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Listening to Children: Perceptions of Nature

Donald J. Burgess and Jolie Mayer-Smith

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This exploratory study investigates children's perceptions and experiences of nature during a residential outdoor environmental education program and contributes to an understanding of how nature experiences arouse biophilia, a love of life and all living things. Using interviews, naturalistic observation, and artifact collection, we studied children's responses to nature during and following their participation in a residential environmental education program known as Mountain School. We explored how an examination of biophilic sensibilities can help researchers and educators focus on the vital intersection between the individual, environment, and action. Our study suggests that children's perceptions of nature are varied and dependent on prior experiences. Our study indicates that after spending time in the wilderness program at Mountain School, children's perceptions of nature changed. Children formed connections with the fauna and flora of the North Cascades. Our use of biophilia as a framework for inquiry demands that we consider what it means to include the larger biotic community in our discussion of educational reform. This research contributes to an evolving understanding of the relationship between people and the natural world.

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Prologue

From the lakeside gravel road, our group follows a path that immediately enters a mixed deciduous and evergreen forest. Flickering green shadows create an inspirational entry into the living forest. Lingering at this natural threshold, surrounded by vibrant nature, fifth graders Emily and Anna exclaim, "Look at this flower, it's tiny! Hey, did you see this orange mushroom? Something has been gnawing on it. It is cold when you touch it." They kneel. "Wow, feel this leaf, it's like velvet! Oh, did you hear that tapping sound?" The girls are lost in intimate interaction with their natural surroundings. Each step down the trail brings a new discovery accompanied by rich emotional responses. Emily and Anna venerate their natural surroundings. *So, is this what emergent biophilia looks and feels like?* (researcher field notes with trail group)

Developing Biophilia: What Types of Experiences Matter?

Children are losing their sensitivity and connection to the natural world; its gentle slowness and ordinariness are being replaced by electronic stimulation and virtual

experience (Pyle 1993, Kahn 2002). In response, environmental educators ask the question: How can we promote a responsible attitude and caring view of the Earth and its inhabitants among young people? Limited research suggests that contact with the natural world, especially during middle childhood, occupies a surprisingly important place in a child's emotional responsiveness and receptivity (Kellert 1985, Pyle 1993, Derr 2002). What isn't known yet is how important a nature experience in a wilderness setting is to the cultivation of early childhood biophilia, or a love of living things. This is the problem that led us to study children's experiences in a residential environmental education program. Since our adoption of a biophilic framework demands a consideration of what it means to include the larger biotic community in the discussion of educational reform, this research contributes to an evolving understanding of the relationship between people and the natural world.

Our study builds on 25 years of multidisciplinary research on biophilia (Wilson 1984, Kellert and Wilson 1993) as we investigate how the innate tendency of children to focus on life and life-like processes can be used to understand their affiliation with nature. The study of the human relationship with nature is "big in

scope” and “interdisciplinary,” involving such diverse fields as history, science, policy, and human behavior (Kahn 1999, p. 1). Biophilia is believed to increase the “possibility of achieving individual meaning and personal fulfillment” while furthering a “human ethic of care and conservation for nature, most especially the diversity of life” (Kellert and Wilson 1993, p. 21).

The biophilia hypothesis has been explored from scientific, cultural, and humanistic perspectives. Accounts of biophilia are also well chronicled as nature writing. This literature, generally defined as nonfiction prose writing about the natural world, offers resplendent accounts of naturalists’ biophilic experiences. Many of these accounts are biographical, personal, and reflective (Austin 1903, Muir 1911, Leopold 1949, Carson 1956, Nelson 1989, Pyle 1993, Wilson 1994, Dillard 1998, Pyle 2002, Oliver 2004). These accounts inspire and provide guidance on how to provoke a biophilic disposition in adult readers. However, there is a need to understand what biophilia looks like in children. Our study will contribute to this understanding by investigating what biophilia looks like ‘in action’ for children.

Based on a critical review of the research on learners and learning in environmental education, Rickenson et al. (2004) found a small number of exploratory studies that focus on how learners perceive nature and how they, in turn, use those lessons to build a relationship with nature and the environment. Several studies report on students’ perception of nature and environment, as well as the influences that may shape these perceptions (Bonnett 1994, Wals 1994a, Bonnett and Williams 1998, Payne 1998, Kahn 1999). The limited empirical research conducted to date suggests that contact with the natural world, especially during middle childhood, occupies a surprisingly important place in a child’s emotional responsiveness and receptivity (Kellert 1985, 1996, Derr 2002).

Of particular interest to our study is research conducted by Kahn (1999) on children and adults’ understandings of the natural world, which contributed insights into how perceptions of nature are “mentally organized (structured) and transformed through development” (p. 213). Kahn used interviews to examine moral and ecological reasoning related to how people value nature and how they view environmental degradation. Based on eight years of studies with children, young adults, and parents in an economically impoverished community in Houston, Prince William Sound following the 1989 oil spill, the Brazilian Amazon, and Lisbon Portugal, Kahn concluded that children have a

deep connection to the natural world that is often severed by modern society.

Our study begins where Kahn’s research ended. Kahn offers a psychological account of how the world has become environmentally fragile as successive generations unknowingly experience an increasingly degraded environment. What is not known yet is how important a nature experience in a wilderness setting is to the cultivation of early childhood biophilia. Understanding how biophilia develops and what it looks like “in action” is the problem that led us to study children’s experiences in Mountain School, a residential environmental education program offered to classes in northwestern Washington. We conducted a case study on the experiences of one class of fifth graders in Mountain School, as they “engaged with nature” in the wilderness of the North Cascade Mountains. We selected Mountain School for our study because its environmental curriculum specifically sets out to introduce urban children to wildlife and wilderness. Our objective was to examine the outcome of children’s involvement in the Mountain School program and to determine if and how such experiences support the development of biophilia in children.

Two research questions guided our study of biophilia in children. First, what are children’s perceptions and experiences in nature? Second, what types of experiences with nature support the development of biophilia in children?

