



Insight

Challenges to understanding nonmaterial dimensions of human-nature connections, and how to address them

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ABSTRACT. Research on the nonmaterial aspects of human-nature connections has grown steadily in recent years, yet efforts to understand nonmaterial connections between individuals and nature confront myriad challenges. We describe a set of three assumptions inherent in research on human-nature connections: (1) that the conceptions researchers are measuring exist inside a person's head; (2) that individuals can express these conceptions (in words or otherwise); and (3) that individuals express these conceptions honestly when asked by researchers. We frame each of these assumptions as challenges, then offer suggestions for addressing each. We have found this three-part framework helpful in designing research into these difficult-to-describe connections, and we provide examples of how these assumptions and responses to them have influenced and appeared in various research traditions.

Key Words: *connectedness with nature; cultural ecosystem services; environmental attitudes; conservation psychology; environmental values; explicit measures; implicit measures.*

INTRODUCTION

Understanding and addressing environmental problems will require a focus on the underlying dimensions of human-nature connections. By underlying dimensions, we refer to beliefs that individuals hold about their connections to the natural environment: e.g., to what extent am I part of nature, or separate?; to what extent do my beliefs about morality and justice apply to nature?; do I have a personal responsibility to protect nature? These beliefs are nonmaterial, i.e., based in psychological and other mental processes, and they interact with a range of sociological and cultural processes. They vary widely across individuals, societies, cultures, religions, and time. They are also often nonconscious, difficult for people to articulate, and sometimes sensitive. All these characteristics make them notoriously difficult to study. Yet these beliefs are critical for understanding links between human behavior and environmental issues; solving environmental problems will require an alignment between these foundational beliefs and the behavior changes required for sustainable transitions (Chan et al. 2020). In this paper, we describe three challenges inherent in the study of nonmaterial human-nature connections and offer suggestions for how to address them.

Research increasingly suggests both the urgency of better understanding complex social-ecological systems (Binder et al. 2013), and that nonmaterial human-nature connections are an integral, influential aspect of these systems (Ives et al. 2017, 2018). By nonmaterial human-nature connections, we mean how people think about, feel toward, and conceive of relationships with more-than-human aspects of the world (Muhar et al. 2018). Although research on nonmaterial human-nature connections is wide-ranging and draws on many concepts and disciplines, it is also limited when compared to research on many other aspects of social-ecological systems, e.g., material ecosystem services (Mandle et al. 2020).

This difficult-to-study and under-researched topic area is increasingly important in a world that aspires to equitable and

effective environmental decision making. One reason to study these nonmaterial aspects of human-nature connections is that they are crucial (if often implicit) aspects of many worldviews, including those outside dominant Western worldviews (Milfont and Schultz 2016, Pascua et al. 2017). Another reason is that positive connections with nature are often associated with pro-environmental behavior (Whitburn et al. 2020). Thus, if societal goals include equity and resource conservation, understanding the cognitive, social, affective, and developmental dimensions of the connections between individuals and place, i.e., nonmaterial aspects of human-nature relationships, will likely play a vital role in efforts to move toward a sustainable future.

Multiple overlapping fields and sub-fields address nonmaterial aspects of human-nature connections (Muhar et al. 2018). These fields include connectedness-with-nature studies (Schultz 2002, Restall and Conrad 2015, Ives et al. 2017); cultural ecosystem services (Milcu et al. 2013); environmental psychology (Gifford 2014); environmental education (Ernst and Theimer 2011); environmental sociology (Witt et al. 2019); geography (Urban and Rhoads 2003); outdoor recreation studies (Beery and Wolf-Watz 2014); and, as an example of a field that eschews the material-nonmaterial division, political ecology (Bryant 2015). This prevalence in academic work, across fields with disparate epistemologies and methodologies, suggests the importance of attention to these nonmaterial aspects of human-ecosystem relationships.

Yet despite their ubiquity, efforts to understand connections between people and ecosystems confront myriad challenges. Although these challenges differ across fields, we suggest that three fundamental assumptions underlie nearly all efforts to understand nonmaterial human-nature connections. These three assumptions were briefly mentioned by Schultz and Tabanico (2007) but warrant further elaboration. Explicating these basic assumptions can provide a useful conceptual tool and set of considerations for research on nonmaterial dimensions of human-nature connections.

