J Environ Stud Sci
DOI 10.1007/s13412-016-0415-4

Arts and humanities inquiry in the Long-Term Ecological Research Network: empathy, relationships, and interdisciplinary collaborations

Lissy Goralnik[1] · **Michael Paul Nelson**[2] · **Hannah Gosnell**[3] · **Mary Beth Leigh**[4]

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Abstract The Long-Term Ecological Research (LTER) Network is a collection of 25 National Science Foundation-funded sites committed to long-term, place-based investigation of the natural world. While activities primarily focus on ecological research, arts and humanities inquiry emerged in 2002 and since then, a substantial body of creative work has been produced at LTER-affiliated sites. These art-humanities-science collaborations parallel a wider trend in universities and non-profits. However, there is little empirical work on the value and effectiveness of this work. After launching a survey in 2013 to assess the values and challenges associated with arts and humanities in the LTER Network (Goralnik et al. 2015), which identified empathy as a meaningful potential outcome of this creative work, we conducted a follow-up analysis to understand the following: the relevance of empathy in the LTER Network; the role of empathy in bridging arts, humanities, and science collaborations; and the capacity of empathy to connect wider audiences both to LTER science and to the natural world. Our research included phone interviews with representatives from 15 LTER sites and an audience perception survey at an LTER-hosted art show. We found that arts-humanities-science collaborations have great potential to catalyze relationships between scholars, the public, and the natural world; cultivate inspiration and empathy for the natural world; and spark awareness shifts that can enable pro-environmental behavior. Our research demonstrates the potential for art-humanities-science collaborations to facilitate conservation attitudes and action in the Network and beyond.

Keywords Environmental arts and humanities · Empathy · Interdisciplinary · Place-based · Conservation · Awe · Relationships

✉ Lissy Goralnik
goralnik@msu.edu

[1] Department of Community Sustainability, Michigan State University, 480 Wilson Rd #151, East Lansing, MI 48824, USA

[2] Department of Forest Ecosystems and Society, Oregon State University, Corvallis, OR, USA

[3] College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, Corvallis, OR, USA

[4] Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, USA

Introduction

The 25 sites of the Long-Term Ecological Research (LTER) Network are housed in an array of biomes, from conifer forests to coral reefs. Funded by the National Science Foundation (NSF), the Network conducts long-term, place-based inquiry to "conserve, protect, and manage the nation's ecosystems, their biodiversity, and the services they provide" (http://www.lternet.edu/network). In addition to conducting ecological research, the Network has made a recent commitment to social science inquiry (US-LTER 2007). As well, arts and humanities projects emerged in 2002, when the HJ Andrews Experimental Forest (HJA) in the Oregon Cascades launched an annual writer's residency program. Since then, other arts and humanities programs have developed, and in 2010, these sites joined to form Ecological Reflections (http://www.ecologicalreflections.com), an informal collection of venues that host arts-humanities-science collaborations. But arts and humanities inquiry in the LTER Network, which is largely without funding or support from the Network office or host sites, is both emergent and unstudied.

Published online: 27 October 2016

At the same time, arts-humanities-science collaborations are a developing trend (see artists-in-labs; Cape Farewell; Climarte; IHOPE; SymbioticA, http://www.symbiotica.uwa.edu.au/; The Institute for Figuring, http://www.theiff.org/) in agencies, non-profits, and universities (Dixon et al. 2011b; Ingram 2011; Jacobson et al. 2007; Muchnic 2013). Practitioners and critics alike suggest that something emergent occurs with this kind of deep interdisciplinary study of the natural world, which they associate with aesthetics (Root-Bernstein 2003), innovation (Demaray 2014; Muchnic 2013), inspiration (Dixon et al. 2011a; Houtman 2012), environmental ethics (Jacobson et al. 2007; Swanson et al. 2008), and appropriate human/nature relationships (Kimmerer 2004). The supposition is that arts-humanities-science collaborations help participants emotionally engage with (Dixon et al. 2011b) or care about (Patterson 2015) the natural world in important ways. While the collaborations are widespread, the literature on these projects is primarily anecdotal.

Describing *The Poetry and Science Symposium at Friday Harbor Labs* in Washington state, Rich Smith (2015) writes: "If you're trying to make somebody cry, laugh, or just be generally interested in what you have to say, then you have to appeal to the senses […and] move people." Bridging poetry with marine science, psychology, and linguistics can do just this, he suggests. Similarly, writer Gary Paul Nabhan explains, "People have to feel some visceral connection to an issue to act upon it ... Artists and scientists ... need cross-fertilization or else their isolated endeavors will atrophy" (qtd. in Brodie et al. 2016, p. 12). These are interesting assertions, but more systematic examination would help us understand how and why these collaborations might be effective. Our work is a step in this direction.

In summer 2013, we distributed a survey to 24 (of 25) LTER Lead Principle Investigators (PIs) (excluding the LTER Network Office, which does not operate a field site) to better understand the extent, values, and challenges of integrating arts and humanities inquiry in the LTER Network (Goralnik et al. 2015). We found that 21 of 24 sites had engaged with arts and humanities inquiry; 19 of 24 sites agreed or strongly agreed that arts and humanities inquiry is important to and relevant for LTER sites. In a question about how arts and humanities reflects the goals of the LTER Network, participants ranked *Relationship-building: to build empathetic relationships with the natural world and to stimulate inspiration, awe, and wonder* third of 12 provided responses, all of which were drawn from stated and implied intellectual commitments of the Network. We were curious about the acceptance of empathy in this scientific context; therefore, to better understand how the PIs thought about empathy and its relationship to the Network, we followed up this initial survey with (a) telephone interviews with representatives from 15 LTER sites and (b) an audience perception survey at a Bonanza Creek LTER-Denali National Park collaborative art show in Fairbanks, Alaska. The interviews explore the relationships between LTER goals; arts and humanities inquiry; and inspiration, awe, and wonder as catalysts for empathy (Lorkowski and Kreinovich 2015; Piff et al. 2015). The audience perception survey investigates the kinds of impacts LTER arts-humanities-science collaborations have for a wider public. We are interested in how arts and humanities inquiry might help LTER do what it is doing better, and what it might bring to the study of place and the natural world that the scientific approach cannot alone accomplish.

In this paper, we detail the methods and results of both the PI telephone interviews and audience perception survey, then jointly discuss the conversation between the two. The interview participants identify a number of perceived values of arts and humanities inquiry in the LTER Network, including relationship building, connection to wider audiences, and a holistic perspective. The survey participants' responses echo these same values, suggesting that the realized value of an LTER arts-humanities-science collaboration parallels the PIs' perceived values. Inasmuch as these perceived and realized values coincide with LTER goals, our data supports the effectiveness of these collaborations, while also illuminating room for growth by identifying several hurdles to further developing arts-humanities-science collaborations in the LTER Network.