Valuing Nature

Our study of children’s responses to nature is informed by Kellert’s (2002) notion of environmental values in relation to evolutionary biology and biophilia. Kellert (1996) established a typology of nine values that “reflect a range of physical, emotional, and intellectual expressions of the biophilic tendency to associate with nature” (p. 129). His research represents the first attempt to systematically assess (through measurement and classification) how people value nature. While Kellert’s survey-based approach provided a way to examine a large number of people’s attitudes toward nature, it didn’t permit an in-depth look at the complexities of how people perceive nature. Our research extends Kellert’s work by examining how first-hand experiences with nature contribute to children’s expression of environmental values. We accompanied children into the field, and used observations and interviews to provide an intimate look at urban children experiencing nature in a pristine wilderness.

Nature is often viewed as a place to relax and be at peace with the world of living things. For the purposes of our research we define and view “nature” as a landscape or environment that is relatively unaffected by humankind (Wilson 1996). Nature is a place to commune with living things, and, in our view, includes urbanized natural areas, parks, and pristine wilderness largely untouched by civilization. Since humans are a part of the natural world, human well-being is considered an environmental consideration (Kahn 1999).

Today, however, ideas about nature are changing as human impact on the planet increases. As the editors of *Nature* (2008) point out, “If nature is defined as a landscape uninfluenced by humankind, then there is no nature on the planet at all” (p. 263). Humans from prehistoric times to the present have had a profound planet-wide effect on earth’s ecosystems (McKibben 1989). Today’s global climate change, the increase in acidity of the earth’s oceans, and the movement of synthetic chemicals in all food chains are just a few examples of vast anthropogenic changes throughout earth’s ecosystems (Orr 2002, 2004). These threats provide the backdrop in which children today develop their early perceptions of nature.

Mountain School

The context for this study is Mountain School, a three-day residential environmental education program for school groups that takes place in the heart of North Cascades National Park. The goal of the Mountain School program is to inspire a closer relationship with nature through direct experiences *in* the natural world. The school’s philosophy and curriculum are informed by research and practice in environmental literacy (Orr 1996, Elder 2003), natural history education (Fleischner and Weisberg 1992, Williams 2005), and environmental education (Pyle 1993, Nabhan and Trimble 1994, Sobel 2004). The program emphasizes the themes of biodiversity and interconnections through curriculum activities that are designed to educate and inspire people about the role of the environment in their lives.

Students travel by bus to Mountain School with their classmates, teacher, and chaperones. Activities take place in the school’s classrooms and labs, and on trails in the North Cascades National Park. Children explore forest and mountain ecosystems, play structured environmental education games, and go on wilderness hikes during the day, evening, and night hours. Trail activities are “hands-on” and designed to introduce students to mountain ecosystems and provide intimate contact with the diverse biological communities of the park. Lessons address

physical and life science topics that include biodiversity, aquatic ecology, glaciers, geology, cultural history, ethnobotany, wildlife, and forest ecology (NCI 2008).

The primary instructors and trail leaders at Mountain School are graduate students who are completing a professional residency environmental education program. Each graduate student is responsible for leading one trail group comprised of six to eight elementary students and two parent/guardian chaperones. Faculty, rangers, and park resource managers also take part in teaching Mountain School students by offering a variety of demonstrations and hands-on activities. Classroom teachers lead pre- and post-program instructional activities at their school as part of the Mountain School curriculum. More information about Mountain School can be found at <http://www.ncascades.org/>.

Research Methods

To answer our research questions, we used a naturalistic case study approach and methods (Merriam 1998). There are limitations associated with examining a single case; however, our examination of the Mountain School experiences is intended to help us understand the phenomenon known as biophilia. Thus while our case is not necessarily typical, nor generalizable to multiple settings, we anticipate it will be instrumental (Stake 2008) in advancing research in natural history education.

Study participants. The participants for this study were two classes of grade 5 students, ages 10-11 (n = 35), who took part in the Mountain School program in 2009. These students attended Cedar Tree Elementary (pseudonym) in Washington State. Cedar Tree Elementary enrolls approximately 450 students in grades K-5 from an urban multicultural neighborhood that includes upper-middle, middle, and lower income families, and Hispanic and First Nation learners. The students attending Cedar Tree reflect the demographics of the larger community and include children with a wide range of socio-economic and cultural backgrounds that encompass English Language Learners (ELL) and Special Education students (SPED). Although aligned with the Washington State Essential Academic Learning Requirements (OSPI 2005), Mountain School is not a required school district educational program. Classes attend voluntarily on a space-available basis. Each year, around 1800 students, 250 parent/guardian chaperones, and 80 teachers from 15 schools across Puget Sound participate in this program.

Data collection. To understand children's responses to nature we conducted interviews, observed children during the program, and collected students' written work.

Interviews. Semi-structured interviews were conducted with all students before and after they attended the Mountain School program. Pre-program interviews were conducted one week before the program and focused on children's initial views and perceptions of nature. The post-interviews, conducted a month after the program was over, focused on memories of Mountain School and changes in perceptions of nature. To stimulate recall during the post-program interviews, children were shown a series of six photographs depicting specific Mountain School experiences (i.e., hiking, an outdoor learning shelter, trail activities, the Microscope Lab, and the Bone Lab). Interviews lasted 20 to 30 minutes and were audio taped for transcription so that we could focus on the nuance of children's words and facial expressions (Wals 1994b).

Interview questions were open-ended (Appendix 1) (Miles and Huberman 1994, Merriam 1998) with descriptive, structural, and contrast prompts (Hatch 2002) to probe for additional information. In addition to pre- and post-program interviews, we conducted informal interviews with children as we accompanied the trail groups during the Mountain School program to probe children's perceptions of their learning experiences in the wilderness. Because conditions such as wind and rain prevented making audio recordings outdoors, we kept field notes to document these conversations. Informal interviews served as a member check that allowed us to augment and/or challenge our interpretations of observations and assess the intent of children's actions (Lincoln and Guba 1985).

Observations. Using field notes we documented children's responses to the wilderness experiences and their social and environmental interactions. Our records included both verbal and nonverbal cues displayed by the students.