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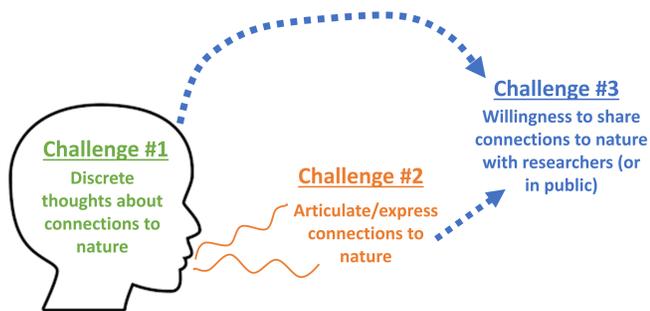
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This conceptual tool describes a cascade of three related assumptions inherent in research on nonmaterial human-nature connections (Fig. 1). Schultz and Tabanico (2007) list these assumptions in a few sentences, as a justification for using implicit measurement techniques, but they provide no elaboration. In the current paper, we provide a deeper examination of these assumptions, which we frame as challenges to understanding human-nature connections, along with an array of possible responses to them. The three assumptions are the following:

- that people have explicit, conscious beliefs about their nonmaterial relationships with nature;
- that when asked by a researcher, people can express their nonmaterial relationships with nature; and
- that people will express these relationships accurately to researchers.

The three assumptions named above can be considered challenges to understanding, and particularly measuring or characterizing, nonmaterial connections between people and nature (defined here as nonhuman elements of ecosystems). These challenges are relevant to many fields that study human-nature relationships, including those fields mentioned above, e.g., from environmental psychology to cultural ecosystem services, and beyond. We emphasize that the concepts involved in describing these challenges are not new; indeed, all have been mentioned elsewhere, as we indicate below. But we suggest that organizing them into this three-step set of challenges is helpful in identifying points in social research on human-environment interaction that require special attention.

Fig. 1. The three challenges to understanding connections to nature.



Although previous work on human-nature relationships (namely, Schultz and Tabanico 2007) has called attention to these three assumptions, it has not described them in detail. Simultaneously, research in other fields (notably psychology) has aimed to address these issues, but does so largely one-by-one, i.e., not collectively, and without attention to their relevance to studies of human-environment relationships. Because we find this conceptual cascade of challenges helpful in designing research on nonmaterial aspects of human-nature connections, in the current paper we expand upon these three assumptions and consider how identifying them may aid future research and advance our understanding of human-nature connections across different social science fields.

CHALLENGES TO UNDERSTANDING NONMATERIAL DIMENSIONS OF HUMAN-NATURE CONNECTIONS

Challenge #1: people have explicit beliefs about their relationships with nature

Before someone asks about them, many people (at least in today's industrialized societies) have likely not explicitly considered how ecosystems interact with or contribute to their well-being, especially in nonmaterial ways. Although connections with nature may be deeply important, they "are often unexpressed and outside our conscious awareness" (Himes and Muraca 2018:2). Many people, in other words, have never consciously thought about the constructs that environmental social science researchers find so important. Psychological research on implicit and explicit attitudes, measurements, and evaluations is helpful for understanding this first assumption that people have explicit beliefs about their relationships with nature. This research suggests, in general, that the mind does not have two separate systems for implicit and explicit functions. Essentially, the research finds evidence that human beliefs and attitudes exist within a large mental network, and can be accessed using both automatic and controlled systems (Gawronski and Brannon 2018). Ongoing research on the implicit-explicit "dualism" breaks down the idea of duality; instead, this research suggests that cognitions are of one type, whether we process these beliefs or attitudes implicitly or explicitly (Gawronski and Brannon 2018).