Background

Arts and humanities in the LTER Network

The most prevalent genres of arts and humanities inquiry across the LTER Network are painting, photography, and literary prose. Of the 21 sites that have hosted arts and humanities inquiry, 6 describe consistent engagement. These programs include the following: (1) a writer's residency, (2) research experiences for undergraduates (NSF-REU), (3) Art and ecology workshops for art teachers, (4) artists' residencies, (5) performing and visual arts exhibits, (6) visiting artist field trips, (7) historical research, and (8) a museum (see Goralnik et al. 2015 for complete information). Because the programs are so varied, it is no surprise that the kinds of collaborations across the Network between artists, humanists, scientists, and place are also diverse.

In our 2013 PI survey, we asked participants to describe which style of collaboration best describes the arts-humanities-science relationships at their site. Four respondents answered *none*. Twelve respondents answered *scholars working individually at the same site*. Seven respondents answered *scholars actively doing work together*. No one answered *genuinely synthetic*. What is missing, it seems, are efforts to move beyond interdisciplinary scholars working in the same place toward more synthetic collaboration. But a move in this direction also requires attention to why these

collaborations might be meaningful in the first place. We are interested in how and why arts-humanities-science collaborations might contribute to the goals, mission, and intellectual commitments of the LTER Network.

Arts-humanities-science collaborations

Scholars often trace contemporary arts-humanities-science collaborations to C.P. Snow's "two cultures" discussion (Snow 1959), in which he "argued that the sciences and humanities had become dangerously disparate" (Gabrys and Yusoff 2012, p. 7). While Snow's intent was not necessarily to encourage more cross-fertilization or collaboration across the disciplines, the ideas did work toward this end, as new projects emerged to address disciplinary rifts. Driven by creative approaches to scientific discourse like Rachel Carson's *Silent Spring* (Carson 1962), some projects adopted an environmental focus. Contemporary collaborations continue this cross-fertilization, including work that engages with technology (Harris 1999), laboratory science (Obrist and Vanderlinden 1999), biomedical issues (Arends and Thackara 2003), sustainability (Bieler 2014), and climate change (Harrison and Harrison 2007) (Gabrys and Yusoff 2012).

But why might arts-humanities-science collaborations be worthwhile? Environmental and design scholars Yusuf and Gabrys (2011) explain that imagination, like that encouraged through arts and humanities inquiry, can both extend our notion of what the human is, as well as help us conceive of how we might be different. These "future imaginings can thus be thought of as a process for developing adaptive capacities and emotional resilience within changed environments" (p. 7). Deep interdisciplinary collaborations might also facilitate changed attitudes about the natural word and innovative approaches to rational decision-making (Holm et al. 2013, p. 29–30). Additionally, scholars suggest, they might be necessary for effective understanding of social-ecological systems, as it is unlikely that siloed bodies of knowledge can address complex problems alone (Jones et al. 2010).

At the heart of many arguments for arts-humanities-science collaborations is their potential to stimulate emotional responses to environmental issues. Scholars argue that affective responses can spark political action, as well as address communication and advocacy limitations of science (Gabrys and Yusoff 2012). Additionally, Kepes (1972, p. 6) argues that arts and humanities can contribute to a holistic understanding of the natural world, explaining, "Spoiled environments lead to a loss of beauty, poetry and wholeness," while art and science collaborations can restore this lost holism, because art helps us "register and reject what is toxic and find what is useful and meaningful in our lives."

A discussion about the potential values of arts-humanities-science collaborations, though, need also attend to how these collaborations might be most effective, because several factors can limit their impact. For example, while arts-humanities-science collaborations can take many shapes, scholars caution about collaborations that simply reinforce traditional disciplinary boundaries or horizontal knowledge sharing between the disciplines, arguing instead for interdisciplinary relationships that create something new and synthetic (Bieler 2014; Gabrys and Yusoff 2012; Jones et al. 2010). Financial and intellectual pressures to appeal to particular audiences can hinder the transformative impacts of art-science collaborations, explains Andrew Bieler (2014, p. 10). As well, institutional structures, like funding and promotion, can impede interdisciplinary collaboration by rewarding disciplinary research and outcomes (Holm et al. 2013). Finally, some disciplinary scholars might lack the tools or self-reflexivity to engage in equitable interdisciplinary collaborations (Jones et al. 2010), therefore recruiting the right collaborators into these relationships is important.

Conceptual framework

Ecophenomenology

Our project is conceptually rooted in ecophenomenology, which applies a phenomenological approach to ecological concerns, with particular relevance for the investigation of nature relationships (Walsh 2013) and ecological experiences (Zealand 2007). Phenomenology seeks to understand phenomena not through abstract theory, but instead through physical experience. It draws from Husserl, who saw phenomenology as a means to provide "the foundation for the sciences by rooting them in our more basic, primordial openness to the world." This did not mean Husserl "rejected the scientific method or its results, rather [he] wishe[d] to illuminate … the phenomenological ground state of reality that makes possible any science at all" (Walsh 2013, p. 6). Contemporary phenomenology also draws on Merleau-Ponty, who believed that bodily perceptions of the world create the foundation for rationality (Zealand 2007). When applied to ecological concerns, this means that an intellectual relationship with the natural world ought to be grounded in physical engagement, as well.

This emphasis on experiences in the natural world as integral to science about the natural world lies at the core of the LTER Network, where research is field-based and "emphasizes the study of phenomena over long periods of time" (https://lternet.edu/network/). The LTER approach to research and education relies on both ecological theory and natural history, mirroring what Louda and Higley (2010) refer to as "responsive science," whereby the researcher attends equally to "theoretical expectation and natural history knowledge, plus a willingness to alter research direction in response to unexpected results" (p. 315). Responsive science, they

continue, is "facilitated by sustained experience with a system—a place, its occupants, and their interactions (p. 321). The arts-humanities-science collaborations across the LTER Network are also field-based. In addition, the attention to and representation of sensory experience in the landscape reflects the embodied approach to knowledge and moral development espoused by Merleau-Ponty, and also by more contemporary scholars like David Abrams (1997). The mere existence of these kinds of art-humanities-science collaborations is, in some ways, an ecophenomenological act in the vein of Husserl's assertion that experience of the phenomena lies at the heart of scientific understanding of the phenomena. The bridging of disciplinary boundaries and giving voice to approaches emphasizing a more creative, sensory engagement with the natural world suggests recognition of the relationships and potential feedback existing between the disciplines.

Ecophenomenology bridges ecology and phenomenology in a way that allows each to inform the other (Brown and Toadvine 2003a). This bridging of two approaches to the natural world directly mirrors the aims and content of our project. Our exploration of relationships and inquiry across the LTER Network pertains to interdisciplinary, place-based field research about the natural world. While the methods and goals of the LTER Network primarily reflect a conservation science approach—represented by a commitment to objectivity and intellectual engagement—our research explores artistic and humanistic approaches to the study of the natural world, represented by a more subjective approach that can facilitate aesthetic and emotional engagement. These two approaches rely upon and also project very different relationships with the natural world. Ecophenomenology honors the different methods and impacts of each approach and offers a way to discuss and assess their interactions.