Student Documents. To augment our data set we collected and analyzed samples of student work produced during the Mountain School program. These documents included children's learning journals that contained their field notes, checklists, worksheets and creative writing. We also collected the postcards with drawings the children created as a reflective exercise on their final day at Mountain School, and the thank-you letters they wrote as a class assignment to the Parent Teacher Association (PTA) the week after Mountain

School had ended. In each of these writing activities the children were prompted to share their specific memories of Mountain School "using descriptive language".

Data analysis procedures. Transcripts from interviews and the samples of student work were read and reread and coded for the common themes that appeared. For this initial step in our analysis, we used Kellert's construct of environmental values as a framework to examine how children's experiences of Mountain School influenced their perceptions and understandings of nature. Kellert's value categories provided a place to begin our analysis of the data and identification of "dispositions associated with the human inclination to affiliate with the natural world" (Kellert 1996, p. 26).

Kellert characterized values as the convergence of emotion and cognition and created a typology that "reflect a range of physiological, emotional, and intellectual expressions of the biophilic tendency to associate with nature" (Kellert 2002, p. 26). He identified and established a functional definition for nine nature values: Scientific-Ecological, Naturalistic, Symbolic, Aesthetic, Humanistic, Negativistic, Moralistic, Utilitarian, and Dominionistic. For example, having or seeking knowledge and understanding of nature is representative of a Scientific-Ecological valuing of nature. A focus on exploration and discovery of nature implies Naturalistic valuing of nature. Symbolic value is seen when nature is used as a source of language and imagination. The physical attraction and appeal of nature is the basis of Aesthetic value, while evidence of an emotional bonding with nature relates to Humanistic value. Utilitarian value is expressed when nature is seen as a source of material and/or physical reward. Moralistic value is expressed when people display an ethical and spiritual connection to nature. Finally, mastery and control of nature represents a Dominionistic value. Table 1 provides examples of the expression of Kellert's environmental values by students in our study.

Table 1. Kellert's Values as expressed by students.

Values	Student statements
Scientific-Ecological	“The track looked hairy and we counted five toes with claws. The track has seven different pads. I think it’s a black bear – a carnivore. I then used a ruler to measure its length (9 inches) and width (5 inches). I drew its shape. I concluded a black bear left this track because the track matches the picture in the field guide exactly. I would like to know the weight of the animal, what it eats and also have more books to read about bears in the North Cascade Mountains.”
Naturalistic	“We like get on our boots and old stuff and we look around for animals. One time I found this cool looking beetle, it was like that big and it was crawling around so I was following it.”
Symbolic	“Deer Soft runner Running, sleeping, eating Nice, sweet, forest-living, beautiful Animal”
Aesthetic (Appeal)	“Everything’s <i>green</i> like the trees and everything’s living like you and it’s not like technology, no robotics or anything, it’s all living! I love animals! I love plants and nature!”
Humanistic (Love)	“I love when I had bats flying over my head, that was just amazing. I loved that! I never knew they lived in the mountains.”
Negativistic (Aversion)	“I’m afraid of being attacked by a <i>bear</i> or <i>cougar</i> .” “I’m mostly nervous about falling down a cliff or something like that, because when I’m close to an edge I am scared!”
Moralistic (Ethical concern)	“You don’t want a bear to <i>get along</i> with humans or eat our food because if it got too friendly then you’d have to put it to sleep.”
Utilitarian	“I like to gather blackberries at my grandparents farm in the fall.”

During our analysis we found Kellert's framework insufficient to characterize the complexity we found in children's actions, behaviors, and words. Thus, we developed additional themes and subthemes that elaborated Kellert's (1996) nine nature values. For example, elaborating on Kellert's Aesthetic value we identified the theme beauty of nature, and within that theme we identified subthemes valuing the beauty of forests, animals, and vistas. Our final analysis of children's words and work resulted in the identification of 33 additional themes and subthemes (Tables 2 and 3).

To illustrate how additional themes and subthemes were developed, we provide here examples focusing on Kellert's Scientific-Ecological and Aesthetic values. For each example, we include excerpts from the data set that illustrate children's expression of these values. We indicate Kellert's value using boldface font and the additional themes and subthemes we developed for these values using italics.

According to Kellert (1996), a scientific understanding of nature emphasizes morphology and physiology of organisms, while the ecological perspective "is a more integrative approach to the natural world emphasizing interdependence between species and natural habitats" (p. 13). We identified the Scientific-Ecological value in our data set when children's responses indicated systematic study of nature that emphasized interdependence among species and natural habitats.

Within the Scientific-Ecological value category we developed three new themes to reflect children engaged with nature: *observation* (e.g., carefully observing animals and plants), *systematic study* (e.g., comparing and classifying organisms, predicting or inferring), and *interconnection* (e.g., making connections among living and nonliving components of an ecosystem). The following excerpts illustrate this value and themes:

There's this tree in my yard and there's a lot of these little brown birds that they're all flying around all over the place and once there was this gray bird with a white chest and it had a black head, I didn't know who it was though. (**scientific-ecological**, *observation*) (Hannah, Pre-Program interview)

I learned about animal tracks, skulls and diets. Did you know that Grey Wolves are now rare but their species is coming back again? There is actually a family of Grey Wolves in North Cascades National Park. (**scientific-ecological**

observation, interconnection) (Alexa, PTA letter, Post-Program document)

Kellert (1996) defined aesthetic experiences as those that evoke feelings of pleasure and awe. We identified the Aesthetic nature value when children's responses indicated appreciation for the beauty of nature.