Empirical work suggests that human-nature connections are often processed implicitly. Participants in our empirical work have shared that before joining our studies, they had not considered these human-nature connections. As one example, participants in the first author's study about cultural ecosystem services in Hawai'i, in semi-structured interviews about their nonmaterial relationships with ecosystems, made comments that indicated that they had not previously thought about these topics (see Gould et al. 2014 for further details on methods). Participants said, for instance: "You're asking me questions that I've never really given any thought to, to tell the truth" and "This is not an easy interview, because a lot of these things are things you don't, like, you're not normally thinking about..." Many also indicated that they were now inspired to think more about the issues. Data from open-ended questions in interviews, such as the data just presented, provide nuance and detail related to how people process inquiries about nonmaterial aspects of their human-nature relationships. The same internal processing phenomena likely often occur with more closed-ended formats, e.g., survey items about human-nature connection, but those methods provide less detail on these underlying mental processes because researchers who use less open-ended methods rarely ask about them. When researchers do provide space to express these complexities, participants often voice them. As one example, when the second author debriefed participants in studies that explored connections with nature using quantitative survey instruments, many expressed that the topic was not one about which they had previously thought (Schultz and Tabanico 2007).

Psychologist Daryl Bem used the term "primitive" to refer to beliefs for which individuals lack words or direct conscious experience. "Our most fundamental primitive beliefs," Bem wrote, "are so taken for granted that we are apt not to notice that we hold them at all; we remain unaware of them until they are called

to our attention or are brought into question by some bizarre circumstance in which they appear to be violated” (1970:5-6). This description suggests that we are unaware of these nonconscious beliefs until they are either, (1) explicitly identified or, (2) threatened. Our work, along with other research on human-nature relationships, suggests that understanding the nonmaterial aspects of these relationships may often be nonconscious until those nonmaterial aspects are explicitly discussed or threatened. Much research that explores nonmaterial human-nature relationships relies on the first avenue for increasing awareness: calling attention to and explicitly discussing them. Scores of studies ask people directly about the nonmaterial aspects of their relationships with nature (e.g., as reviewed in, for example, Milcu et al. 2013 and Ives et al. 2017). The second avenue for increasing awareness—considering the beliefs (or the relationships that support them) as threatened—is arguably less common. As one example of this less common approach, work in Hawai‘i on human-nature relationships finds that in many cases, the most effective way to guide people to articulate the nonmaterial aspects of place-relationships that mattered most to them was to pose a hypothetical situation in which those relationships were severed. That is, portraying those relationships as lost was the most effective way to help people become aware of their importance, and particularly the nonmaterial aspects of their importance (Pascua et al. 2017; Pascua 2020, *personal communication*).

The challenges of studying concepts such as connectedness with nature become particularly salient in working with people from cultures with worldviews that differ substantially from Western viewpoints that tend to dichotomize humans and nature. The very idea of humans as separate from nature may be odd to some people. This may be especially true of Indigenous peoples and other communities for whom relationships with nonhuman elements of the world are central (e.g., Zent 2013, Mikolajczak et al. 2021). Studies demonstrate, for instance, that Native American participants are more likely to describe people as “a part of” nature than are European American respondents (Bang et al. 2007). Questions or studies that assume (implicitly or explicitly) that people and “nature” are separate entities may not resonate with, or even make sense to, people who do not see that separation as stark (Zent 2014). This is a crucial consideration for two reasons. First, it calls into question the entire topic of human-nature relationships as a framing for research (how, some might ask, can the relationship be studied if the two entities are not distinct?). Second, even when the topic of human-nature relationships is deemed valid or at least useful (as we deem it to be, despite its flaws), methods would do well to leave space for nondualistic conceptions, as a matter of epistemic justice (Himes and Muraca 2018).

Challenge #2: individuals can express their beliefs about connectedness with nature

Even if individuals have a mental construct to represent these nonmaterial connections, expressing those ideas can be difficult. In Western, and particularly academic, circles, we rely on verbal or written representations of abstract mental phenomena. Yet empirical work repeatedly demonstrates that individuals often struggle to articulate these deeply held conceptions. During interviews that involved various prompts about cultural ecosystem services in Hawai‘i, for instance, participants expressed

this in many ways (as above, see Gould et al. 2014 for methods details). Interviewee comments included the following:

- “That’s a hard, hard question, I think, just to put into words;”
- “I don’t know the right word;”
- “that’s kind-of a hard ... subject to put your thumb on;”
- “I don’t know if I’m going to describe this well, but ...;”
- “I don’t know how to explain that feeling ...;”
- “So maybe it’s indescribable...;”
- and the straightforward: “I don’t know if I can put it into words.”