Empathy

We included empathy in our research because it is an ethically relevant quality that applies to human/nature relationships, and which is discussed or implied in psychology (Lorkowski and Kreinovich 2015; Piff et al. 2015), experiential education (Agate 2010), natural history learning (Fleischner 2011), arts education (Davis 2008; Jeffers 2009), place and resources studies (Ramkissoon et al. 2012; Walker and Chapman 2003; Wattchow and Brown 2011), and environmental ethics literature (Gruen 2009; Moore and Nelson 2010). Thus empathy, and the associated qualities of inspiration, awe, and wonder, can serve as a bridge across the disciplines.

We introduced interview participants to the concept of empathy in a question about the potential value of arts and humanities inquiry for LTER Network's goals and mission. Within the 12 responses provided for ranking, we included: *Relationship-building*: *to build empathetic relationships with the natural world and to stimulate inspiration*, *awe*, *and wonder*, which reflects the Network's commitment to place-based inquiry about the natural world (Fleischner 2011, Walker and Chapman 2003, Wattchow and Brown 2011). We linked empathy to inspiration, awe, and wonder because this is a relationship described by experimental psychologists, who, in a series of experiments designed to study the relationship between awe and prosocial behavior, found that, "Awe has also been associated with a sense that one is a part of something larger than oneself, [… like] a community, a culture, the human species, or nature [, and] those individuals who report feeling part of a greater entity … tend to report increased gratitude and empathy" (Piff et al. 2015, p. 883–885). Additionally, we thought inspiration, awe, and wonder as related to outdoor experiences would be more familiar to the participants, primarily field-based ecologists, therefore might elicit honest responses without distraction.

The psychological description of awe parallels discussions of awe in experiential environmental education, which, in its focus on field-based experiences, is relevant for the LTER context. Agate (2010), in his thorough treatment of awe in the outdoors, explains that "awe as experienced in the outdoors serves to motivate, inspire, and empower people to act… [, and] to encourage contemplation of life and existence, to strengthen relationships, [and] to increase respect of nature" (ii). This kind of awe, he continues, "opens people up to consideration and reflection of their moral obligations (Düzgün 2004)." Thus, awe and empathy are described as relational qualities that facilitate ethical interactions with both human and nonhuman communities across the disciplines.

During the interviews, we further described empathy for the participants by sharing Vucetich and Nelson's (2013) definition: "A vivid knowledge-based imagination of another's circumstance, situation, or perspective." This is, they continue, "a capacity that depends on objective, empirical knowledge ... about the conditions and capacities of others" (p. 19). In many ways, this definition—in its inclusion of objective empirical knowledge as a means to understand others—describes the domain of ecology. Therefore, we used this definition to help the participants connect to empathy in a way that reflected their research process. It moves empathy away from being a solely emotional or relational quality by rooting it also in a cognitive process of knowledge development and observation, which are tools of ecological research. This description of empathy mirrors Gruen's (2009) concept of "engaged empathy," which is an ethical approach to empathy for the natural world. She writes, "Engaged empathy thus involves both affect and cognition and will necessitate action" (p. 30). This definition, and our choice to use it in our research, reflects the nested cognitive and affective goals and content of our study, as well as facilitates a jump to action. What action do we hope empathy for the natural world might stimulate? Rather than advocate for specific behaviors, it seems reasonable to hope that empathy inspired by arts and humanities in

the LTER Network might inspire participants to develop curiosity, seek knowledge about or relationships with place, and cultivate a desire to act in ways that respect the natural world.

Methods

Interviews

In fall 2014, we invited all 24 PIs from the previous study to participate in follow-up interviews and received responses from 15 LTER sites. We then conducted 15 semi-structured telephone interviews with 14 LTER PIs and two LTER outreach and education coordinators. One interview included both a PI and an outreach and education coordinator; joint interviews are a fairly common, if rarely studied, phenomenon (Arksey 1996; Morris 2001) that can surface tacit knowledge and richen data through the relational dynamic of the participants (Polak and Green 2015). One pitfall is the tendency for one participant to overshadow the other; therefore, the interviewer pressed individual participants for particular responses when she felt this might be happening (Morris 2001; Polak and Green 2015).

We used a telephone protocol because the participants were spread across the country; phone interviews are generally considered as effective as in-person interviews, while also providing a more efficient use of human and economic resources (Knox and Burkard 2009). Two interviewers each conducted half the interviews and both used the same semi-structured interview guide (Flick 2002):

(1) What is the connection between environmental science and inspiration, awe, and wonder?
(2) How is empathy important to or relevant for the LTER Network?
(3) How might the LTER Network already be working to stimulate empathy?
(4) How might arts and humanities inquiry stimulate inspiration, awe, or wonder, or empathetic relationships with, the natural world?

While both interviewers asked the same four questions, each interviewer also allowed for participant responses to lead to authentic dialog that pertained to, but was not limited by, the guide (DiCicco-Bloom and Crabtree 2006; Hill et al. 2005). The interview process was active (Holstein and Gubrium 1995), whereby both the interviewer and the interviewee participated in the making of meaning during the dialog process.

The interviews lasted between 12 and 42 min. The average interview was 26-min long. All interviews were recorded and fully transcribed (available upon request), and we used Nvivo qualitative software to manage the data and the coding process. We conducted a thematic analysis of the transcripts (Boyatzis 1998; Vaismoradi et al. 2013), reading and re-reading the texts to observe themes across questions and participants. Our approach was interpretivist, in that we did not read the transcripts with a particular theoretical frame in mind. Instead, we observed themes as they arose in the transcripts, made notes about these themes during the coding process, condensed themes into categories as we observed recurrent patterns, and finally, analyzed these patterns within and across interviews to arrive at conclusions about the participants' experiences with arts and humanities inquiry in the LTER Network.

Participant surveys

In 2012, 10 visual and literary artists were selected to participate in a series of expert-guided field trips in Denali National Park and the Bonanza Creek LTER site in Fairbanks, Alaska, with local ecologists. After the trips, the participants had 1 year to create original work that responded to place and the complex webs of interdependence among plants, animals, humans, and ecosystems. In August 2013, a show of their collected work opened at the Fairbanks Arts Association's Bear Gallery. *In a Time of Change*: *Trophic Cascades* included textile art, sculpture, and painting, as well as storytelling and poetry (for more information, see: https://sites.google.com/a/alaska.edu/itoc-trophic-cascades/home/bear-gallery-exhibit). Following this show, the work traveled to Anchorage for a month-long exhibit at the Alaska Pacific University.

To better understand the impact of art-humanities-science collaborations on a specific public, we launched an audience perception survey during the show's opening night. In addition to demographic questions, we asked six 5-point Likert-scale questions about the impact of the exhibit on participant knowledge and attitudes about predators and ecosystem health; two 5-point Likert-scale questions about the role of art in building awareness about ecosystems and issues; and two Likert-scale questions about participant motivations. We asked one short answer question about the most thought-provoking element of the exhibit (Fig. 1).

Opening night attendance was 280 visitors. Between August 2 and 21, attendance numbered 1820 visitors. In this time, we collected 94 surveys. Participants who completed a survey could enter a raffle to win a small piece by a show artist (US$100 value). Most surveys were completed on opening night when researchers were present. Not all participants completed every survey question. The survey respondents were highly educated and primarily Alaska residents (see Figs. 2 and 3). Seventy-three percent of the participants ($n = 69$) self-identified as female, 23 % identified as male ($n = 22$), and 2 % declined to answer ($n = 2$). The majority of the participants were between 49 and 70 years old.