We found that children's aesthetic expressions were provoked by a range of experiences, from viewing a grand mountain vista to finding simple appeal in the diversity of the living green forest, such as watching a wild bird species like an iridescent Blue Jay or a small furry species like squirrels. Thus, we identified the theme *beauty of nature* to represent the aesthetic aspect in children's responses and capture responses that focused on the physical appeal of nature. We identified and developed three subthemes in the children's words and texts. The *animal* subtheme was apparent when children spoke or wrote about beautiful colors, movements, or behaviors of wildlife; the *forest* subtheme for responses about color, light, smells, or variety of flora; and *vista/scenery* subtheme for references to landforms such as glaciers, mountains, or lakes. The following interview and document responses illustrate how children responded aesthetically to nature experiences at Mountain School:

I could feel the wind against my face. I couldn't have imagined the beauty of Mountain School. From the dock, it [lake, mountains, and forest] looked so superb! (**aesthetic**, *beauty of nature, vista/scenery*) (Jacob, PTA Letter, Post-Program document)

I liked Mountain School. My group, the Cougars, got to see bear tracks and the waterfall! It was the best waterfall I had ever seen in my whole entire life. I loved it! It was the most wonderful falls. Well that's not the best part; we got to get our hair wet and our clothes! (**naturalistic**, *exploration, aesthetic, appeal, vista/scenery*; **humanistic**, *emotional attachment to nature, relax*) (Haley, PTA Letter, Post-Program document)

To organize our data, we created a table for every child in our study where we recorded their expressions of nature. These tables allowed us to track how and whether each child's written and verbal expressions of nature developed and changed over the course of the program and beyond. Table 2 shows one student's expressions of environmental values.

Table 2. One student's expressions of environmental values.

Values	Themes & Subthemes	Pre-Program		Day 1-3		Post-Program	
		Interview	Document	Interview	Document	Interview	Document
Scientific-Ecological	<i>Systematic Study</i>						
	<i>Observation</i>	*			*	*	*
	<i>Interconnection</i>				*	*	
Naturalistic	<i>Exploration</i>				*	*	*
	<i>Play</i>				*	*	*
Symbolic	<i>Poetry</i>				*		
	<i>Story/fantasy</i>				*		
	<i>Anthropomorphism</i>				*		
Aesthetic Appeal	<i>Beauty of Nature</i>		*		*	*	*
	• <i>animals</i>	*				*	
	• <i>forest</i>					*	
	• <i>vista/scenery</i>					*	
Humanistic Love	<i>Emotional Attachment</i>					*	
	• <i>relax</i>		*		*		*
	• <i>reflect</i>						
	• <i>respect</i>				*	*	*
Negativistic Aversion	<i>Fear of:</i>						
	• <i>heights</i>	*					
	• <i>weather</i>						
	• <i>plants</i>						
	• <i>animals</i>						
	• <i>predators</i>	*					
	• <i>insects</i>						
	• <i>dark</i>						
• <i>getting lost</i>							
• <i>people</i>							
Moralistic	<i>Concern</i>				*	*	*
	• <i>ethical treatment</i>					*	
	• <i>etiquette</i>				*	*	*
Utilitarian	<i>Hunter/Gatherer Photos</i>						
Dominionistic	<i>Nature Suppression</i>						

Findings

Children's perceptions of nature changed over the course of their involvement in Mountain School. This change was evident in both their interview responses and written work. We observed an increase in the number of children who expressed *scientific-ecological, naturalistic, aesthetic, humanistic, moralistic, and symbolic* valuing of nature and a corresponding decrease in the number of children who expressed *negativistic* views (Table 3).

In our discussion, we consider children's Scientific-Ecological, Naturalistic, and Symbolic values together, as these values are more cognitive in their expression. Next, we discuss children's Aesthetic, Humanistic, and Negativistic values, as these are representative of emotions. Finally, we discuss children's Moralistic, Utilitarian, and Dominionistic values together, as these are values associated with broad belief orientations that involve the intersection of the cognitive and emotional domains (Kellert 1996).

Children's scientific-ecological, naturalistic, and symbolic valuing of nature. Our data indicate that prior to attending Mountain School, most of the children's perceptions of nature were based on limited direct experiences and general *observations* of the natural world. Children were eager to discuss their ideas about nature but had little to say about ecological relationships. When asked, "What is nature to you?" children responded with simple objective descriptions of nature that highlighted the presence of plants and animals:

Like animals, like wild animals, like lots and lots of trees and plants and things. (**scientific-ecological, observation**) (Olivia, Pre-Program interview)

I think of living things like plants and animals. (**scientific-ecological, observation**) (Nick, Pre-Program interview)

During their participation in Mountain School, children's knowledge of the natural world increased. They began to recognize individual species and learn the scientific and common names of animals and plants, and started to build a framework and taxonomy of the natural world. This increase in scientific knowledge was accompanied by a growing awareness of the interconnections for organisms in the wilderness. Children were comfortable and excited about sharing what they were learning:

At the park Visitor's Center I learned that black bears like moist forests. Mother bears have two to three cubs in January and February in their den. They eat plants, ants, yellow jackets and termites that they dig in the forest. In the spring bears eat grass in meadows. They peel bark from trees too. (**scientific-ecological observation, interconnection**) (Ethan, Day One, Mountain School journal)

Children also built ecological understanding as they engaged in primary experiences. All children made discoveries about nature that ranged from an intimate encounter with a wildflower, colorful fungus along the trail, or bones and feathers representative of predation, to identifying bear tracks in mud and cougar scratch marks on a tree. These discoveries appeared to stimulate the development of *naturalistic* values. On Day Two, children were encouraged to reflect on their discoveries and then express them creatively as poems or stories recorded in their Mountain School journals. After finding a sword fern along the trail, Jarrod first made a labeled drawing of one of the fronds. He then read briefly about ferns in a field guide before writing a piece that reflected a naturalist's attention to detail and the artistry of a poet:

Fern
green, small
waving, popping, reproducing
a small waving feather
green plant

(**naturalistic, play; symbolic, poetry**) (Jarrod, Day Two, Mountain School journal)

After the program ended, we observed that children continued to draw on first-hand experiences from Mountain School to think and write about nature through a poetic lens:

I dreamed
I was a Pika,
in the snow
burrowing with my pals.

(**symbolic, anthropomorphism/fantasy/poetry**) (Haley, PTA Letter, Post-Program document)

Table 3. Children's expression of environmental values. Numbers in this table indicate how many children expressed a particular environmental value at various points in the program. A dash indicates that no responses were coded for this environmental value category.