One respondent closely reflected the idea of nonconscious beliefs: “I don’t know; it’s so central that I cannot, I cannot even figure out a way to describe it. It shapes every, every part of who you are.” Yet another located himself directly in this second stage of our three-stage challenge, suggesting that there is indeed a distinction between a conception in one’s head and the ability to convey it to others: “I know the meaning, but I don’t know how to express it.”

One line of scholarly research that specifically addresses challenges in articulating difficult-to-discuss human-nature relationships relates to understanding environmental values. Anthropological research has addressed this issue for decades (Satterfield 2001). It has confronted this challenge in diverse social-ecological situations, including those that involve differing perceptions of land/territory between Aboriginal people and white cattle farmers in Australia (Strang 1997); conflicts over old-growth logging in the U.S. Pacific Northwest (Satterfield 2007); Māori reactions to genetically modified organisms (Satterfield et al. 2013); and different stakeholder groups at the agricultural/forest frontier in the Brazilian Amazon (Hoelle 2018). Other research on environmental values acknowledges challenges to articulating values in contexts that range from United Kingdom marine protected areas (Kenter et al. 2016a) to a German mountain range (Bieling 2014). This work illuminates multiple ways to address challenges of articulation, some of which we describe below.

Challenge #3: people will accurately express their connectedness with nature to researchers (or in a way researchers can access)

The third challenge to studying these phenomena involves respondents sharing their deeply held perspectives, feelings, and beliefs with researchers (or in a way researchers can access). This challenge has at least three components: well-known biases in social, and particularly self-report-dependent, research; a wariness of sharing highly important and/or private knowledge; and familiarity and trust.

First, psychologists have identified a range of biases that impede accurate representation of social phenomena; most relevant to this paper is social desirability bias. This bias involves over-reporting socially preferable responses (Fisher 1993); it describes the tendency of participants to provide answers that conform to social norms, or that will not “make them look bad.” Social desirability bias has received extensive attention in psychology (Krumpal 2013). These concerns are, logically, particularly strong

for topics with well-recognized social norms and expectations; the majority of psychological research on the importance of social desirability bias addresses race, sexual activities, or illegal behavior (Krumpal 2013).

In the case of research on nonmaterial human-nature connections, social desirability bias might involve respondents reporting that, sure, they feel a connection with that ecosystem—because that may be seen as positive, even if that is not a terribly accurate description of their experience. This bias is also possible in sources not expressly collected for research purposes, but that researchers may use. As one example, social desirability bias may be especially relevant, and may take novel forms, in social media sources, which are notoriously skewed toward positive representation (Reinecke and Trepte 2014) and are increasingly mined to understand nonmaterial human-nature connections (e.g., Schwartz et al. 2019).

Next, the nonmaterial aspects of people's connections to nature can be intertwined with knowledge, places, and beliefs that are culturally important, sacred, or otherwise private. Extensive work, particularly in anthropology and political ecology, demonstrates the importance of private, protected, and sacred knowledge in diverse contexts (Tuhawai Smith 2005, Simons 2017). Communities with deeply held, rich, and well-understood connections to ecosystems may be unwilling to share details about these connections for multiple, often well-justified, reasons. Examples include hesitation to share specific information about valued ceremonial places and their significance because of fear of exploitation, or conventions about the inappropriateness of discussing sacred topics in unconsecrated or nonceremonial contexts.

This point connects closely to a third component of this challenge: that many people may not want to share personal and deeply meaningful aspects of their individual and community lives and experience with people they do not know, or people unfamiliar with or to their communities. Researchers often fall into these categories, and in some cases, potential participants may be wary of researchers because of experience (either personal or historical) with, for example, extractive research practices. In this case, though a respondent may be able to eloquently describe (or otherwise convey) their experience, they may choose not to do so with a researcher, or in a public way that researchers can access.