Fig. 1 Audience perception survey instrument

1. In one sentence, please describe the most important, exciting, or thought-provoking element of the exhibit in your experience.

2. Experiencing the Trophic Cascades exhibit has increased my knowledge about the interconnectedness of plants and animals in ecosystems.

☐Strongly agree ☐Agree ☐Neutral ☐Disagree ☐Strongly disagree

3. Experiencing the exhibit has increased my knowledge about predators in Alaska

☐Strongly agree ☐Agree ☐Neutral ☐Disagree ☐Strongly disagree

4. Before viewing the exhibit, my attitude toward the importance of predators in ecosystems was

☐Very Positive ☐Positive ☐Neutral ☐Negative ☐Very negative

5. As a result of experiencing the exhibit, my attitude toward the importance of predators in the ecosystem is:

☐Much more favorable toward predators ☐More favorable toward predators ☐The same

☐More negative toward predators ☐Much more negative toward predators

6. As a result of experiencing the exhibit, my attitude toward removing predators from the ecosystem is:

☐Much more favorable toward predator removal ☐More favorable toward predator removal ☐The same

☐More negative toward predator removal ☐Much more negative toward predator removal

7. After viewing the exhibit, I am motivated to learn more about predator-prey-ecosystem interactions in Alaska.

☐Strongly agree ☐Agree ☐Neutral ☐Disagree ☐Strongly disagree

8. I will recommend Trophic Cascades exhibit to others.

☐Yes ☐No ☐Maybe ☐I don't know

9. I believe that art can be an effective mechanism for building public awareness and understanding of important issues.

☐Strongly agree ☐Agree ☐Neutral ☐Disagree ☐Strongly disagree

10. I believe that art can be an effective way to understand ecosystems and the role of humans in the natural world.

☐Strongly agree ☐Agree ☐Neutral ☐Disagree ☐Strongly disagree

11. What most motivated you to attend this exhibit? Check all that apply.

☐Know someone involved in the project ☐Interested in the theme ☐Stumbled upon it

☐Often visit this gallery to see exhibits ☐Enjoyed previous In a Time of Change events ☐Other (explain)____

12. Do you have any other comments about this exhibit?

Results

Interviews

Our coding process was emergent, in that we coded themes that arose directly from the data. Several of these themes reflected the language of the interview questions and these became well-populated major categories, all of which include several subthemes (in parentheses): *empathy* (LTER, arts and humanities, inspiration, definition); *inspiration*, *awe*, *and wonder* (empathy, environmental science, personal story); *LTER* (arts and humanities, purpose and goals, empathy, challenges); and *arts and humanities inquiry* (challenges, LTER, empathy, content, environmental science). Other themes—*animal relationships*, *conservation and environmental action*, *money and resources*, *outreach*, and *holism*—were less robustly populated, though several were still vital to participant stories and therefore are also discussed in the analysis.

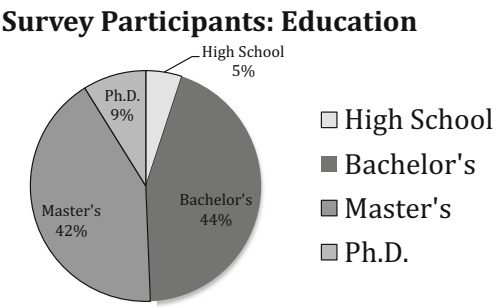

Fig. 2 Survey participants: education

Empathy

One goal of the interviews was to explore how participants understood empathy on the survey, and then with further explanation during the interviews. We received mixed reactions

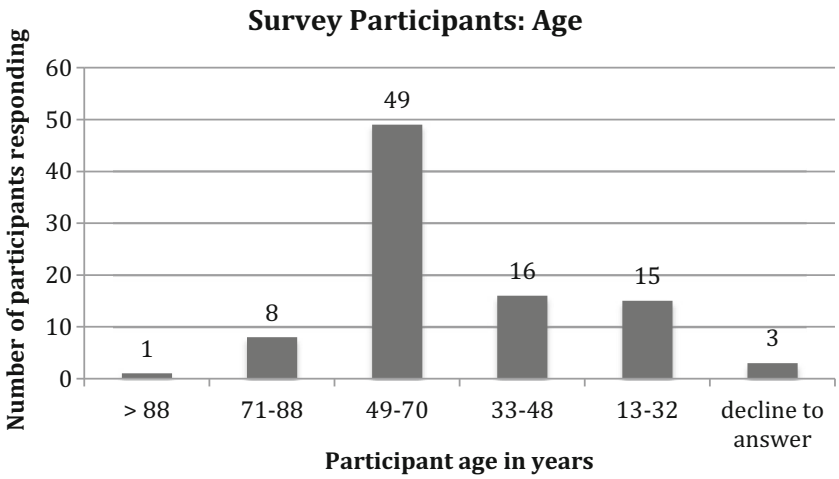

Fig. 3 Survey participants: age

to our use of empathy. Eight participants were comfortable with the word, saying it "wasn't strange to me" and explaining that it was "[d]ifferent language than I use, but that all sounds right." One participant adopted the word in her interview, sharing that she wants her students "to get that empathy piece." Several participants used the word empathy to describe work they are already doing with place-based children's books, outreach activities, and remote alpine research. These participants associated empathy with responsibility, care, stewardship, and environmental connectedness.

Alternatively, only one participant found our use of the word empathy problematic:

> I'm actually a little uncomfortable with that word … in relationship to environmental science … I don't think most science is … motivated by empathy …. It's not my primary bonding with other things in the universe that draws me to [my] work, so it's a ... bit of a foreign concept in this context.

Two other participants also found the context jarring, but were less troubled by the ecological application. One participant explained, "I conceive of empathy in relationships between people … with the capability of one person to try to appreciate and understand the reality being experienced by another person. I hadn't really thought about it as a feeling between myself and the environment." Only one participant was confused about our use of empathy. He asked, "What really is an empathetic relationship?" to which the interviewer responded, "What do you think [it] is?" The participant replied, "I have no idea what you're trying to characterize there." He went on, though, to suggest a few options—"a warm fuzzy feeling, …, a serious emotional attachment, … [or] an awareness about the importance of something"—that all apply to our intentions in a reasonable way, suggesting he did have an intuitive understanding of empathy. During the interviews, all of the participants but one came to accept the idea of empathy for the natural world, as well as its potential relevance for the LTER Network. To clarify our specific use of empathy, and also to lessen anticipated reactions to the word (rather than the concept) in a potentially novel context, we focused the interviews on inspiration, awe, and wonder as catalysts for empathy (Lorkowski and Kreinovich 2015; Piff et al. 2015).

Inspiration, awe, and wonder

Respondents drew on personal experience to discuss the relationship between environmental science and inspiration, awe, or wonder. One participant explained: "[F]or people that are interested in environmental science … it kind of starts with inspiration and awe of the natural world …. [H]aving … [it] helps extend it beyond the intellectual exercise." Most participants ($n = 13$) connected inspiration to environmental science either as the driver of their own career or as the root of ecological or LTER research. Claimed another participant, "If you are inspired by nature, you can be inquisitive about its dynamics and how it responds to disturbance, and how ecosystems contribute in terms of services …. [Therefore, environmental science and inspiration] complement each other." Being inspired by the natural world, their study sites, or their research subjects, many participants explained, drives them to be good scientists.

