

**How to Practice Posthumanism in Environmental Learning: Experiences
with North American and South Asian Indigenous Communities**

Ranjan Datta

Abstract

This paper explores how to practice posthumanism in everyday life. This idea has increasingly come under scrutiny by posthumanist theorists, who are addressing fundamental ontological and epistemological questions in regard to defining an essential 'human,' as well as the elastic boundary work between the human and nonhuman subject. Posthumanism is essential for considering today's environmental problems and environmental science education. This paper then has three goals: developing posthumanist ontology, exploring methodology, and investigating whether environmental science education and practices can help students, teachers, and community in learning, teaching, and practicing processes. I demonstrate the complementary contributions from two Indigenous communities' field studies that can be made when a researcher moves beyond an exclusive focus on western interests and considers participants as co-researchers. This paper concludes with a discussion of implications for this field.

Keywords: human; posthumanism; ontology; methodology; practices; Indigenous

Introduction

It is a fact that posthumanism has gained a strong foothold within human geography and environmental sustainability (Castree, Nash, Badmington, Braun, Murdoch, & Whatmore, 2004; Castree & Nash, 2006; Murdoch, 2004; Simonsen, 2013). At the same time, what is often neglected in analysis of practice is the suggestion of how to practice posthumanism (Whatmore, 2013a). This paper aims to explore how a posthumanist ontology and methodology can be developed. The focus is given not only on philosophical discussion, but also on connections between theory and practice.

Humanism as a philosophical approach has long been problematic in environmental and science education. It claims that the figure of ‘human’ naturally stands at the center of things; is entirely distinct from animals, machines, and other nonhuman entities; is absolutely known and knowledgeable to himself, is the origin of meaning and history, and shares with all other human beings a universal essence (Whatmore, 2013a). Whatmore (2013b) further argued that it “is a mistake to posit humanity (culture) as somehow existing apart from the world of things (nature); rather, the human comes into being with this world” (p. 6). Haraway (2004) also criticized humanist projected knowledge processes and asked how, when, and why did we become human? Haraway (2004) strongly criticized artificial projected knowledge and argued that scientific projected knowledge has created *Homo sapiens* as pioneers, opportunists, and survivors. Likewise, Latour (2001) also rejected the assumption that human actors have a special status; instead, the activities of things and humans should be taken into account in the same way when examining social reality. Thus, Latour (2004) and Canadian Indigenous scholar Little-bear (2009) suggest that we need to redefine all social actors, both human and non-human from everyday practices. The term everyday indicates a way of thinking about the places in which we live; maintain relationships, and the spaces we move through on a daily basis (Herbert, 2000).

Posthumanism, Whatmore (2013a) and Haraway (2004) identified, is a crux in understanding relationships between people and the material world. The term material explains our relationships with our physical, mental, and spiritual environment (Castree, 1995). Practices in posthumanism have emerged in feminist and poststructural thought and include many different relational approaches. In a recent and cogent reflection, Castree and Nash (2006, p. 501) identified that posthumanist practices can be seen as disturbances on humanity, for example, new biotechnology, or as an idealized definition of the posthuman subject as separated and liberated from human. Fukuyama (2003) also asserts that new biotechnology threatens both the very definition of a human being and the existing social fabric. Posthumanist practice can be explained either as more-than-human thinking and doing or as a fracturing of the human subject (Latour, 2004; Simonsen, 2012).

My intention, however, is not to promote posthumanism as the largest term or name new theoretical directions or rename established themes. This paper’s main target is to explore how to practice posthumanism in everyday practices. For this, I first discuss how to develop posthumanist ontology. Second, I explore methodology. I then point to how to practice posthumanism in everyday practice through two empirical experiences with Indigenous communities (Datta, Khyang, Khyang, Kheyang, Khyang, & Chapola, 2014; Ginn, 2008). Finally, I discuss my everyday environmental learning experience with two field studies: The Laitu Indigenous community in Chittagong Hill Tracts in Bangladesh and the Dene First Nation community, Fund Du Lac, Saskatchewan, Canada. I learned from both studies how practice-based learning can have diverse impacts in our research and education such as (a) it can disturb the western notion of only human-oriented learning; (b) it can claim to reframe research and

education to focus on how we are always already related to animals, plants, and machines, and things within everyday practice; and (c) it can enable us to begin exploring new posthumanist directions in research, policy development, curriculum design, and pedagogy practices.