SUGGESTIONS TO ADDRESS THE CHALLENGES (AND WORK THAT EXEMPLIFIES THESE SUGGESTIONS)

In this paper, our primary goal is to raise the three challenges herein, to articulate them, and to point out their relevance for researchers interested in studying human-environment connections. In exploring these challenges, both in the literature and in our own work, we have come across and developed suggestions as to how researchers might respond to them. Here we offer ideas of potential ways to address each challenge. We do not intend for these suggestions to be comprehensive, but hope that they spark further innovation and discussion.

Responses to Challenge #1: the conceptions exist

The first challenge concerns the assumption that people are aware of their beliefs, attitudes, and values related to human-nature connections. Above, we described psychological research on beliefs that are “nonconscious” (beliefs of which we are unaware until

they are either explicitly identified or threatened) and suggest that human-nature connections may, for many people, fall into this category. We draw from the definition of nonconscious beliefs, combined with extensive research on implicit evaluation of attitudes, to categorize possible responses to this challenge into three actions: (1) use implicit evaluation techniques; (2) help people to explicitly identify these beliefs; or (3) present evidence that makes those beliefs, or threats to them, salient.

The first possibility is to use implicit measures, for example, implicit association tests of connectedness between individuals and nature (Schultz and Tabanico 2007, Bruni and Schultz 2010, Thomas and Walker 2016). Unlike explicit measures, which require individuals to recall and report their attitudes, beliefs, or behavior, implicit measures utilize response patterns and latencies to derive a metric of cognitive association. Although implicit approaches can provide important insights on nonconscious perceptions and associations between people and nature, they have drawbacks that researchers should consider. One of the drawbacks associated with the use of implicit measures is that they are limited to researcher (rather than participant) perceptions of the phenomena at hand, and that they are unable (at least as currently employed) to detect nuanced differences in types of connections or what those connections mean to people. In essence, creating an implicit measure, such as the implicit association test, requires that the researcher predefine the concept categories and stimuli. For example, research has used “self” and “nature” in studies of connectedness, with specific words or images selected as representative of these two categories. This deductive research approach imposes artificial constraints on the definitions of nature, which may differ from participants' conceptualizations.

A second route to addressing this challenge is to scaffold and support individuals to explicitly identify and understand these constructs; researchers might do this in several ways. At a basic level, researchers can introduce a particular concept of human-nature connection, e.g., how ecosystems benefit people in nonmaterial ways, and allow an opportunity for thinking about it. They can ask follow-up questions and work with participants to better understand their experiences. Another approach within this category is to provide carefully designed aids to participants. Such aids might include examples of connections from other participants or other places; analogies or metaphors to other realms of life; an instance of these connections in stories common to the study site; or art supplies combined with prompts. Yet another possible approach, this one the most involved and long-term, would be forms of environmental education. Environmental education could support individuals in making salient their many connections with the natural world, which may be present but latent or unacknowledged, for example through discussion (e.g., about ways in which people need ecosystems), activities (e.g., silent reflection), and experiences (e.g., of awe).

A third way to help people conceptualize their connections to nature builds on Bem's claim that people will become aware of nonconscious beliefs “when [those beliefs] are brought into question by some bizarre circumstance in which they appear to be violated” (Bem 1970:5-6). When nonconscious beliefs are considered as understandings of meaningful human-environment interconnections, demonstrating possible threats to those beliefs

unfortunately does not require bizarre circumstances. Researchers in most contexts can probably easily generate examples, real or hypothetical, of instances in which underlying, nonmaterial connections between humans and ecosystems “appear to be violated.” Research on ecological grief, which demonstrates the grief associated with ecological degradation such as that caused by climate change, provides one example of a burgeoning field with understanding responses to violations of important beliefs at its core (Cunsolo and Ellis 2018). An alternative way to approach this suggestion is to explore nonconscious beliefs that contradict actual human-environment interconnections—for example, a belief of oneself, or humans, as the center of the universe. In cases like these, research might take the approach of offering “threats” to these beliefs, i.e., a research process might elucidate the inaccuracies of these perceptions as a way to challenge them. This work might draw on findings from psychological research on implicit and explicit evaluation in cases in which implicit evaluations reveal beliefs that contradict reality. Experiments demonstrate that asking people to reflect on the reasons associated with their beliefs, rather than their feelings associated with their beliefs, helps to align explicit evaluations of attitudes with accurate portrayals of reality (Gawronski and LeBel 2008).

