

**Preschool children's biophilia and attitudes toward nature:
The effect of personal experiences**

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ABSTRACT

Regular engagement outside may promote healthy physical and psychological development as well as a respect and appreciation for nature. This exploratory study compared biophilia and attitudes toward nature between young children living in an urban area to those in a rural area. Urban and rural areas may offer different opportunities for exposure and engagement with elements such as water, plants, and animals. A comparison between young children in these settings may determine if experience in these different environments affects their attitudes and biophilia. Thirty-six children (urban $n = 27$; rural $n = 9$) participated in one-on-one structured interviews about their attitudes toward and being in nature. Results revealed no significant difference in biophilia between children by geographical area. Common themes in children's attitudes emerged: 1) young children define nature by identifying specific elements; 2) young children are aware that their actions have consequences for the condition of the natural environment; and 3) children understood that the expectations guiding behavior in the natural environment apply to everyone. Preschool children's level of cognitive maturity and individual preferences may be better predictors of biophilia and attitude than location alone. Authors suggest implications for teachers and parents.

Keywords: biophilia, preschool children, child development, nature

Playing outside, climbing trees, and throwing rocks in lakes may bring forth many fond memories for adults; however, the current generation of children may not have the same opportunities. Richard Louv, author of *Last Child in the Woods* and child and community advocate, explains a phenomenon called "nature deficit disorder" (Louv, 2005, p.10). While this phenomenon is a condition that is not medically diagnosable, it reflects the effects that nature alienation has on humans, more specifically children (Louv, 2005). A review of the literature reveals, however, few empirical studies about the "disorder".

In a multidisciplinary synthesis of empirical literature, Tremblay and colleagues (2015) conclude a consistent relationship exists between engaging in nature outside and healthy child development and suggest play in natural environments is more complex and diverse, gender neutral, and promotes more occurrences of moderate to vigorous physical activity. Spending time outside has positive effects on children's cognitive, physical, emotional well-being, mental health, creativity, problem solving, self-regulation, resilience, and language (Evans, 2006; Louv, 2005; O'Brien & Murray, 2007; Tremblay et al, 2015; Wells, 2000). Nature can be a form of therapy for physical as well as psychological conditions (Louv, 2005). Studies involving childhood issues such as physical fitness and depression suggest a relationship between time outside and a decrease in these childhood concerns (Frost, 2006; Sallis & Glanz, 2006). Researchers have also examined the restorative effects on attention among children with

attention deficit hyperactivity disorder (ADHD) after having contact with nature (Taylor & Kuo, 2009; Taylor, Kuo, & Sullivan, 2001).

Despite the increasing awareness of the physical, social and mental-health benefits of being in natural environments, researchers express concern that children are losing their connection to the natural world that surrounds them (Beyer et al., 2015; Klesges, Eck, Hanson, Haddock, & Klesges, 1990). Parental and community concerns about child safety (not only related to stranger abductions but liability related to playground injuries) has its own consequences including increased indoor sedentary behavior (resulting in increasing type-2 diabetes, cancer, negative mental health and heart disease), consumption of unhealthy foods, and increased time and exposure to video violence and cyber bullying (Tremblay et al, 2015). The current “wired generation” of children is not exploring the outdoors as extensively as children formerly did, hence diminishing their engagement with and appreciation for nature (Louv, 2005; O’Brien, Jones, Sloan, & Rustin, 2000). In a review of the extant literature on the relationship between children and nature, Munoz (2009) suggests children see home as safe and hold fears to being outside in public places and natural spaces. The percentage of green space in urban environments has a positive relationship with perceived health, particularly among youth and the aging and the development of green spaces should have priority position in spatial planning policy (Maas, Verheij, Groenewegen, de Vries, & Spreeuwenberg, 2006). However, city planners, in an effort to accommodate the growing population, may place less importance on maintaining child-friendly outdoor environments (Moore, 1997). The consequence of this limited engagement outside is “diminished use of the senses, attention difficulties and higher rates of physical and emotional illnesses” (Swiderski, 2006, p. 96).

Previous studies about appreciation of nature reveal distinct differences based on age, among other factors. For instance, children under six years of age label categories of animals and may be fascinated by them, but show fear of or a hesitancy to explore the natural world (Kahn, 1997; Kellert, 1996, Rivkin, 1995). As children progress into their adolescent years, they begin to express concern for the well-being of animals, treating nature and animals with newly-found moral considerations (Kahn, 1997; Kellert, 1996).

