beyond collaboration: an interdisciplinary typology of knowledge types and their integration in practice. Sustain Sci. doi:10.1007/s11625-019-00690-z.

Sterling EJ, Filardi C, Toomey A, Sigouin A, Betley E, Gazit N, Newell J, Albert S, Alvira D, Bergamini N, et al. 2017. Biocultural approaches to well-being and sustainability indicators across scales. Nat Ecol Evol. 1:1798–1806. doi:10.1038/s41559-017-0349-6.

Strauss A, Corbin J. 1990. Basics of qualitative research: grounded theory procedures and techniques. Newbury Park: Sage Publications, Inc.

Suddaby R. 2006. From the editors: what grounded theory is not. Acad Management J. 49:633–642. http://www.jstor.org/stable/20159789.

Tengö M, Brondizio ES, Elmqvist T, Malmer P, Spierenburg M. 2014. Connecting diverse knowledge systems for enhanced ecosystem governance: the multiple evidence base approach. Ambio. 43:579–591. doi:10.1007/s13280-014-0501-3.

Topp EN, Loos J, Martín-López B. 2021. Decision - making for nature' s contributions to people in the Cape Floristic Region: the role of values, rules and knowledge. Sustain Sci. doi:10.1007/s11625-020-00896-6.

Tschakert P, Tuana N, Westskog H, Koelle B, Afrika A. 2016. TCHANGE: the role of values and visioning in transformation science. Curr Opin Environ Sustain. 20:21–25. doi:10.1016/j.cosust.2016.04.003.

Turnhout E, Metze T, Wyborn C, Klenk N, Louder E. 2020. The politics of co-production: participation, power, and transformation. Curr Opin Environ Sustain. 42:15–21. doi:10.1016/j.cosust.2019.11.009.

[UNDP] United Nations Development Programme. 2013. Education Index.

[UNDP] United Nations Development Programme. 2018. Gender Inequality Index.

Waldén E, Lindborg R. 2018. Facing the future for grassland restoration – what about the farmers? J Environ Manage. 227:305–312. doi:10.1016/j.jenvman.2018.08.090.

Weddfelt E, Vaccari M, Tudor T. 2016. The development of environmental visions and strategies at the municipal level: case studies from the county of östergötland in Sweden. J Environ Manage. 179:76–82. doi:10.1016/j.jenvman.2016.04.050.

West S, Haider LJ, Stålhammar S, Woroniecki S. 2020. A relational turn for sustainability science? Relational thinking, leverage points and transformations. Ecosyst People. 16:304–325. doi:10.1080/26395916.2020.1814417.

Wiek A, Iwaniec D. 2014. Quality criteria for visions and visioning in sustainability science. Sustain Sci. 9:497–512. doi:10.1007/s11625-013-0208-6.

Wiek A, Lang DJ. 2016. Transformational sustainability research methodology. In: Hienrichs H, Michelsen G, Martens P, Wiek A, editors. Sustainability science – an introduction. Dordrecht: Springer; pp. 31–42.

Woiwode C, Schäpke N, Bina O, Veciana S, Kunze I, Parodi O. 2021. Inner transformation to sustainability as a deep leverage point : fostering new avenues for change through dialogue and reflection. Sustain Sci. 16:841–858. doi:10.1007/s11625-020-00882-y.

Wolff MG, Cockburn JJ, Wet CD, Bezerra JC, Weaver MJT, Finca A, De A. 2019. Exploring and expanding transdisciplinary research for sustainable and just natural resource management. Ecol Soc. 24:14. https://doi.org/10.5751/ES-11077-240414.

Wyborn C, Louder E, Harfoot M, Hill S. 2021. Engaging with the science and politics of biodiversity futures: a literature review. Environ Conserv. 48:8–15. doi:10.1017/S037689292000048X.

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, et al. 2020. Plural valuation of nature for equity and sustainability: insights from the Global South. Glob Environ Chang. 63:102115. doi:10.1016/j.gloenvcha.2020.102115.