Empathy and the LTER Network

Most participants ($n = 12$) agreed that facilitating empathy (or inspiration, awe, and wonder) is something the LTER Network should be doing. One explained, "I would say empathy is essential …. [T]hat's part of the rationale for conducting the research." Participants described inspiration and empathy as: (1) unmentioned Network objectives, (2)

factors of outreach, and (3) important elements of education about the natural world. A number of participants (n = 11) explained that the Network is already fostering inspiration or empathy through education, broader impacts research, and outreach activities, as well as in the ways researchers engage their work and the landscape. One participant explained, "I think we do stimulate empathy …. We have broad outreach programs that are really engaging students in hands-on activities, exposing them to the natural world." One participant identified empathy as a Network-facilitated characteristic:

> [T]here is the site-based, place-based focus of LTER, from which I think you derive empathy for a particular kind of environment …, [and] it's reinforced … [by] coordinating research with others who are similarly motivated. Persistent relationships partly forged as a result of having similar experiences and the feeling of empathy toward our ecosystem, we bond around that, it's reinforced through the Network.

Most participants qualified their responses, though, by saying the Network could also be doing better: "I think it's something they do particularly well, [and] I think they should be doing it more."

Several participants (n = 5) shared that while facilitating inspiration and empathy was a good idea, they did not feel it is something the Network is doing explicitly. Very few participants (n = 3) stated that facilitating empathy is *not* something the Network should be doing in a structured way, though two of these also said that facilitating empathy *is* something the LTER Network should be doing; therefore, the negative statements were qualifications about using site resources to support this work, rather than outright statements against the cultivation of empathy as a Network activity. As one explained, "I don't think [inspiration or empathy] is the primary goal of LTER. I think the primary goal of LTER is understanding and communication." This is an interesting response, though, because several (n = 5) participants suggested that fostering outcomes like inspiration and empathy, especially through arts and humanities inquiry, contributes to more effective science communication and a wider understanding of the natural world. Therefore, the wrong work, as this participant described facilitating empathy, might actually be doing the right work, or accomplishing what he identifies as the most important Network goals.

The value of arts and humanities inquiry

Nearly every participant (n = 12) discussed the positive impact that arts and humanities can play in the cultivation of inspiration or empathy for the natural world, which they attributed to its ability to enhance perception, inspire awe and wonder, provide a sense of fulfillment, broaden the audience, educate, and make the science better. When asked about the role of arts and humanities inquiry in the LTER Network, participants tied it to (1) communication and outreach, (2) education, and (3) inspiration and empathy. Describing the relationship to outreach, one participant explained, "I see the value of the humanities [as] inspiring people that maybe don't have that natural curiosity or natural wonder [… who might be] more likely to get inspired by a beautiful sculpture or painting than by a Ph.D. scientist espousing the virtue of ecological theory." Participants also identified educational impacts. One participant shared that when students "interact with the arts it seems like there's a sense of fulfillment … that's very different than the classic activities of the scientist, … [T]here's another level of engagement and a different part of your brain … that happens in the dimension of the humanities." The inherent difference between creative inquiry and science can be a benefit of arts and humanities, she explained, because the difference draws attention and demands curiosity.

One of the more surprising comments about the value of arts and humanities inquiry focused on its ability to portray whole systems, connectivity, and the sense of responsibility that arises from this perspective, which two participants noted. Wrote one,

> [W]ith scientists, we are looking at the nuts and bolts of what's going on in the environment. Most scientists still conceive of the environment as a machine, and it's hard to talk about the environment as a holistic entity, which is the kind of thing you gain empathy with. That's, I suppose, a role for the arts and humanities, to educate scientists about the environment.

Ecology is a science about systems and interrelatedness, therefore it is fair to assume that a majority of ecologists do not intentionally ascribe to the metaphor of "nature as machine" (Nelson 2010; Worster 1994). But what the speaker is alluding to is that contemporary science, including ecology, is often reductionist, focusing on the parts of nature while assuming that the whole is equal to the sum of the parts (Zealand 2007). Therefore, whether intending to ascribe to the nature as machine analogy or not, the work many scientists do, ecologists included, often does align them with this belief. This mechanistic, rather than holistic, method of inquiry has grave implications for our relationship to the natural world (Callicott 1989; Plumwood 1993; Mathews 1991). It is not just a methodological observation about the way we do science; rather, it is a metaphysical observation about the way the world is that has wide-reaching ethical consequences (Walsh 2013; Zealand 2007). The participants suggested that arts and humanities can allay these consequences by inspiring a whole system understanding.

Challenges of arts and humanities integration

While participants attributed a number of values to arts and humanities inquiry, and nearly all of them supported its inclusion in the Network (n = 14), they did discuss several perceived challenges to further developing this work in the Network. These challenges included (1) the structure of NSF grants, (2) LTER Network or individual site objectives, (3) funding constraints, and (4) lack of experience with deep interdisciplinary collaborations.

Since the sites depend on 6-year NSF grants for day-to-day operations and long-term data collection, they must work within the boundaries of each grant's objectives. Arts and humanities inquiry (or empathy development) is neither a network-wide goal, nor written into any individual site grants. Therefore, attention to creative work would likely occur at the expense of other grant-sanctioned projects. Similarly, sites agree to contribute to network-wide and site-based goals. This work leaves little time for unrelated projects.

While often less resource-intensive than scientific inquiry, arts and humanities inquiry does require funding. Site resources are already spread thin. Several participants (n = 6) said they welcome arts and humanities work in the Network, but worry about draining resources from current projects. One participant concluded, "[C]reative approaches … outside the natural sciences should be fostered if they have means to support it from other sources. But I would not want to see 25 % of each site's budget … be used to support poetry writing."

Finally, two participants questioned the feasibility of meaningful collaborations across such disparate disciplines within the structure of the Network. The enormity of doing this kind of work and a desire to do it well, in addition to a lack of experience with similarly broad interdisciplinary engagement in the Network, made these participants hesitant to push for widespread inclusion of arts and humanities inquiry.

Participant surveys

More than half the participants *agreed* or *strongly agreed* that the exhibit increased their knowledge about predators in Alaska and the interconnectedness of plants and animals in the ecosystem (Fig. 4).

While 81 % of the participants (n = 77) reported a *positive* or *very positive* attitude about the importance of predators in ecosystems prior to the exhibit, 34 % participants (n = 32) still answered that their attitude was *more favorable* or *much more favorable* following the exhibit. When asked about the impact of the exhibit on their attitude about removing predators from the landscape, 32 % of the participants (n = 30) reported a *negative* or *very negative* attitude about removing predators, thereby affirming the role of the exhibit in participants' perceived importance of predators in the landscape. Finally, when asked if viewing the exhibit impacted their motivation to learn more about predator-prey interactions in Alaska, 73 % of the participants (n = 68) either *agreed* or *strongly agreed*. Only 3 % of the participants (n = 3) disagreed. Therefore participants grew more curious as a result of the show (Figs. 5, 6).