Responses to Challenge #2: articulation

The second challenge is for people to articulate their conceptions of human-nature relationships. Suggestions of how to overcome this challenge fall into three categories: acquire responses to researcher-designed explicit measures, provide aids to articulation, and use existing data sources. A crucial consideration for all three of these categories is that the process that structures how people discuss connections with nature can strongly delimit the possibility of what can be expressed (Jax et al. 2013). Dimensions of process that especially influence what can be expressed include power differentials; use of collective vs. individual approaches (Kenter et al. 2019); how nature is defined (Coscieme et al. 2020); and a focus on producing quantitative vs. qualitative data (Jax et al. 2013). The importance of the elicitation process means that contextual appropriateness and considerations of justice (both procedural and representational) will greatly increase the likelihood of achieving accurate understanding (Kenter et al. 2019).

Researchers have developed and refined many explicit measures that assess a person’s understanding of their connections to nature. Commonly used scales include those that measure connection to nature (Mayer and Frantz 2004), sense of place (Stedman 2003), inclusion of nature in self (Schultz 2002), and the “new environmental paradigm” (Dunlap 2008). These scales, and most related explicit measures, use traditional methods such as Likert-scale surveys. Researchers implement many techniques to ensure that these methods are reliable and valid, and the measures clearly capture important meaning (Tam 2013). Participants’ responses to the items can be seen as one way that they articulate their beliefs; they make explicit their degree of agreement with statements such as “I often feel part of the web of life” (Mayer and Frantz 2004:513).

Yet as researchers who refine these explicit measures recognize, these measures also have drawbacks; primary among them is that they allow respondents to express connection to nature only by

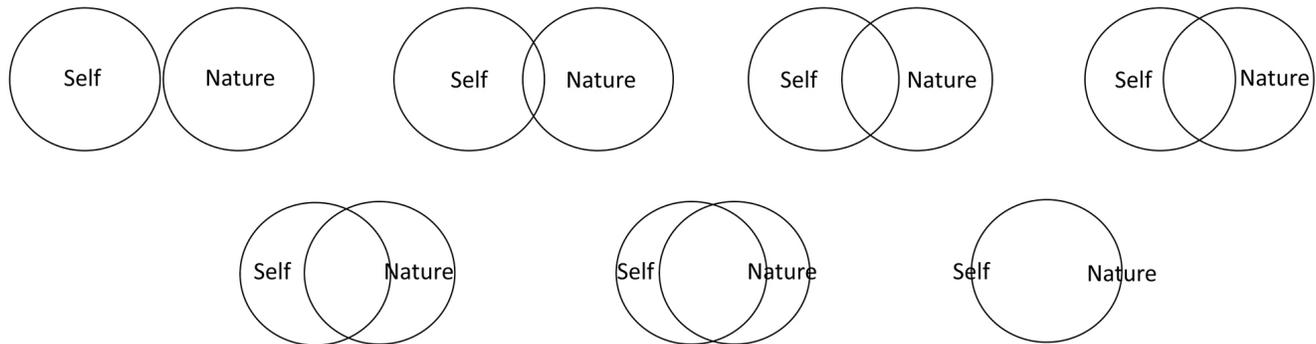
rating items developed and defined by researchers. It is reasonable to expect that respondents, when provided with space, prompts, and encouragement, can figure out how to overcome the challenge of articulating their human-nature relationships and convey meaning in ways and words that they choose (Satterfield 2001). Research on human-nature connections on Hawaiian shorelines provides one example: participants in workshops focused on human-nature relationships in particular places collaboratively developed, along with the researchers who guided the work, a detailed typology of nuanced aspects of meaning attributed to ecosystems in their places (Pascua et al. 2017). Other research into values elicitation as part of marine spatial planning on Vancouver Island (Canada) concludes that “the capacity for stakeholders to articulate the seemingly inarticulable is high, given an appropriately designed opportunity” (Satterfield et al. 2013:109). The next two suggestions build on this expectation that participants can convey meaning effectively, in their own words, if provided “appropriately designed” opportunities.