Posthumanist Ontology

Envisioning the future of both posthumanism and everyday practices, it is clear to those working in political ecology and others in human sciences that posthumanist ontological understandings of the world are the key to a process of practice that values and enacts environmental education. Ontology corresponds to multiple relational realities; “there is no one definite reality but rather different sets of relationships” (Wilson, 2008, p.7). Drawing from Whatmore (2013a), Haraway (2004), Latour (2004), and others (e.g. Escobar, 2008; Little Bear, 2009), I proceed by articulating a basis for engaging “practices,” not as static, but as simultaneously shaping and being shaped by more-than-human relationships.

According to Whatmore (2013b) a posthumanist or more-than-human theoretical approach is significant for understanding everyday relationships (i.e., both human and nonhuman). She suggests, “Living/ness is a relational condition that reconnects the intimate fabric of corporeality, including that of human becoming, to the seemingly indifferent stuff of the world that makes living possible” (p. 4). Whatmore suggests that posthumanist ontology is able to challenge human prioritized ontology. Whatmore argues that humanist ontology (i.e., ways of knowing relationships) is constructed and structured. Whatmore (2013a, 2006) states that posthumanist ontology centers on questions such as how the world makes itself known, the powers and forces that make our everyday life, political structures, economic arrangements, and so on. Her idea of posthumanist ontology helps us to understand what human and nonhuman relationships are in practice.

The posthumanist ontology deeply relies on the concept of *heterogeneity* (Murdoch, 2006). The term heterogeneity denotes the condition of being composed of different elements; the uses of the term are neither uniform nor are the differences or similarities of the related terms obvious. It is rather a complex assembly of relationships (Merkel & Weiffen, 2012). The poststructural geographer Jon Murdoch (2006) posits that heterogeneity in environment (i.e., geography or environmental sustainability) helps us to understand the complexities of human and nature relationships where nature and society are outcomes rather than causes. In heterogeneity both humans and nonhumans construct each other. He further explains that heterogeneity is significant in practice as it answers a number of questions such as: What is left out in humanism? Why is it important to know the diversity? How the social life of humans did construct us as being?

Post-humanistic ontology is interconnected thinking; it is neither singular nor a different discipline (Simonsen, 2013). Posthumanism in practice considers everything as mixed, for example, environmental management is relational and includes spiritual practices among human, animals, plants, birds, land, forest (Ingold, 2011; Little-bear, 2009). Whatmore’s (2013a) also points out that posthumanist ontology considers relationships a significant concept which is able to open our mind, bodies, diversities, and possibilities. Relationships suggest a significant move from human family (i.e., singular western thought) to the existential family (i.e., diverse but interconnected thoughts) from human rights to existential rights. She further explains that relationships are considered a political conception which can connect us with everything, and shapes others as us. In developing posthumanist ontology, Whatmore and others (Agamben, 2004; Derrida, 2003) suggested three kinds of views.

The first view challenges human historical conditions through biotechnology and genetic science (Fukuyama, 2002). Fukuyama (2002) and Whatmore (2013a) suggest that biotechnology created a kind of crisis on humanity; a crisis of ‘human’ thinking. Fukuyama (2002) gave examples from genetic science engineering, which can modify us and our known ideas. Haraway (2004) similarly explains through posthumanist ideas (e.g., genetic science) that we can reshape ourselves from our everyday practices. Thus, Whatmore (2013a) thinks that posthumanism is fundamental to environmental history in challenging the western idea of human.

Second, deconstructing the figure of ‘human’ (western sense) (Agamben, 2004; Derrida, 2002). Agamben (2004) and Derrida (2002) argued that the concept of ‘human’ needs deconstruction. Both Agamben and Derrida asked why and how the ‘human’ idea deploys through the politics of power. For example Escobar’s works (2011, 2010) explained how the ‘human’ idea became prioritized in modern humanist politics over the traditional every practice.