When asked to respond to the statement: "I believe art can be an effective mechanism for building public awareness and understanding of important issues," 97 % of the participants (n = 91) *agreed* or *strongly agreed*. When asked to respond to the statement, "I believe that art can be an effective way to understand ecosystems and the role of humans in the natural world," 98 % of the participants (n = 92) *agreed* or *strongly agreed*.

Open-ended responses

Eighty participants (85 %) responded to the open-ended question asking them to "describe the most important, exciting, or thought-provoking element of the exhibit in your experience." Participants discussed the impact of particular pieces; the themes of interconnectedness, cycles, change, and balance; the evocative collaboration between art, science, and nature; and the value of creative, imaginative, and innovative approaches to nature and science. One participant, echoing PI interview data about the role of art in stimulating empathy, shared that an art piece "help[ed] me … empathize with the hunted." Another participant shared that she, "never realized that predators were necessary" prior to her experience with the exhibit, capturing the PI claims that arts and humanities can serve as effective outreach for site science. A third participant explained that, "the artist perspective brings a wholeness to the world." This statement directly recalls the interview sentiments about the mechanistic worldview of science versus the holistic worldview of the arts.

The show was impactful in intellectual, emotional, and, for a few participants, ethical ways. Participants enjoyed themselves and also thought about relationships between predators and prey; humans and nature; art and science; image and text; and ideas and beauty. They described their experience of interacting with science through art with words like "awe," "amazement," "unexpected," and "fascinated." These responses affirm the kinds of impacts art-humanities-science projects can have for participant knowledge, attitudes, issue awareness, and respect for the natural world.

Discussion

The PI interviews and the audience perception survey both show there is great potential for arts-humanities-science collaborations in the LTER Network, and, by extension, in other ecological research contexts, as well. Together, they demonstrate that some of the proposed values of this work, as identified by the PIs, are already taking shape in the world, as

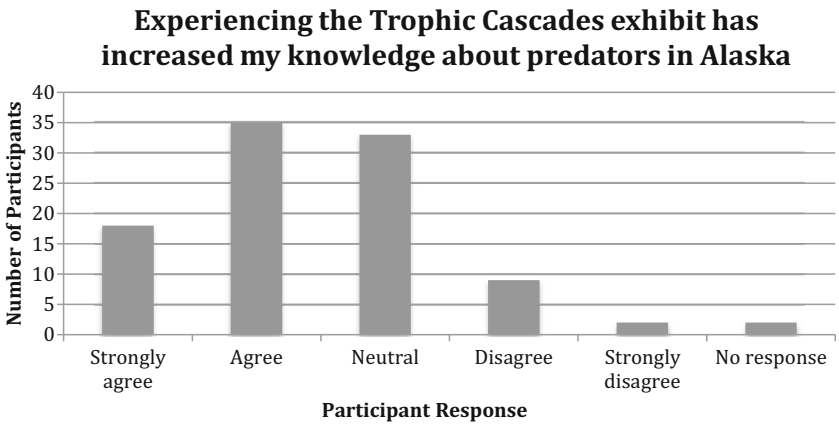

Fig. 4 Trophic cascades knowledge shifts

shown through the audience perception survey. For example, interview participants discussed arts and humanities as an opportunity to inspire and capture the attention of audiences who are not moved by the language of science, and they explained that if one is inspired by the natural world, one will become curious about it. The reactions of the Trophic Cascades art show affirm these suppositions in promising ways.

In response to the question about the "most important, exciting, or thought provoking element of the exhibit," one survey participant wrote: "After reading and looking closely at each piece, I stood in awe, surrounded by the by the power of words and images to evoke deep feelings of amazement at the precarious balance of the natural world." The images were not just pretty, but they sparked awareness. Another participant shared, "I've become much more aware of the interconnection of our AK [Alaska] ecosystem." And this awe opened the door to deeper learning. Though the science the participants learned might seem trivial to the scientists—"How killing one thing affects the cycle of life" or "Plant species changing due to changes in animal populations"—it created an opportunity for the participants to learn more through deeper exposure. As one participant wrote, "Art speaks to our hearts and souls where (hopefully) the science of this exhibit will take root, grow, and become change." Seventy-three percent of the survey participants said they felt motivated to learn more about predator-prey relationships as a result of the exhibit. Participants felt, learned, and grew curious, results that parallel Gruen's (2009) simultaneously cognitive and affective description of "engaged empathy." Since conservation outreach and education are both LTER goals, these results suggest the arts-humanities-science collaboration was effective in ways that are relevant to the LTER Network.

Another synergy between the interviews and the survey responses is the shared references to the potential of arts and humanities to provide a more holistic understanding of the natural world, which capture the ethical potential of arts-humanities-science collaborations. These references echo the goals and purpose of ecophenomenology (Brown and Toadvine 2003b: Nazir 2016; Wood 2003), which seeks to provide a "whole-nature perspective," allowing for both a "penetrating and expansive vision of science … without sacrificing intimacy and engagement" (Walsh 2013, p. 4). As well, these references to holism mirror scholarship on art-science collaborations (Kepes 1972), whereby art-science collaborations heal the rift caused by degraded environments.

Holism has a deep history in ecocentric, or morally inclusive, environmental ethics, which grant moral consideration to both nonhuman beings and ecological collectives (Callicott