Values	Themes & Subthemes	Pre-Program		Day 1-3		Post-Program	
		Interview	Document	Interview	Document	Interview	Document
Scientific-Ecological	<i>Systematic Study</i>	9	3	14	24	15	25
	<i>Observation</i>	22	-	18	35	30	35
	<i>Interconnection</i>	8	2	14	15	15	21
Naturalistic	<i>Exploration</i>	3	1	14	13	15	10
	<i>Play</i>	5	-	10	14	17	11
Symbolic	<i>Poetry</i>	-	-	8	35	-	2
	<i>Story/fantasy</i>	3	-	10	20	21	24
	<i>Anthropomorphism</i>	4	-	12	2	4	2
Aesthetic Appeal	<i>Beauty of Nature</i>	11	2	17	8	19	9
	• <i>animals</i>	14	2	15	7	14	15
	• <i>forest</i>	7	-	-	5	12	8
	• <i>vista/scenery</i>	5	-	10	8	12	8
Humanistic Love	<i>Emotional Attachment</i>	11	-	10	16	22	24
	• <i>relax</i>	12	2	-	1	10	-
	• <i>reflect</i>	3	-	10	-	12	-
	• <i>respect</i>	9	1	12	1	14	-
Negativistic Aversion	<i>Fear of:</i>	1	-	-	-	-	-
	• <i>heights</i>	6	-	4	3	2	-
	• <i>weather</i>	6	-	1	-	1	-
	• <i>plants</i>	3	-	-	-	-	-
	• <i>animals</i>	4	-	4	3	1	-
	• <i>predators</i>	7	-	2	2	-	-
	• <i>insects</i>	5	-	2	-	2	-
	• <i>dark</i>	2	-	1	-	1	-
	• <i>getting lost</i>	1	-	1	-	1	-
• <i>people</i>	5	-	-	-	1	-	
Moralistic	<i>Concern</i>	15	1	-	3	21	5
	• <i>ethical treatment</i>	7	1	15	-	16	3
	• <i>etiquette</i>	7	1	-	1	12	1
Utilitarian	<i>Hunter/Gatherer</i>	5	-	1	2	7	-
	<i>Photos</i>	1	-	3	-	4	-
Dominionistic	<i>Nature suppression</i>	-	-	-	-	-	-

Children's expressions of aesthetic, humanistic, and negativistic valuing of nature. Prior to attending Mountain School most children described nature dispassionately, characterizing it through simple objective descriptions of animals and plants. Few children described nature in terms of how it made them feel. This changed. Participation in Mountain School nature experiences appeared to evoke strong aesthetic and emotional responses in children. On Day One, although encouraged to walk slowly, make observations, and write in their journals, children had difficulty settling into deep place-based reflection. They were compelled to move about, discovering the trails, vistas and forest spaces and made animated responses. However, later on that same day during a night hike, we observed children engaging in calm reflection. Walking close to their friends, surrounded by darkness, they learned about bats, watched for shooting stars, and listened to an underground creek beneath their feet. Children's responses to these experiences, which included the liberal use of the word love, communicated emotional connections to nature, indicative of emergent biophilia:

I love when I had bats flying over my head, that was just amazing. I loved that! I never knew they lived in the mountains.
(**naturalistic**, *discovery*; **humanistic**, *emotional attachment to nature*) (Carmen, Post-Program interview)

Everything's green like the trees and everything's living like you and it's not like technology, no robotics or anything, it's all living! I love animals! I love plants and nature!
(**aesthetic**, *beauty of nature, forest, animals*; **humanistic**, *emotional attachment to nature*) (Jacob, Trail conversation, Day Three)

As children explored, played, hiked, and made discoveries, they gained new perceptions of nature. They began to talk about nature as diverse, green, living, and interconnected and began to view nature as something compelling, alluring, and interesting. This was distinctly different from what we saw and heard from the children before they attended the program, and provides evidence that direct experience in nature can be transformative. Significant for this study of the development of biophilia, we observed that following participation in the program, children's responses to nature continued to display expressions indicative of ecological, emotional and aesthetic values:

It [nature] is beautiful, there are lots of animals to watch and there is a bunch of things to do. I love just being around the trees and seeing all the animals. I figured out there are a lot more trees in the world than I really thought. Everything is so different, a bunch of beautiful colors! (**scientific-ecological**, *observation*; **humanistic**, *emotional attachment to nature*; **aesthetic**, *beauty of nature, forest, animals*) (Nick, Post-Program interview)

In post-program interviews and documents when children recalled their experiences, their scientific and ecological discussions were augmented by emotional expressions and accounts of first hand encounters with wildlife:

I loved walking at night with friends. We saw a lot of bats, a planet and a shooting star! When I looked over the side of the dam, it looked like 1000 feet down. Except it was only 400 feet. We even heard an underground creek. It was the most amazing night and a wonderful experience to be outside. (**naturalistic**, *discovery*; **humanistic**, *emotional attachment to nature*; **aesthetic**, *vista*; **naturalistic**, *exploration*) (Kenya, Post-Program interview)

Approximately one third of the children in our study arrived at Mountain School worried about outdoor experiences and expressed fears about the dark, the weather, the "wild" animals, and the dangers of getting lost. This finding supports research that many children fear the natural world (Pyle 2002, Sobel 2008). While negative feelings such as fear and aversion are part of our innate response to the natural world, they can serve as impediments to the development of biophilia. For the 11 children that initially expressed fears about nature, we saw a decrease in their negative expressions about nature. For example, after a number of steep hikes children who were initially afraid of heights commented on how the North Cascade Mountains were steep but more accessible than previously imagined. Children's *negative* views changed to more *humanistic* values informed by *respect* for the mountainous terrain:

I would say that it's pretty safe in nature on the trails if you know what you're doing.
(**humanistic**, *respect*) (Jacob, Post-Program interview)

Thus it appeared that exposure to, and experiences with nature at Mountain School contributed to reducing barriers to biophilia (e.g., *negativistic* values of *fear of*

heights and predators), and increased biophilic valuing of the beauty and accessibility of mountainous terrain and animals (e.g., *humanistic, aesthetic and naturalistic* values of informed *respect, appeal* and *discovery*). Anthony's written and spoken response to the wilderness is representative of this shift in values:

I learned how to hike by myself and it seems like it is scary but it's not. If you are afraid, try not being afraid. What's to be afraid of? It is just the wilderness. Nothing is going to eat you. Just be quiet and listen. What do you hear? Look around, what's around you? Do you see any bears? (**humanistic, respect; aesthetic, animals; scientific-ecological, observation**) (Anthony, PTA letter, Post-Program document)

Um, [bears] are not really scary now. Like I'm not really a country boy – like out in the woods – I'm a city boy. So, I wasn't used to it back then, and I was scared. But, now I'm not, because I know what to do. It's their home. When you see a bear, don't run, act big, make a lot of noise and walk away quietly backwards. (**humanistic, respect; moralistic, ethical concern**) (Anthony, Post-Program interview)

Spring who was also afraid of wild animals became respectful of predators in the wilderness:

Yeah, my favorite memory is probably seeing the cougar marks on the tree and the bear marks, that was like scary awesome! Kind of like when you're going on the Ring of Fire [amusement park ride], it's scary awesome! (**humanistic, respect**) (Spring, Post-Program interview)

Expressions of dominionistic, utilitarian, and moralistic value of nature. Initially children had concerns about care for nature in a very general sense but seemed to lack language for expressing this more abstract value. At Mountain School, children became familiar with small forest creatures (e.g., squirrels, chipmunks, raccoons, and coyotes) and megafauna (e.g., deer, bears, and cougars) through field and lab activities and games. Trail leaders modeled, through their words and practices, a respectful relationship with all animals including large charismatic predators like bears. These experiences appeared to assist children in developing a heightened respect for non-human species and a language to communicate this respect. Anthony and

Koby's responses are representative of the respectful relationship observed in all the children:

You don't want a bear to *get along* with humans or eat our food because if it got too friendly then you'd have to put it to sleep. (**moralistic, ethical concern; humanistic, respect; symbolic, anthropomorphism**) (Anthony, conversational interview, Day Two)

My favorite memory is when my group heard a bear noise and then we had finish our Track Lesson somewhere else because our leader told us that we had to give the bear its space. (**humanistic, respect; moralistic, ethical concern**) (Koby, PTA Letter, Post-Program document)

While children in this study expressed awareness of the potential for humans to control nature (characteristic of a Dominionistic value according to Kellert (1996), they did not express an inclination to dominate or suppress nature directly either before or after their wilderness experience. Similarly, our study revealed little change in utilitarian values. In contrast, moralistic values (ethical concerns for nature) appeared to change noticeably through participation in the Mountain School program. As mentioned previously, children became less fearful and more respectful of wildlife and natural surroundings.

Summary, Conclusions, and a Call for Further Research

Investigating children's perceptions of nature and participation in an environmental education program provides a look at the development of biophilia in children and offers insights on how connection and affiliation with the natural world may be cultivated and enhanced through a wilderness experience.

What are children's perceptions and experiences in nature? Our study suggests that children's perceptions of nature are varied and dependant on limited prior experiences. The interviews show that children's initial impressions of nature are often based on experiences in their own neighborhoods and local parks. Even urban children have developed a sense of nature as a place to play (e.g., sports, informal games, climb trees) and explore (e.g., bike and follow trails). Many children have a special place in nature to rest and enjoy solitude (e.g., shade of a backyard tree or park bench to read). Children's emergent biophilic sense is that nature is alive with many plants and animals. This view of nature

is often tempered for urban children with a frequent parental warning to stay away from the wooded sections of the parks where children might be victimized by bullies.

Children in our study expressed curiosity about the distant mountains that form a green backdrop above their lowland towns. Because most lacked direct experience outside urban environments, they imagined the mountains as an extension of their local park, a vast alluring green home for small animals like chipmunks, squirrels, and birds. This compelling view of mountains contrasts with stories of remote, steep, and snowy mountains that are homes for large predatory animals like bears, wolves, and mountain lions. For these urban children, the mountains remain an alluring yet sometimes scary place to visit. Similar findings have been reported by Pyle (1993) who argues that “extinction of experience” results when children spend less time looking closely at nature. Sobel (1996) warns that disconnection from nature can lead children to develop a fear of nature, resulting in ecophobia. More recently, Louv (2005) reports that ecophobia is becoming a potent barrier to children spending time in nature.

Our study indicates that after spending time in the wilderness program at Mountain School, children’s perceptions of nature changed. Children formed connections with the fauna and flora of the North Cascades. Their words and actions indicated feelings of love, care, and respect for the green ecosystems of the forest and mountains, and its inhabitants. We observed increases in children’s *aesthetic, humanistic, moralistic, symbolic, naturalistic, and scientific-ecological* valuing of nature. We also found a decrease in *negativistic* views of nature. Thus, involvement in the environmental education program appeared to help children not only understand the natural world but also reduce their concerns and negative feelings about wild animals, heights, and the dark.

What types of experiences with nature support the development of biophilia in children? Our study indicates that particular types of experiences seem important for the development of biophilia in children.

- Direct experiences that involve primary contact with nature prompt aesthetic and emotional responses that support and contribute to the development of biophilia in children.

Well it’s beautiful and I love all the animals that live there – I can’t believe the animals get all that – they have a big beautiful home! During the Silent Hike you could hear sounds and could see squirrels and chipmunks and we got to see that blue bird – I think a blue Steller’s Jay.

When I walked over the bridge I saw water and then saw a chipmunk sitting and staring at me – and I say hi. And, I heard a tree frog.

On the Night Hike I saw bats flying above my head catching insects – that was just amazing. I loved that! I never knew bats lived in the mountains.”
(Carmen, Post-program interview)

- Physically demanding and challenging experiences in nature provide a sense of accomplishment that reinforces the positive rewards of aesthetic and emotional experiences. Such experiences enhance and further the development of childhood biophilia.

I like putting my head in the creek under the waterfall. We were so high in the mountains, the sun was almost under us. (Ethan, Conversational interview, Day Two)

- Structured reflective experiences that provide the opportunity and time for personal contemplation centered on nature help children strengthen their emotional connection to nature and advance biophilia.