Exposure to nature provides opportunities to develop a positive and supportive attitude toward nature. Results from a study on children’s connection and attitude toward nature found that “connection to nature is a strong predictor of children’s interests in environmentally friendly practices” (Cheng & Monroe, 2010, p. 45). In other words, children’s affiliation with nature may predict their ecological behaviors such as conservation.

Biophilia is a hypothesis that “asserts the existence of a fundamental, genetically based, human need and propensity to affiliate with life and lifelike processes” (Wilson, 1984; Kahn, 1997, p. 1). Wilson proposes that people have a natural, almost intuitive, need to be around other living things (1984). Humans have this innate need to connect with nature, and Kahn suggests that biophilic connections can be both positive and negative. These connections to nature are expressed based upon the early experiences children have with nature (Chawla, 2009). Kahn (1997) concluded from studying biophilia among children and youth in varying contexts, that negative affiliations with nature may turn into a “life-affirming orientation” (p. 53). For example, a child fearful of dogs from an aggressive encounter may, with adult-guided experience caring for a dog, develop a deep sense of responsibility to feed and care for all animals, a life-affirming orientation.

Urban areas may offer fewer opportunities for engagement with green space outside for a child, thereby minimizing the extent of experience and exposure to the natural environment (Moore, 1997). The denser traffic found in urban areas “limits children’s knowledge of the community environment—including its natural characteristics and components” (Moore, p. 204; O’Brien et al., 2000). Research by Lindsey, Maraj and Kuan (2001) suggests that children of racial and ethnic minority status in urban environments are particularly disadvantaged with respect to access to natural areas. Rural areas with lower population density as well as minimal traffic may offer higher exposure to green space for the child, such as access to ranch land with farm animals, fields with crops, forests, creeks, or grasslands. A rural town may provide children potentially greater exposure to nature in their daily life, and such exposure may be reflected in children’s attitudes toward nature. While children in urban areas may be at risk of becoming de-natured adults, children who are exposed to and engaged with nature show an awareness and appreciation for it (Louv, 2005). Similarly, Cheng and Monroe (2010) suggest that children who spend more time in nature establish a stronger relationship with it.

The purpose of the present study was to compare children's exposure to nature (among children in urban and rural settings) on two characteristics: (1) children's biophilia, and (2) children's attitudes towards nature. We hypothesized that children living in a rural area would be more likely than their urban counterparts to demonstrate an understanding of the need to protect and respect nature. Similarly, we hypothesized that rural children would demonstrate a higher level of biophilia than their urban counterparts would. These hypotheses are based on the proposition that exposure to natural environments nurtures understanding, respect, and biophilia, and that because of their geographic location, preschool children in rural areas may have greater exposure to nature than children in urban settings.

Method

Participants

Urban participants. Children in the urban setting attended preschool in a city of over 54,600 people (U.S. Department of Commerce, United States Census Bureau, 2010). This city provided natural places including more than ten parks, a zoo and nature trails, as well as a variety of popular chain restaurants, and the convenience of diverse commerce for shopping. Eleven public schools and three private schools (preschool, elementary, high schools) were located in the area. Due to distance from their homes and traffic, parents often choose to drive their children to preschool rather than walk. At the time of this study, no public transportation was available, thus potentially minimizing access to areas of the city in which children could experience green space.

The preschool included two part-day inclusive (Division of Early Childhood/National Association for the Education of Young Children [DEC/NAEYC], 2009) classes and two full-day classes participating in a larger study in which parents were surveyed about their children's experiences with nature (70 surveys distributed; $N = 37$ received; 53% response rate). Researchers interviewed 27 of the 33 children with informed consent [$n = 12$ females; $n = 15$ males; $M = 49$ months; range 35-65 months; 74% White/Caucasian, 4% African American; 11% Asian/Pacific Islander, 11% mixed race]. Six children did not give assent or were not present the day of the interview. The number of children with disabilities was unknown; however, all participating children demonstrated comprehension and the ability to articulate coherent responses.

Rural participants. Children in the rural setting attended a preschool affiliated with the public school district in a town of 741 people (U.S. Department of Commerce, United States Census Bureau, 2010). This agricultural community contained small family-owned restaurants, a variety of businesses and two parks. One park was large, peripherally located, and poorly maintained. The second park was smaller with less playground equipment and located on a high traffic street. Cattle feedlots and fields of corn and wheat surround the town. Citizens must travel to the nearest city about 65 miles away for a variety of groceries and clothing. One building housed all grades from preschool through high school. Parents drove their children to school and buses transported children living over two miles away. Otherwise, children who lived closer to the school building rode their bicycles or their parents walked with them.