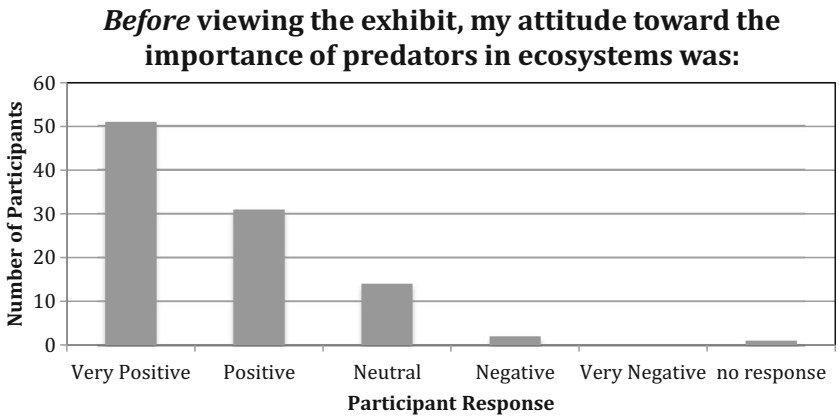

Fig. 5 Trophic cascades predator attitudes before viewing the exhibit

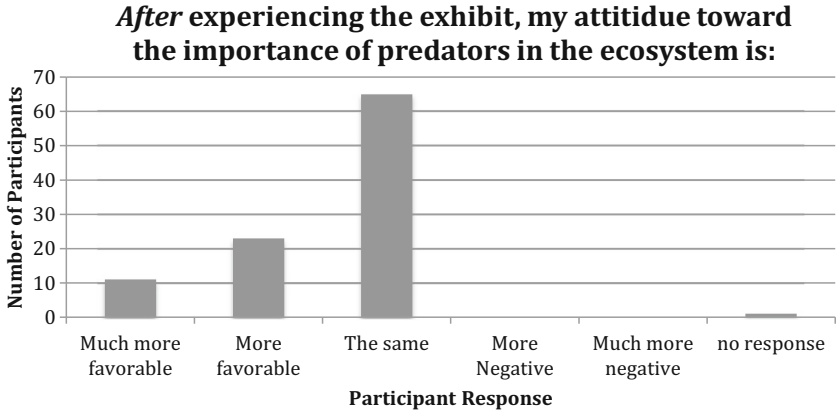

Fig. 6 Trophic cascades predator attitudes after viewing the exhibit

1989; Mathews 1991; Moore 2004; Sylvan 1973). Ethical holism is "the idea that not only is the reality of the individual entwined within the collective, but that the well-being or interests of that individual are provided therein as well" (Nelson 2010, p. 45). This leap to include wholes—populations, species, ecosystems—and not just individual beings (or humans alone) in the moral community "changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members and also respect for the community as such," writes Leopold (1949, p. 204). If arts and humanities inquiry can contribute to this kind of holistic understanding of and respect for the natural world, then it could potentially spark a kind of moral awareness for the viewer, too, in addition to its other impacts, e.g., aesthetic, conceptual, or inspirational. The interview participant's suggestion that arts and humanities might do this work, and the survey participants' acknowledgement that their experiences at the show did have that effect, support this idea.

Finally, recognition of empathy as a means to catalyze relationships between artists, scientists, place, audiences, LTER science, and the natural world arose in both the interviews and the surveys. Interview participants suggested that arts and humanities work in the Network creates opportunities to converse with new audiences; they noted that one expression of empathy in the Network is the meaningful relationships between scientists, and between scientists and place. Survey participants made similar connections to the perceived relational and emotional elements of the show and were moved in response. In addition to remarking on the beauty of the art and the power of the science when asked to describe "the most important, exciting, or thought provoking element of the exhibit," participants also noted:

- Relationships and how they flow
- The collaboration between the artists of different mediums, focused on a common goal
- The unbridled enthusiasm with which the artists absorbed the science
- The affection for natural processes seen and felt here
- How much the artists were effected [sic] by their experiences
- Artist discovering interconnectedness

Participants were welcomed into the artistic process and also encouraged by the connections they felt with the artists, as much as they were drawn to the content. In this way, the art and the science, the affect and the intellect, worked in tandem, and the participant responses speak to the powerful potential of arts-humanities-science collaborations to develop relationships between and across groups, content, and places.

Conclusion

Empathetic awareness of the natural world is a potential outcome of arts-humanities-science collaborations that does not just benefit the sites or the science. Rather, it "contributes to the advancement of the health, productivity, and welfare of the global environment," (LTER Vision) as the LTER Network intends to do, by inspiring awe, inviting curiosity, and fostering connections between participants and both LTER science and the natural world. Furthermore, this outcome reflects the non-utilitarian intentions of ecophenomenology (Harris 2004), in that it elevates the impacts of arts-humanities-science collaborations beyond the directly instrumental contributions of education and scientific outreach, two other perceived values articulated by the PIs (Goralnik et al. 2015), to operate instead in the realm of relationships and ethics, an outcome that benefits the whole, not part, of the system. While there are challenges to further developing creative inquiry across the LTER Network, these challenges are not insurmountable. And the potential benefits of doing this work, as shown through the enthusiasm of the PIs and the impacts on the survey participants, are worthy of further exploration in the Network and beyond.

Currently, there is little empirical work being done to demonstrate either the value of arts-humanities-science collaborations or the impact of creative inquiry in ecological contexts. This is a great opportunity for more and different kinds of assessment, including narrative inquiry and other qualitative approaches. Systematic attention to these kinds of interdisciplinary relationships can complement the meaningful, yet anecdotal and conceptual, work being done; help us better understand the dynamics of effective collaborations; and illuminate the impacts these collaborations can have on the participants, place, and human/nature relationships.

Acknowledgments This research was supported by a Long-Term Ecological Research Network (LTER) subaward grant 976021-874U-2 from the University of New Mexico (NSF Prime award #0936498). We obtained approval from the Oregon State University Institutional Review Board (project #5827). The authors acknowledge support from the HJ Andrews LTER program, funded by the National Science Foundation's Long-Term Ecological Research Program (DEB 0823380), as well as LTER colleague Fred Swanson. Thanks, also, to Elyse Richman for transcription assistance.

References

Abrams D (1997) The spell of the sensuous. Vintage Books, New York

Agate J (2010) Inspiring awe in the outdoors: a mechanistic and functional analysis. Clemson University, Dissertation

Arends B and Thackara D (Eds) (2003) Experiment: conversations in art and science Wellcome Trust, London

Arksey H (1996) Collecting data through joint interviews. Social Research Update 15. Retrieved from http://sru.soc.surrey.ac.uk/SRU15.html artists-in-labs. Retrieved from http://www.artistsinlabs.ch/en/

Bieler A (2014) Exhibiting climate change: an examination of the thresholds of arts-science collaborations in the context of learning for a sustainable future. York University, Dissertation

Boyatzis RE (1998) Transforming qualitative information: thematic analysis and code development. SAGE Publications, Thousand Oaks

Brodie N, Goodrich C, Swanson F (2016) Forest under story. University of Washington Press, Seattle

Brown CS, Toadvine T (eds) (2003a) Eco-phenomenology: back to the earth itself. SUNY Press, Albany

Brown CS, Toadvine T (2003b) Ecophenomenology: an introduction. In: Brown CS, Toadvine T (eds) Eco-phenomenology: back to the earth itself. SUNY Press, Albany, pp. ix–xxi

Callicott JB (1989) In defense of the land ethic: essays in environmental philosophy. SUNY Press, Albany Cape Farewell Retrieved from http://www.capefarewell.com/

Carson R (1962) Silent Spring. Houghton Mifflin Company, Boston Climarte Retrieved from http://climarte.org/about/

Davis JH (2008) Why our schools need the arts. Teachers College Press, New York

Demaray E (2014) Work samples from the field of art and science collaboration. J Environ Stud Sci 4:183–185

DiCicco-Bloom B, Crabtree BF (2006) The qualitative research interview. Med Educ 40:314–321

Dixon D, Hawkins H, Ingram M (2011a) Blurring the boundaries. Nature 472:417

Dixon D, Straughan E, Hawkins H (2011b) When artists enter the laboratory. Science 331:860

Düzgün SA (2004) Contextualizing the term 'religious experience' in religious discourse. Islam Chritian-Muslim Relat 15(4):497–514

Fleischner TL (2011) The mindfulness of natural history. In: Fleischner TL (ed) The way of natural history. Trinity University Press, San Antonio, pp. 3–15

Flick U (2002) Qualitative research in psychology. Sage, London

Gabrys J, Yusoff K (2012) Arts, sciences and climate change: practices and politics at the threshold. Science as Culture 21(1):1–24. doi:10.1080/09505431.2010.550139