Dear Me, I really enjoyed the Silent Hike just now. My favorite time at Mountain Explorations was when we first made it onto the trail! My favorite trails were the Peninsula Trail and Sourdough Trail, which I am on now. I hope you remember how much fun you had here! The animals are awesome! (Paige, Post Card, Day Three)

This study not only contributes to an understanding of how particular experiences in a wilderness setting can arouse biophilia but also can inform educational

practice. Our findings on the impact of particular wilderness experiences can assist nature centers, environmental learning organizations, and other institutions that wish to develop programs that advance children's affiliation with nature. Scholars in the environmental sciences and environmental education speculate that the study of natural systems may help us extend environmental ethics to the larger biotic community or land organism (Leopold 1949, Gould 1991, Pyle 2002, Orr 2004, Wilson 2006). Many environmental and sustainability educators share this simple conservation assumption. Thus, educators may use biophilia as a salient conceptual framework to explore educational reform that starts by listening to children's ideas about nature.

We have examined the "wilderness experience" and its implications for the development of biophilia. By extending Kellert's environmental values framework, we have a more nuanced look at children's experiences in nature. This is a good place to begin, but further research is needed.

For example, there is a need to study how children's biophilic expressions can develop through urban nature experiences, such as surveying local wild species or mapping open space and parks in and around urban centers. Also, since studies suggest that the majority of outdoor activity occurs along trails in urban and state parks and in established campgrounds, research into children's biophilic experiences in "front country" or day-use areas is warranted.

As we documented children's enjoyment, happiness, joy, interest, anticipation, fear, and threat, we noticed that many children seemed to be particularly "tuned in" to nature. These were times when children were so immersed and focused on nature that they were unaware of time passing. Such moments seemed to capture what has been termed "flow" by Csikszentmihalyi (1990) and colleagues who studied individuals involved in demanding and intrinsically rewarding activities. Flow requires total focused concentration, a merging of action and awareness, loss of awareness, and a temporal distortion (Nakamura and Csikszentmihalyi 2002). Mulder and Kate (2011) has recently proposed that flow is a fundamental characteristic of direct experiences in natural settings. Her work and our observations of children deeply engaged with nature suggest that further research on the phenomenon of flow may be a valuable approach for furthering our understanding of biophilia.

John Burroughs (2000) warned that "knowledge without love will not stick but if love comes first, knowledge is

sure to follow." Our findings support the view that biophilia is cultivated through the blended growth of environmental knowledge, emotional responsiveness, physical connectedness, and aesthetic appreciation of nature. This research with school-aged children suggests that by shifting emphasis toward a heartfelt affiliation for life and a love affair with the natural world through nature study, we can promote a fruitful union between humans and their environment.

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References

- Austin, M.H. 1903. *The Land of Little Rain*. Houghton, Mifflin and Company.
- Bonnett, M. 1994. *Children's Thinking: Promoting Understanding in the Primary School*. Cassell.
- Bonnett, M., and J. Williams. 1998. Environmental education and primary children's attitudes towards nature and the environment. *Cambridge Journal of Education* 28(2): 159-174.
- Burroughs, J. 2000. *Field and Study*. Fredonia Books.
- Carson, R. 1956. *The Sense of Wonder*. Harper and Row.
- Csikszentmihalyi, M. 1990. *Flow: The Psychology of Optimal Experience*. Harper and Row.
- Derr, V. 2002. Children's sense of place in Northern New Mexico. *Journal of Environmental Psychology* 22(1-2): 125-137.
- Dillard, A. 1998. *Pilgrim at Tinker Creek*. Harper Perennial Modern Classics.
- Elder, J.L. 2003. *A Field Guide to Environmental Literacy: Making Strategic Investments in Environmental Education*. North American Association for Environmental Education.
- Fleischner, T.L., and S. Weisberg. 1992. Teaching for nature: Filling the need for natural history in experiential education. *Clearing* 74: 36-37.

- Gould, S.J. 1991. Enchanted evening. *Natural History* 100: 4-14.
- Hatch, J.A. 2002. *Doing Qualitative Research in Education Settings*. New York Press.
- Kahn, P.H. 1999. *The Human Relationship with Nature: Development and Culture*. MIT Press.
- Kahn, P.H. 2002. Children's affiliations with nature: Structure, development, and the problem of environmental generational amnesia. Pages 93-116 in P. Kahn and S. Kellert, editors. *Children and Nature: Psychological, Sociocultural and Evolutionary Investigations*. MIT Press.
- Kahn, P.H., and S.R. Kellert. 2002. *Children and Nature: Psychological, Sociocultural and Evolutionary Investigations*. MIT Press.
- Kellert, S.R. 1985. Attitudes toward animals: Age-related development among children. *Journal of Environmental Education* 16(3): 29-39.
- Kellert, S.R. 1996. *The Value of Life: Biological Diversity and Human Society*. Island Press.
- Kellert, S.R. 2002. Values, ethics and spiritual and scientific relations to nature. Pages 49-63 in S. Kellert and T. Farnham, editors. *The Good in Nature and Humanity: Connecting Science, Religion, and Spirituality with the Natural World*. Island Press.
- Kellert, S.R., and E.O. Wilson. 1993. *The Biophilia Hypothesis*. Island Press.
- Leopold, A. 1949. *A Sand County Almanac*. Oxford University Press.
- Lincoln, Y.S., and E.G. Guba. 1985. *Naturalistic Inquiry*. Sage Publications.
- Louv, R. 2005. *Last Child in the Woods: Saving our Children from Nature Deficit Disorder*. Algonquin Books.
- McKibben, B. 1989. *The End of Nature*. Random House.
- Merriam, S.B. 1998. *Qualitative Research and Case Study Applications in Education*. Jossey-Bass Publishers.
- Miles M.B., and A.M. Huberman. 1994. *Qualitative Data Analysis*. Sage Publications
- Muir, J. 1911. *My First Summer in the Sierra*. Houghton Mifflin Company.
- Mulder ten Kate, Q. 2011. Direct experiences in nature. Unpublished doctoral thesis, Simon Fraser University, Burnaby.
- Nabhan, G.P., and S. Trimble. 1994. *The Geography of Childhood*. Beacon Press.
- Nakamura, J., and M. Csikszentmihalyi. 2002. The concept of flow. Pages 89-105 in C. Snyder and S. Lopez, editors. *Handbook of Positive Psychology*. Oxford University Press.
- Nature. 2008. Handle with care. *Nature* 455: 263-264.
- NCI. 2008. About Us. Retrieved July 1, 2009, from http://www.ncascades.org/more_info/about_us/index.html
- Nelson, R.K. 1989. *The Island Within*. North Point Press.
- Oliver, M. 2004. *Blue Iris: Poems and Essays*. Beacon Press.
- Orr, D.W. 1996. *Ecological Literacy: Education and the Transition to a Post Modern World*. State University Press.
- Orr, D.W. 2002. Political ecology and the ecology of childhood. Pages 279-303 in P.H. Kahn and S.R. Kellert, editors. *Children and Nature: Psychological, Sociocultural and Evolutionary Investigations*. MIT Press.
- Orr, D.W. 2004. *Patriotism, Politics and the Environment*. Island Press.
- OSPI. 2005. Washington State Essential Academic Learning Requirements. Retrieved July 9, 2010 from <http://www.k12.wa.us/CurriculumInstruct/default.aspx>.
- Payne, P. 1998. Children's conceptions of nature. *Australian Journal of Environmental Education* 14: 19-26.