The part-day preschool included separate morning and afternoon classes. Four children were enrolled in the English as a Second Language (ESL) program. A survey and informed consent form in Spanish were sent to the non-English speaking parents (21 packets distributed, $N = 10$ received; 48% response rate). Researchers conducted nine interviews ($n = 4$ males; $n = 5$ females; range 60-69 months; $M = 65$ months; 89% White/Caucasian, 11% Hispanic). The number of children with disabilities was unknown; however, all participating children demonstrated comprehension and the ability to articulate coherent responses.

Measures

Researchers did not specifically define the term *nature* for children for this study. Rather, the focus was on understanding how children perceive, understand, and interact with nature. Nature, therefore, was an inclusive term pertaining to children's outdoor experiences, including their interactions with the natural elements such as soil, wind, temperature, water, plants, and animals.

Biophilia. Children's biophilia was measured using the biophilia interview by Rice and Torquati (2013). The interview consisted of eleven questions. Researchers presented two identical, gray stuffed squirrels holding an acorn, each representing one of the given options, to the child (biophilic and non-biophilic). It was important to have identical puppets when presenting questions to children so that children's responses were not influenced by unique characteristics of puppets, such as clothing or facial expression. The gender of the squirrel was the same as the child's gender. For example, "This *boy* likes to play outside (biophilic). This *boy* likes to play inside (non-biophilic). Which *boy* is more like you?" The child would then point to the squirrel that best represented his or her preference. A code of 1 was given for a biophilic answer, 2 for a non-biophilic answer, and 3 for a child who felt both answers suited him or her. For analytic purposes, responses of "both" (3) were recoded to biophilic (1) because the child endorsed both and did not reject the biophilic response. The presentation of options (biophilic on the child's right and non-biophilic on the child's left) was reversed mid-interview and at the end, such that the non-biophilic choice was presented first to minimize a response set by the child. The squirrel on the child's right then represented the non-biophilic choice.

Attitudes toward nature. Children's attitudes toward nature were measured with the conservation interview (Kahn, 1999) adapted for this study and administered after the biophilia interview. The full semi-structured interview included 14 multi-part questions (Appendix A). After each question, children were asked "why" to give them the opportunity to illustrate or explain their response. If a child chose not to respond, a "no response" was noted. Children's explanations revealed their thinking on, knowledge of, and judgments about what is important in nature and to themselves. Asking children to explain their ideas draws from a constructivist pedagogical approach in which children utilize language to "construct" their understanding reflective of their level of logic (DeVries, Edmiaston, Zan, & Hildebrandt, 2002; Vygotsky, 1986).

Procedure

Before interviewing, the researcher spent between 30 and 45 minutes in each classroom each day for four days to become better acquainted with the classroom setting and the children. This enabled the researcher to understand the classroom experiences of the children and for the children to become comfortable with the researcher and transition to the interview. The lead teacher extended the invitation to the child to interview by asking the child if he/she would like to go with the researcher to answer questions. The researcher and child walked to a separate research room with a two-way mirror for supervision. The recorded interviews lasted between five and 15 minutes and began with the researcher asking the child for his or her assent to participate. The first author transcribed the labeled audio files. The (blinded) Institutional Review Board reviewed and approved this protocol (#5377.1).

Data Analysis and Coding

Coding quantitative data. Children's demographics and responses to the biophilic interview were entered into SPSS (IBM, SPSS 2012). Data analysis compared urban and rural interviews using nonparametric statistics including cross tab analysis with chi square to determine significance between the responses of urban and rural children.

Analysis of qualitative data. Researchers conducted a systematic review of children's explanations in response to the questions (Creswell, 2007). Researchers offer a description of the analysis process here to provide a framework for comparison and confirmability. The first two authors engaged in an iterative process wherein each author read the transcripts separately identifying repeated phrases, terms, and emerging ideas within each question on the protocol as well as by the overall question. Researchers met to discuss the emerging themes after which each worked independently again to review and verify. This process continued until researchers reached consensus and prepared a summative document.

Results

Children's biophilia

A 2 by 3 (urban vs. rural; biophilic, non-biophilic, and uncertain) cross-tabular analysis was conducted comparing the frequency of responses on one question (#7) and a 2 by 2 (urban vs. rural; biophilic vs. non-biophilic) cross-tabular analysis was conducted on the remaining questions. Results revealed no statistically significant differences on any question suggesting that children's biophilia was not differentiated by whether or not they live in a designated urban or rural area (see Table 1).