Third, (re)making the human/body/ecology through *choreography* concerned with relational practices or networks (Whatmore, 2013b). According to Haraway (1991) choreography means remaking ideas from a material sense, not a linguistic or figurative sense. In this theoretical thought, the boundaries (e.g., body/human/ecology) are highly fluid. The boundaries are explained as constructed in historical processes. The main focus is on diverse and alternative ways of understanding the concept of human as more-than-human.

In sum, posthumanist ontology can be seen as various relationships that connect us in complex networks (Latour, 2004). Murdoch (2006), Latour (2004), and Whatmore (2013 a & b) advocate for alternative ontology that rejects western dualisms such as fact and value, human and nonhuman, along with nature and culture, and rather looks to emphasize relations between entities. Thus, like Murdoch (2006), I also see posthumanist ontology in practical life as how “the mingling of various entities in complex assemblages, networks and/or systems, might now comprise geography’s main intellectual concern” (p. 196). Therefore, in posthumanist ontology there is a need to put the idea of relational politics into our everyday practice

Methodology in Posthumanism

Posthumanist methodology relies on Haraway’s (2004) and Whatmore’s (2013a, 2009) concepts of *interdisciplinary* and *knowledge controversies*. For explaining these two concepts in a posthumanist methodological framework, Whatmore (2013a) identifies three significant concepts: amplifying inter-corporeality, mapping into knowledge, and redistributing expertise. Such concepts answer a number of methodological questions: how do we study the human environment and why do we study the human environment differently with posthumanism. Both of these concepts (interdisciplinary and knowledge controversies), as Haraway and Whatmore explain, are able to breakdown the boundaries among human and non-humans.

The first aspect is *amplifying* which means interconnectedness or fluidity in posthumanist methodology (Whatmore, 2013a). Whatmore defines interconnectedness as different ways of thinking, as all bodies (not only human bodies rather all kinds of bodies within earth), as a whole body. According to her, our body is not only controlled by our cognition, but also our cognition also can be controlled by our body. For example, if our finger touches anything, it has effects on our entire body and/or our cognition. So the idea is that our finger has the ability to control our cognition, instead of our brain having complete control of our body. New bodily approaches need to evolve from amplifying in posthumanist methodology. Haraway (2004)

also makes a similar point, that our knowledge interferes by a set of factors, and each setting has relational influences on the others. Similar arguments are made by Indigenous scholars Smith (2005) and Wilson (2013) that all action is relational. Such relational actions help us to understand how we come to know, and how we can achieve our goals.

The second aspect is *mapping into knowledge*. Whatmore's (2013a) mapping is the idea that through training we can control our bodies and capacities to move in the world and to sense the world and how other kinds influence us. Drawing from Latour (2004) and Haraway (2008) Whatmore (2013a) explains that mapping into knowledge is an idea that we need to learn and practice to understand these kinds of effects on us. Mapping into knowledge is the ability to influence the way the world wants to speak to us.

The third aspect is *redistributing* expertise. According to Whatmore (2013a) our knowledge needs to redistribute in collaborative ways, for example working with science and collaboration between science and public policies by the source of knowledge that we want to build ourselves. Redistributing expertise is a deconstruction of our material understanding of the ways of understanding, the way in which we relate, and the ways in which we act with our material world (Haraway, 2004).

The three points previously discussed are helpful for understandings the concepts of *interdisciplinary* and *knowledge controversies* (Whatmore, 2013a; 2009). The interdisciplinary notion is significant posthumanism methodology (Haraway, 2004). Whatmore (2013a) explains the concept of interdisciplinary through the term of 'disciplinary in-between'. Instead of multidisciplinary (i.e., collection of disciplines), the disciplinary in-between term lead us toward disciplinary coherence. The disciplinary in-between has many similarities with interdisciplinary understandings and practices. Whatmore (2013a; 2013b) pointed to a collaborative methodological framework and gave examples that both (human geography and environmental sustainability) have shifted from disciplinary to collaborative disciplinary in-between (such as: science and technology studies (STS), performance arts, and animal studies). Thus, the interdisciplinary concept is a significant concept for posthumanism methodology in bridging science, technology, natural and social sciences as whole.