One way to provide such opportunities is to develop or use tools or techniques that specifically aim to help people express nonmaterial aspects of their relationships with nature. These aids to articulation can be both direct and indirect. Direct aids encourage people to discuss and develop understanding of their connections to ecosystems. One direct technique with infinite permutations is deliberative discussion of human-nature relationships in many places, using diverse focal constructs, e.g., ecosystem services or social values of nature. This research addresses the crucial issue of how to account for human-nature relationships that are collective, i.e., not only about individuals and their personal experiences. This aggregated, collective approach is helpful from many perspectives: when dealing with public goods (Wilson and Howarth 2002); when working with communities with strong communitarian orientations (Pascua et al. 2017); when addressing values and relationships that make little sense when conceived as atomistic (Kenter et al. 2016b); and when considering that many understandings of value, meaning, and relationship are co-developed through discourse and social interaction (Irvine et al. 2016).

Other direct aids to eliciting and understanding people’s values include visual aids, pairing discussion of abstract concepts with concrete activities, and creating hypothetical situations. Visual aids, including pictorial representations and maps, can help to make otherwise abstract discussions more concrete. The “inclusion of nature in self” scale (Schultz 2002; Fig. 2) provides one simple example: overlapping circles represent the degree to which people see themselves as connected to nature. Maps, as another type of visual aid, can help people to ground an abstract discussion in physical places (Gould et al. 2015). Another way to ground abstract discussion in more concrete (and thus often easier-to-discuss) terms is to ask people to consider those nonmaterial concepts in conjunction with reflection on material practices or places (Satterfield et al. 2013). Hypothetical situations, also called vignettes (Wilks 2004), take another approach to making abstract discussions more specific and manageable: they can, if carefully constructed, help people to determine why particular situations are more or less meaningful to them (Gould et al. 2015).

Fig. 2. Inclusion-of-nature-in-self scale (reproduced from Schultz 2002).

Please circle the picture below that best describes your relationship with the natural environment. How interconnected are you with nature?



Indirect articulation aids take a more subtle approach; they create contexts in which values are likely to emerge, but do not necessarily directly seek values. Examples include storytelling (Bieling 2014) and novel methods such as writing letters to trees (T. Marquina, D. Murdoch, and R. K. Gould, *unpublished manuscript*). Another possible source of insight, this one almost a field unto itself, is ethnographic or observational methods that do not require participants to specifically articulate human-nature connections, but rely on actions and contextualized conversations. The core idea of indirect methods is that they create space for people to express (often implicitly, sometimes nonverbally) their connections to ecosystems, whether those connections are meaningful to them, and if so, how—all with no or minimal engagement with researchers' framing or academic jargon, e.g., questions about ecosystem-related values. The open-ended nature of indirect approaches comes, however, with a notable drawback: in some cases, responses or actions can reasonably be interpreted to address constructs other than (or in addition to) the construct researchers seek to understand. This leads some researchers who study socially sensitive topics, e.g., racism, especially in psychology, to recommend using direct measures (Axt 2018).

Both direct and indirect articulation methods create scaffolds that encourage people to identify and discuss meaningful values; one tool that can be useful in both types of method is suites of categories (or types) of human-environment connections. Even though categories for different types of human-ecosystem relationships and values will almost always be both incomplete and overlapping, they can still provide structures that help people to interpret and make sense of their own experiences; they can spark ideas and expand the breadth of peoples' reflections. Suites of categories can also provide structure for researchers to organize findings that result from the use of indirect methods. One example of a suite of categories is found in typologies of cultural ecosystem services, which describe a variety of nonmaterial aspects of human-nature relationships (categories include, for example, identity, spirituality, and recreation; summarized in Table 1 in Gould and Lincoln 2017). Another example can be found in categories of relational values, such as those created by quantitative survey items (categories include, for example, kinship, responsibility, and care; Klain et al. 2017).