Goralnik L, Nelson MP, Gosnell H, Ryan L (2015) Arts and humanities efforts in the US LTER Network: understanding perceived values and challenges. In: Rozzi R, Chapin FS, Callicott JB, Picket STA, Power ME, Armesto JJ, May Jr RH (eds) Earth stewardship: linking ecology and ethics in theory and practice. Springer, Berlin, pp. 249–268

Gruen L (2009) Attending to nature: empathetic engagement with the more than human world. Ethics Environ 14(2):23–38

Harris AL (2004) Ecological phenomenology. Unpublished manuscript. Available at: http://studylib.net/doc/7856248/ecological-phenomenology—individual.utoronto.ca

Harris C (ed) (1999) Art and innovation: the Xerox PARC artist-in-residence program. MIT Press, Cambridge

Harrison HM, Harrison N (2007) Greenhouse Britain: losing ground, gaining wisdom. Harrison Studio and Associates, Santa Cruz

Hill CE, Knox S, Thompson BJ, Williams EN, Hess SA, Ladany N (2005) Consensual qualitative research: an update. J Couns Psychol 52:196–205

Holm P et al (2013) Collaboration between the natural, social and human sciences in global change research. Environ Sci Pol 28:25–35

Holstein JA, Gubrium JF (1995) The active interview. Sage Publications, Thousand Oaks

Houtman N (2012) Forms from the sea. Terra 8:20–25 Retrieved from http://oregonstate.edu/terra/2012/10/forms-from-the-sea/IHOPE. Retrieved from http://ihopenet.org/about/

Ingram M (2011) Eliciting a response through art. Nat Clim Chang 1: 133–134

Jacobson SK, Mcduff MD, Monroe MC (2007) Promoting conservation through the arts: outreach for hearts and minds. Conserv Biol 21(1): 7–10

Jeffers CS (2009) Within connections: empathy, mirror neurons, and art education. Art Education 62(1):18–23. doi:10.2307/27696326

Jones P, Selby D, Sterling S (eds) (2010) Sustainability education: perspectives and practice across higher education. Earthscan, London

Kepes G (1972) Arts of the environment. George Braziller, New York

Kimmerer RW (2004) Interview with a watershed. Ecological Reflections website. Retrieved from http://andrewsforest.oregonstate.edu/lter/research/related/writers/wir/kimmerer1.pdf

Knox S, Burkard AW (2009) Qualitative research interviews. Psychother Res 19(4–5):566–575

Leopold A (1949) A Sand County almanac and sketches here and there. Oxford University Press, New York

Lorkowski, J, Kreinovich, V (2015) Why awe makes people more generous: Utility theory can explain recent experiments. University of Texas El Paso Departmental Technical Reports. Paper 927. Retrieved from http://digitalcommons.utep.edu/cs_techrep/927

Louda, SM and Higley, LG (2010) Responsive science: The interplay of theory, observation, and experiment in long-term, place-based research. In Billick, I and Price, MV (eds.), The Ecology of Place. University of Chicago Press, Chicago, pp 303–327 LTER Vision. Retrieved from: https://www.lternet.edu/node/20

Mathews F (1991) The ecological self. Routledge, London

Moore KD (2004) The Pine Island paradox. Milkweed Editions, Minneapolis

Moore KD, Nelson MP (eds) (2010) Moral ground. Trinity University Press, San Antonio

Morris S (2001) Joint and individual interviewing in the context of cancer. Qual Health Res 11(4):553–567

Muchnic, S (2013) Under the microscope. ARTnews (March): 70–75

Nazir, J. (2016). Using phenomenology to conduce environmental education research: experience and issues. The Journal of Environmental Education 0(0): 1–12. doi: 10.1080/00958964.2015.1063473.

Nelson MP (2010) Teaching holism in environmental ethics. Environmental Ethics 32:33–49

Obrist, HU, Vanderlinden, B (eds) (1999) The theater of proof: Catalogue of the Antwerp Laboratorium on the occasion of the Antoine van Dyke exhibition. Open Roomade, Antwerp

Patterson B (2015) Al Gore inspires 'CO2,' an opera; a physicist lectures on climate change with a string quartet. ClimateWire. Retrieved from http://www.eenews.net/stories/1060019537

Piff PK, Feinberg M, Dietze P, Stancato DM, Keltner D (2015) Awe, the small self, and prosocial behavior. J Pers Soc Psychol 108(6):883–899

Plumwood V (1993) Feminism and the mastery of nature. Routledge, London

Polak L, Green J (2015) Using joint interviews to add analytic value. Qual Health Res 9(1):1–11

Ramkissoon H, Weiler B, Smith LDG (2012) Place attachment and pro-environmental behavior in national parks: the development of a conceptual framework. J Sustain Tour 20(2):257–276

Root-Bernstein RS (2003) Sensual chemistry: aesthetics as a motivation for research. HYLE 9:33–50

Smith, R (2015) When scientists and poets study together, the world gets cooler. The Stranger, Seattle. Retrieved from http://www.thestranger.com/books/feature/2015/11/11/23132536/when-scientists-and-poets-study-together-the-world-gets-cooler

Snow CP (1959) The two cultures and the scientific revolution. Cambridge University Press, Cambridge

Swanson FJ, Goodrich C, Moore KD (2008) Bridging boundaries: scientists, creative writers, and the long view of the forest. Front Ecol Environ 6:499–504. doi:10.1890/070076

Sylvan R (1973) Is there a need for a new, an environmental, ethic? Proceedings of the XV World Congress of Philosophy 1:205–210

U.S. Long Term Ecological Research Network (US-LTER) (2007) The decadal plan for LTER: integrative science for society and the environment. LTER Network Office Publication Series No. 24, Albuquerque, New Mexico

Vaismoradi M, Turunen H, Bondas T (2013) Content and thematic analysis: implications for conducting a qualitative descriptive study. Nurs Health Sci 15:398–405

Vucetich JA, Nelson MP (2013) The infirm ethical foundations of conservation. In: Beckoff M (ed) Ignoring nature no more: the case for compassionate conservation. University of Chicago Press, Chicago, pp. 9–25

Walker GJ, Chapman R (2003) Thinking like a park: the effects of sense of place, perspective-taking, and empathy on pro-environmental intentions. J Park Recreat Adm 21(4):71–86

Walsh, PW (2013) Whole-nature: integrating science and ecophenomenology. Thesis, University of Montana

Wattchow B, Brown M (2011) A pedagogy of place: outdoor education for a changing world. Monash University Press, Victoria AU

Wood D (2003) What is eco-phenomenology? In: Brown CS, Toadvine T (eds) Eco-phenomenology: back to the earth itself. SUNY Press, Albany, pp. 211–234

Worster D (1994) Nature's economy: a history of ecological ideas, 2d edn. Cambridge University Press, Cambridge

Yusuf K, Gabrys J (2011) Climate change and the imagination. Wiley Interdiscip Rev Clim Chang 2(4):516–534. doi:10.1002/wcc.117

Zealand, CTW (2007) Decolonizing experiences: an ecophenomenological investigation of the lived-experience of Appalachian Trail thru-hikers. Thesis, University of Waterloo