In addition to the interdisciplinary concept as a significant turning point in post-human methodology, the *knowledge controversies* are also a vital concept to create political ideological urgencies (Whatmore, 2013a; 2009). Whatmore (2009) explains three different political implications for redistributing expertise including: first, knowledge controversy aims for enabling interested citizens to trace the 'partisanship' of scientific knowledge claims; the second is accounting for the political force of techno scientific controversies by mapping the intense entanglements of scientific knowledge claims with legal, moral, economic and social concerns on the web; and the third is meshing the borders of animal/machine, social/material, flash/information, cultural/natural.

In sum, Whatmore and Haraway's contributions are helpful in order to develop a posthumanist methodological framework. Such a methodological framework is able to question humanists along the lines of: What are the underlying assumptions of post-human practice? To whom are we giving voice and agency, and at whose expense? And, which forms of science knowledge and practice are privileged and which forms are relegated to the margins? Therefore, I think a posthumanist methodological framework provides not only new representations, but also includes new forms of practices and other ways of living that result in humans and non-humans together.

Posthumanism in Practice

Example A: Experience with Laitu Khyeng Indigenous Community, Chittagong Hill Tracts (CHT), Bangladesh. Exploring an Indigenous perspective on meanings of land, management, and sustainability were at the heart of this research, we tried to demonstrate how research can be used to involve empowered participants that challenges different agencies' (i.e., government and non-governmental) anti-community land and forest management policies, and also to explore the linkage between traditional cultivation practices and sustainability. As such, our research engaged participants of community Elders, knowledge-holders, leaders, and youths in research processes such as conducting research, data analyzing, and identifying research themes that encouraged critical thinking, taking responsibility, and building community-based sustainability. This was a collaborative and participatory research journey that included an academic non-Indigenous researcher, Indigenous participant community co-researchers, Elders, leaders, and knowledge-holders who collaboratively owned research results (Datta et. al., 2015).

Research participants were engaged throughout our research by collectively identifying research questions and collecting and analyzing research data. As part of our posthumanist methodological framework we acquired consent during each research method process such as: traditional collective story sharing circle, individual story sharing, photo voice, and participant observation. We shared our community co-researcher translated transcripts with each participant and requested them to add and/or change anything our participants wanted. Throughout our research we followed Laitu Indigenous research protocols.

This posthumanist research focus was concerned with building a space in which participants felt enabled to share their stories, as well as explore possibilities and actions in sustainability. As a result, throughout the field study, the participants steered their traditional cultivation culture and took an active stand against different agencies' anti-community land management policies, in order to achieve their own sustainability goals.

We chose to use a posthumanist methodological framework of relational participatory action research (PAR) methodology in order to include and engage participants in meaningful participations. As one of the Elder participants shared:

This PAR is different from other research approaches as this PAR not only created a knowledge sharing space for writing our own oppressions and suffering stories, but also put our voice, our needs, and our abilities at its center (Datta et al, 2015).

To support posthumanist methodology as a relational PAR we drew a number of methods and techniques to engage participants in conducting field research, analyzing, and identifying themes that were important to them.

Drawing from posthumanist ontology, one of the main concerns was to explore meanings of land from community perspectives. According to the community's perceptions their land is interconnected. For example, both Elders and knowledge-holders participants described that the meanings of land and water are interconnected with both human and non-human. In addition, both are considered to be available for everyone. For example the Elder Kosomo Pure Khyeng explained:

Land and water are everything for us, including: our cultivated land, uncultivated land, food production, water, birds, animals, hills, the sky, winds, insects, plants, trees and feelings as well as spirituality, sounds, father-mother, brother and sister, and many

others. Land and water are for both visible and invisible things such as: visible things are human, animals, birds, crops, lands, insects, mountains, rocks, moon, sun, water, and so on; and invisible things are our feelings, winds, smells, sounds, spirituality, and so on.