In addition to direct and indirect aids to articulation, existing data sources may also provide important insight into human-ecosystem connections. In particular, researchers can look to places and sources wherein people might be likely to express these types of deeply rooted views. An obvious, enormous, and relatively new data source is social media; publications that explore what social media tells us about human-nature connections are rapidly increasing (Guerrero et al. 2016, Oteros-Rozas et al. 2018). Other sources, many not yet explored, may offer insight into human-nature connections. These might include news media (text or audio), or resources that relate to ceremony or spiritual belief. Poetry and other art forms in which people express what they feel nonverbally may also have potential for understanding these connections, though analysis would likely require new approaches and possibly widened epistemologies, for example, incorporating humanistic approaches to understanding. All of these sources have both benefits and drawbacks as sources of information related to connectedness to nature, and research that uses these sources would need to not only gain insight from the benefits but also acknowledge and work to address drawbacks.

Responses to Challenge #3: sharing with researchers

The third challenge is for individuals to communicate with researchers about the meaningful aspects of their connections with ecosystems. Ways to address this final challenge are difficult to discuss in the short format of this piece, because the issues that underlie this challenge are wide-ranging and central to research ethics. We offer a few suggestions, including making space for a full range of responses and drawing on transdisciplinary research approaches such as working with partners and discussing research outcomes up-front; we encourage readers to pursue more in-depth discussion in cited (and other) works.

One way to address this challenge is to design data collection protocols that make a full range of responses socially acceptable, in other words, protocols that make people comfortable not answering or even contradicting questions (Satterfield 2015, *personal communication*). Ways to encourage this include collapsing power differentials between respondents and researchers and explicitly inviting respondents to critique instrument items if they feel compelled to do so. A related suggestion is to practice "deep listening" and humility, i.e.,

researchers being as open-minded and nonjudgmental as possible and listening for what is actually said instead of what they want or expect to hear (though this seems obvious, it may be less common than we think; Koch 2020). This humility-infused deep listening can build trust and rapport and encourage people to share their experiences.

Other ways to address this challenge relate to transdisciplinary research approaches, which aim to dismantle barriers between researchers and communities (Lang et al. 2012). One practice that may address the sharing-with-researchers challenge is to develop and implement the research with partners who understand the research site's context; these partners can help to ensure that language, physical settings, and other aspects of the research plan reflect and respect the study community's norms and will produce knowledge of interest or use to the community. In work that is deeply community-based and/or participatory, an ultimate goal may be to share ownership of the research between researchers and partners (Lang et al. 2012, van den Broek et al. 2020). Another practice, one often integrated with working with site-specific partners and co-creating research, is to engage in intentional and transparent discussion to jointly determine what will happen with the insight and information that respondents share. Shared understanding of the motivation for the research, and its expected products and audiences, may elucidate for respondents why they should bother to spend time on this research and/or risk sharing sensitive or personal information. Importantly, these community-embedded approaches also encourage researchers to consider ethical issues related their studies. Transdisciplinary approaches such as those described here and the deductive, hypothesis-driven research tradition can complement one another and jointly reveal more insight than could either alone.

CONCLUSION

Understanding the varied psychological, cultural, and spiritual connections between people and nature can be difficult. Yet we share the views of many other researchers that understanding these connections constitutes an important avenue for transitions toward sustainability. By breaking down the difficulty inherent in studying these phenomena, and then offering approaches to overcome each component in our breakdown, we open the door to many possibilities for understanding the rich and varied nonmaterial aspects of human-ecosystem connections. We hope that this work aids diverse fields, using diverse approaches and methodologies, to continue and expand multi-faceted study of these diverse relationships, and what they mean for individuals, communities of various sizes, and the planet.

Responses to this article can be read online at:
<https://www.ecologyandsociety.org/issues/responses.php/12604>

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Data Availability:

This paper, as an insight piece, has no associated data.

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