- Pyle, R. 1993. *The Thunder Tree: Lessons from an Urban Wildland*. Houghton Mifflin.
- Pyle, R. 2002. Eden in the vacant lot: Special places, species and kids in the neighborhood of life. Pages 305-327 in P.H. Kahn and S.R. Kellert, editors. *Children and Nature: Psychological, Sociocultural and Evolutionary Investigations*. MIT Press.
- Rickinson, M., J. Dillon, K. Teamey, M. Morris, M.Y. Choi, and D. Sanders. 2004. *A Review of Research on Outdoor Learning*. National Foundation for Educational Research and King's College London.
- Sobel, D. 1996. *Beyond Ecophobia: Reclaiming the Heart of Nature Education*. The Orion Society.
- Sobel, D. 2004. *Place-based Education (Vol. 4)*. The Orion Society.
- Sobel, D. 2008. *Childhood and Nature: Design Principles for Educators*. Stenhouse Publishers.
- Stake, R. 2008. Qualitative case studies. Pages 119-150 in S. Denizen and Y. Lincoln, editors. *Strategies of Qualitative Inquiry*. Sage Publications.
- Wals, A.E.J. 1994a. Nobody planted it, it just grew: young adolescents' perceptions and experiences of nature in the context of urban environmental education. *Children's Environments* 11(3): 177-193.
- Wals, A.E.J. 1994b. *Pollution Stinks! Young Adolescents' Perceptions of Nature and Environmental Issues with Implications for Education in Urban Settings*. Academic Book Center.
- Williams, E.H. 2005. *The Nature Handbook: A Guide to Observing the Great Outdoors*. Oxford University Press.
- Wilson, E.O. 1984. *Biophilia*. Harvard University Press.
- Wilson, E.O. 1994. *Naturalist*. Island Press.
- Wilson, E.O. 1996. *In Search of Nature*. Island Press.
- Wilson, E.O. 2006. *The Creation*. W. W. Norton and Company, Inc.

Pre-Program Interview Questions (semi-structured interview format)

1. Please tell me something about your neighborhood, your yard, playing outside or family trips.
2. What does nature mean to you?
 - a. What do you think of when I say the word nature?
 - b. When you look around in a forest what do you see?
3. When you are outside in nature, what do you like to do?
 - a. What else do you like to do in nature?
4. When you the leave the city and go into the countryside, how do things change around you.
 - a. How is nature different from human-made places?
 - b. How is nature the same as human-made places?
5. Describe your favorite place in nature.
 - a. Why is this your favorite place in nature?
 - b. What is your favorite thing to do in your favorite place?
 - c. What do you do when you are by yourself in nature?
 - d. What do you do with others in nature?
 - e. How does your special place make you feel?
 - i. Why does it make you feel _____?
 - f. Is nature ever a scary place for you?
6. Is a zoo different from nature?
7. Can you find nature in your neighborhood?
8. How does nature change?
 - a. Seasonally? Yearly? Longer?
 - b. Imagine your favorite nature setting – have you seen it change?
 - c. Can anything destroy nature or does it always stay the same?
9. Have you been to a day camp or overnight camp before?
 - a. A lot – some - never
 - b. What kind of activities did you do at camp?
 - c. What is the best experience?
 - d. What is the scariest?
10. Have you gone hiking before?
 - a. A lot – some – never
 - b. What is your favorite part of hiking?
11. Have you gone camping before?
 - a. A lot – some – never
 - b. What is your favorite part of camping?
12. Have you been to the mountains before?
 - a. A lot – some – never
 - b. What is your favorite memory of the mountains?
13. Tell me what you know about Mountain School.
 - a. What do you hope to see at Mountain School?
 - b. What do you hope to do at Mountain School?
 - c. What do imagine nature be like at Mountain School?
 - d. What do you think you will be learning at Mountain School?
14. Do you have any concerns about going to Mountain School?
 - a. What are you most nervous about for your time at Mountain School?
 - b. Why?
15. What are you looking forward to most at Mountain School?
 - a. Why?
16. Do you have any questions for me?

Post-Program Interview Questions

1. Thinking back over Mountain School, what was the natural environment like?
2. How is nature the same or different at Mountain School and here in your hometown?
3. What was the best nature memory from Mountain School?
4. Tell me about your trail group.
5. How did you feel walking along the trails?
6. Tell me about your favorite trail activity? What did you learn? How did you learn that?
7. What was the hardest thing about Mountain School?
8. How is the learning at Mountain School different than at school?
9. Hypothetically, your school principal is thinking about cutting the funding for Mountain School. What would you say to defend your position?
10. (Read each child's initial perceptions of nature out loud from the Pre-Program Interview)
What would you add your description of nature today?
Please respond to these prompts:
 1. I think nature is. . .
 2. I affect nature by. . .
 3. Nature affects me by. . .
 4. My favorite outside spot is. . .