It is revealed by our participants' stories that the community does not see a difference between human and nonhuman. These two concepts (i.e., human and nonhuman) are indistinguishable. For instance, Elder Okko Khyeng explicitly stated that "We do not differentiate ourselves, animals, plants, water, and land. For us, we are collective."

Both Elders and knowledge-holders describe the meanings of land and water as relational practices. For example Nyojy U Khyang gives an example in his commonplace book, stating, "When we climb up to a big tree for food, we pray and ask permission from the plant by saying, 'Do you allow me to take your creation (fruit) for us?'" He wrote that, "The community believes that if they ask permission to the trees, indicating the community may not overuse their resources, the trees may continue blessing the community."

In relational practice, the community acknowledges (mainly Elders and knowledge-holders during first sharing circle) the plants and trees by praying, "We will not hurt you and will not take more than we need," explains Nyojy U Khyang.

In contrast, it is clear from our participants' discussions that the current government and non-government agencies' definitions and meanings of land differ from the community's understandings and management practice. Participants explained that the outsider, non-Indigenous agencies' land and forest management policies (i.e., mainly projects) have focused on projected knowledge and economic profit instead of traditional relational practices that have never been intended to benefit the community. According to Elder Basa Khyeng, the different agencies' anti-community management policies (i.e., prioritized profit for outsiders) rendered the community essentially unsustainable.

It became obvious during the study that participants challenged the current government's profit oriented idea of land and management. The knowledge-holders Ching Cho Khyeng expressed that different agencies' profit oriented definitions of land and management have created serious challenges for the community's traditional management practices. According to him, outsiders' definitions promote suffering, exploitation, and displacement. The community's everyday relational and spiritual practices of Mother-land, forestland, and water bodies (i.e., lakes from hills' waterfalls) were transformed as a source of profit in the different agencies' (government and non-government) projects.

In order to understand traditional meanings of land and water, it is evident that participants—particularly Elders and knowledge-holders—position their understanding of land and water in their everyday relational knowledge and practice. Like posthumanist ontology, the community's attitude towards land and water is also based on relational practices, and they are obligated to care for, honor, and learn relational practices in their everyday practices.

Example B: Experience with Dene First Nation Community, Fond du Lac, Saskatchewan, Canada. Posthumanist learning from traditional cultivation culture and spirituality stories have the power, perhaps, to recreate posthumanism in science if we, as researchers and educators, are willing to consider a relational theoretical framework and place-based approach (Datta et al., 2014; Escobar, 2011, 2008, Massey, 2004; Willson, 2008). This informs the approach we took with a group of students in an attempt to lead them to a state or center of their traditional knowledge whereby they would challenge current hierarchical science and environmental

education. The Dene First Nation community is situated on the east side of Lake Athabasca (Treaty 8). According to Fond-du-Lac School Principal, Fond-du-Lac is one of the oldest settlements (colonized) in Canada. I was part of the science and environment science ambassador program in spring 2014 from the University of Saskatchewan, Saskatchewan, Canada. One of the Elders argued that the classroom settings (i.e., particular ways of knowing) teaching science does not include proper connections with their traditional practices and learning.

Like posthumanist ontology, the Dene First Nation community does not consider human as a separate entity from their environmental entities (e.g., plants, animals, sun, moon, forest). For example, one of the nine students expressed that “We are not human [according to scientific sense], we are First Nation”. I invited him to elaborate on his comments. He further explained, “We are everything, and our science education is also about everything, such as: our Caribou, our birds and our lakes, the plants and the sun along with the moon, our stones, and our land” (see figure 1).



Figure 1. Relational meanings of human beings. One of the grade nine students (from Dene First Nation community) drew this art work to explain their relational and scientific education.

A similar story was explained by an Elder, that everything in the environment has purpose and scientific meanings. The Elder commented about more than human views of environmental science in their practices, “if our traditional stories can bring successes for present and future, why should we not consider our traditional stories as scientific knowledge. Our scientific education is defined by our relational practices, care for our environment, and natural laws.” He further explained that science “comes from land and goes back to the land.” He also believes, “if we are able to learn science from our relational and spiritual practices, we neither need to create artificial science or our science will get lost.” He further comments that relationships with both human and non-human are scientific ceremonies; each action has scientific meaning and purpose to him and to the community.

Posthumanist ontology in practice is considered as relational responsibilities in the community (see figure 2). For example, one of the Knowledge-holders explained that every relationship is considered a significant responsibility to the community, and it begins with *me*. Every

individual is responsible for maintaining their relationships with their animals, birds, plants, and fish. He used the word *me* to explain that responsibility starts with me; everything is dependent on my responsibilities. He said our relational responsibilities have scientific meanings that “we will respect, honor, and care for everything, for instance: our land, animals, plants, fish, lakes, and so on.” One of the Elders considers this practice as human and non-human’s relational responsibilities, and through these responsibilities Dene communities are connected with everything. For example, the animals (such as the bear and caribou) have spiritual and relational meanings to the Dene First Nation. The animals have deterring power in hunting, producing and distributing food, and predicting weather. The wing refers to birds (e.g., Eagle, Crow). Each bird has a different purpose to the community, such as the Eagle is admired as a living symbol of power, freedom, and transcendence. The plants are used for many purposes (e.g., medicine, healing). The fish are used to signify water and the flow of life. Thus, one Knowledge-holder thinks their traditional knowledge has scientific value to them. Their practice-based science teaches them how they need to think together, see together, and act together. He said, “my learned science is from my everyday practices, including stories, arts, dance, and songs. Through our practices, we have been protecting our environment from generation to generation.” Therefore, he said, “science education is to me collective practices, which make us responsible in developing strong eyes and strong ears, to survive no matter where I go.” Therefore, Indigenous scholar Shawn Wilson (2008) argued that practice-based learning makes us accountable towards our relationships.

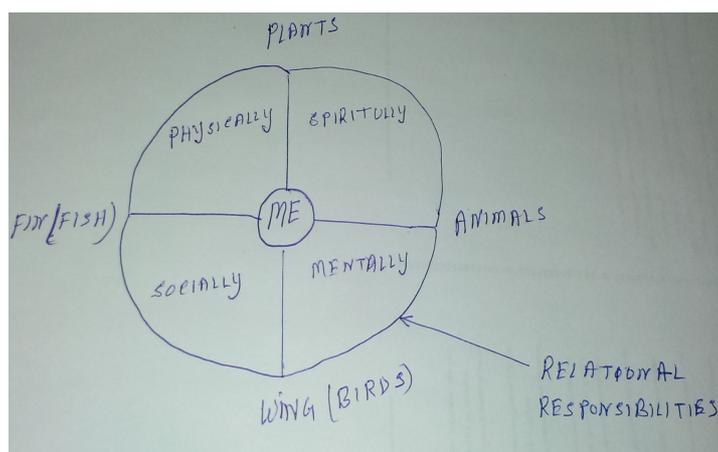


Figure 2. Relational responsibilities figure. Dene First Nation Knowledge-holder drew this figure during his collaborate talk in Fond du Lac school. This figure illustrates relational responsibilities in environmental science education from everyday practices.

Including posthumanism in modern science education is not easy; however, it is necessary if we (as a researchers, educators, and community members) wish to uphold traditional community-based science knowledge and everyday practices in our education systems. In relation to this argument I have asked a number of students their views on current environmental science study and their traditional everyday practices (i.e., hunting, fishing, clothing, and relations with ecology). Most students in grade eight and nine answered that they were more interested to learn different things from their practices. For example, the Elder explained that the traditional practices have given direction on how to think, how to look, and how to act when it came to conquering difficulties (see figure 2).

Grade eight and nine students explained that there were many differences between Indigenous and scientific ways of practicing and understanding science. For instance, one of grade nine students expressed that “we cannot share our science knowledge [classroom science

educations] with our parents or community members.” He explained further that “classroom science education doesn’t have similarities with our traditional knowledge and practices. In most cases, we need to memorize. If we are not able to memorize and we will not be able to write during our exam.” On the same point, a grade eight student expressed that “our science classes are not fun.” One of the science teachers also expressed that she had been facing difficulty acquiring science students in her class. She gave an example that “grade 6-12 classes have more than 100 students and she had less than 10 students. We also discovered similar difficulties during science ambassador experiments (such as DNA, optics, magnet, fossil findings, and other experiments) though I did not agree with their teaching techniques (i.e., particular ways of knowing, settings, and designs). One of the students also explained why she did not in particular like the ways of comprehending during environmental science education. For example she said, “We are not opposing science education. In fact, we need science education; however, we do not like memorizing science.”

It was a learning experience for me that many modern techno scientific (i.e., humanism) study curriculums do not consider traditional knowledge as a sustainable learning structure (Littlebear, 2009, 2000). For instance, during my science and environmental science experience I wanted to obtain students in a cultural camp. Cultural camp is an annual traditional knowledge sharing and activity camp. It is organized by the First Nation community particularly for community children. My co-science ambassador wanted to caution that “I should not change our classroom science and environmental teaching techniques for a less significant teaching technique [cultural camp].” He further argued that, “according to scientific study traditional knowledge does not carry significant scientific value, at least not according to my experience during my four years of core science study.”

Although I was seriously shocked by my co-science ambassador’s comment, I knew that individual personal opinions were not the issue, rather his own scientific education (Haraway, 2004). Moreover, one of the science teachers and my co-science ambassador commented that, “science has been created for particular skills and if students do not have particular skills they will not be able to understand.” Yet, one of the students commented that, “during science classes I feel bored since a large portion of class is having to memorize. Memorizing is not fun to me.”

Interestingly, student learning and views about science have changed greatly since inviting community knowledge-holders to our science class. We requested knowledge-holders to share practice-based science knowledge when following students during outdoor science activities and a school principal helped me in contacting community knowledge-holders for science class talks. From grade 6-10, classes of almost 50-60 students participated in knowledge-holder talks and outdoor activities. Students were divided into six groups and took several pictures with school provided iPads. During the outdoor activities, students took pictures of rocks, plants, trees, the lake and fish. They wrote many relational stories such as poems and storytelling, and created art to explain their relationships with their ecology and scientific understandings.

Discussion

The aim of this study was to explore posthumanism in everyday practices. The two empirical examples presented above demonstrate ways in which research can engage and cultivate communities. Indeed, it seems clear that practices in posthumanism are central (Whatmore, 2013a). Both of the studies’ results revealed that posthumanist knowledge is able to protect local people, their knowledge, and interest (Escobar, 2008; Berkes, 2012, 2003). Further, we have seen that post-humanist practices consider relational and spiritual knowledge as

significant sources of science. On the contrary, both studies' findings indicate that western human (i.e., profit) oriented definitions of science education and management have perhaps been too simplistic, too projected, and too far from local practice (Escobar, 2008; Haraway, 2004). Environmental science education and environmental resource management, both in Western science, are regarded as a concern of elites who are insensitive to local Indigenous people and their livelihood and needs (Bekers, 2003). Thus, Haraway (2004) and Franklin (2008) and others elsewhere argue that the more-than-human practices in management and environmental science education remains weak.

One important finding of the study in example A suggests that the current profit-oriented environmental resource management practices are artificial and projected. Experience from Laitu Indigenous community, CHT, Bangladesh shows that the expulsion of Indigenous communities' knowledge from the current government and non-government environmental management practice may result in their (local people) displacement and poverty by powerful outside economic groups. In current outsiders' profit oriented management policies, small Indigenous farmers, fishers, and forest users may not fit well with outsider definitions of management (Anderson, 2003, 2001).

The concept of posthumanist ontology has been one of the most powerful means of re-examining and reconfiguring everyday practices in a way that values diversity and honors interconnectedness among multiple actors. In the Laitu Khyeng context, posthumanist understandings of environment (i.e., land, water, and management) are significant for the community's land rights and identity. Such a correlation seeks to advance the discussion of Whatmore's concept of posthumanism as a means of understanding the transformative and dynamic interplay of cultural land practice. For example, as Elder Kosomo Prue Khyeng explained, "For us, both land and water are our parents, culture, and our identity."

I also learned from the Laitu Khyeng Indigenous community that posthumanist meanings of environment are connected to their strength (Escobar, 2008). For example, knowledge-holder Ching Cho Khyeng characterized traditional land and water practices as sustainable management practice." The knowledge-holder further stated that "our natural crisis [which is not imposed] is also our strength as our crisis also teaches us how to face challenging situations." Consequently, notions of more than human approaches are conveyed discursively through community operations in order to establish this strength.

In Example B, Dene First Nation Community, Fond du Lac, Saskatchewan, Canada, land-based learning was able to break the boundaries between humans and nonhumans. For example, a grade nine student's comments on human science broke the boundaries between human and nonhuman. This student explained that current science education in school "only benefits to humans and denies community's plants, animals, and other non-human rights. Such limited science education creates danger for community's traditional education of environment." A similar point was raised by Heimans (2012) that, "the bodies, human and other, which are produced through everyday practice... Practice is always both discursive and material; re-impose the messiness of bodies into accounts of practice" (p. 318). Similarly Latour (2004) argued that "without the nonhuman, the humans would not last for a minute" (p. 91). He further explained the importance of practice:

What is human, what is material and how they are related are what comes to--matter? Here then we can call on the material to become accountable... The argument here is that "objects as things" cannot and do not speak for themselves. They can be most articulately

heard when placed within the purview of practice. Practice can articulate objects; make them articulate (p. 318).

Similarly Elders of this study explained that western scientific knowledge has not only shifted from reality, but is also limited by its specific dimensions. This study's findings have similarities with Little-bears (2009) arguments that science is about new knowledge and reality (i.e., practices). The aims of scientific knowledge, as Einstein (cited in Little-bear, 2009) explains, is to seek something new or unknown from reality. In this view, environmental science education and knowledge definitions are not from outside of reality or limited by particular settings. Similarly Chalmers (2004) says science is derived from reality. "Science is to be based on what we can see, hear, and touch rather than on personal opinions [structured knowledge] or speculative imaginings" (p. 1). Dene First Nation students and their Elders suggest that science is always engaged with spiritual and relational practices, but the current western notion of science in education is from reality. Thus, Dene First Nation and other studies (Franklin, 2008; Heimlich & Andoin, 2008) suggest that both (researcher and research) need to diversify practice oriented learning and sharing processes on the basis of people who speak for both human and non-human and build constituencies for sustainability.

In this study, Dene First Nation students and Elders emphasized collaborative (human and nonhuman) practice oriented science education. To explain collaborative science education they focus on a community's relational and spiritual practices. Both Elders and Knowledge-holders explained that the language of spirituality and relationships were the window of reality. According to them, spiritual and relational practices can produce bridges among scientific notions and can create new knowledge. Such practice-based knowledge, according to Dene First Nation students is easy to learn, teach, and appreciate; class room oriented science education is much more difficult to teach and practice.

In summary, both study examples investigated how Indigenous environmental practice is needed as forms of knowledge, policies, and rituals in order to promote environmental sustainability. Both studies make a significant contribution to the existing literature in general, as well as contribute to the future of environment-related educational practices. The studies' findings reveal that "science education and practices are spiritual and relational celebrations." Their stewardship, learning, teaching, and practicing ethics may not fit well with western science education and management practice. Elders of this study explained that the practice-based complex learning systems are not only able to create collaborative learning and teaching processes, but are also able to break down the artificial boundaries among human/non-human, nature/culture, theory/practice, and body/mind.

In addition to the studies' findings, there were some limitations in both studies. First, in both studies the academic researcher's identity was non-Indigenous; however, in both studies Indigenous participants were considered as co-researchers and Indigenous people and their needs were a first priority. Second, both studies were conducted in non-Native language (i.e., English); but Indigenous participants were engaged throughout the research processes such as collecting data and analysis processes. Finally, as a posthumanist researcher I would like to make two arguments through both of the study experiences. First, it is useful to consider the local community and their needs. Their interests are a main and significant source of research knowledge and practice. Second, we need to shift our vision and develop empathy and respect (i.e., practice-oriented posthumanist ontology and methodology) for the needs, practices and voices of our participants.

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