Children's attitudes toward nature

Three interrelated themes emerged across the interview regarding children's attitudes toward nature: 1) young children defined nature citing concrete examples; 2) young children were aware that their actions had consequences for elements of nature; and 3) children understood that the expectations guiding behavior in the natural environment apply to everyone.

The first theme was that children define nature by identifying specific elements of nature drawing from their experiences. When asked, "Do you think about nature?" 59% of urban and 44% of rural children said yes and referred to plants including sticks and flowers, stars, familiar animals such as dogs, rabbits, kitties, and chickens as well as wild animals including lions, cheetahs, zebras, animals not found naturally in the child's geographic area. Children in both urban and rural areas (56% each) considered pets as part of nature as illustrated by comments including, "you have to take care of them [pets] or they will die;" and "because you have to feed them." Among those who noted pets were "not important" one child supported this response by commenting: "because they are not." Although wild animals were identified as elements of nature, only 33% of children in the rural area and 41% in the urban area agreed they were important. For example, children used the terms "mean" and "dangerous" to describe them; however, children also observed that wild animals "need to live," and "I like to pet them if they're gentle." Both children in urban and rural areas agreed plants were important because "you have to water them," "they need water and sun," and "they need to grow." Children who said plants are not important to them reasoned that "they don't have fur," and "you have to do nothing." Children in both areas agreed that parks were important stating, "You get to play there." Other children shared, "Important. Because I like to go to them if they're open; if they're closed we do not go to them;" and "Because parks you can play on and we like to play."

Children were aware that people's actions have consequences for nature. More children in the urban area (63%) than rural area (22%) responded affirmatively in that they knew of problems that might hurt the environment. Among those in the urban area, several stated that fire and smoke were problems. Two children commented on deforestation and illegal hunting: "People are cutting down trees and killing some animals: crocodiles, snakes, and monkeys." Children in both urban and rural areas commented on picking plants; for example, one child noted that if one "picks the petals off [the flowers]" it hurts the plant and "if you pull on a baby tree, obviously it's trying to grow." However, about half of the children in both urban (48%) and rural (55%) areas offered personal examples of how they protect the environment. Children stated actions such as watering plants, putting a fence around a garden, helping mom feed the plants, and feeding the birds. One child shared, "I turn off the lights when I go [on a] trip so I won't waste the batteries."

The third emerging theme was that children understood rules to protect nature apply to everyone. In response to the series of questions about a fictitious situation in which people throw trash into a familiar lake, 100% of children in the rural area and 81% of children in the urban area indicated it would be "bad" for a person to throw trash into the lake because it would "kill the animals," "make the sea die" and "animals in the lake might eat it and die." When asked if it was acceptable if "everyone" threw trash in the lake, children in both urban and rural areas (89% each) agreed it was not acceptable citing possible consequences, in order of frequency: killing fish and animals, littering, making the earth/ocean sick, because it is "bad" and making the water un-swimmable. For example, one child said "Because the animals...will be killed again." However, children also referenced settings that were imaginary or uncharacteristic of their area to explain their thinking: "Cause of the same thing: a mermaid got stuck when someone

threw trash in the ocean;" "cause the crocodile might eat the trash away;" and "cause it would make the rainbow fish die or the sea horses. I like sea horses."

Table 1
Comparison of Urban and Rural Children's Biophilic Attitudes

Question	Rural	Urban	X ²	df	p*
1) Likes to play outside. <i>Likes to play inside.</i>	9 0	23 3	1.13	1	0.28
2) Likes to dig for worms. <i>Does not like to dig for worms.</i>	3 6	10 16	0.75	1	0.78
3) Likes to jump in puddles. <i>Does not like to jump in puddles.</i>	5 4	20 6	1.50	1	0.22
4) Likes to watch birds. <i>Does not like to watch birds.</i>	7 1	17 9	1.44	1	0.23
5) Likes to catch bugs and look at them. <i>Does not like to catch bugs and look at them.</i>	3 6	17 9	2.80	1	0.09
6) Likes to watch animals like squirrels and rabbits. <i>Does not like to watch animals like squirrels and rabbits.</i>	6 3	20 5	0.65	1	0.42
7) Likes to play in creeks and lakes. <i>Does not like to play in creeks and lakes.</i> Uncertain	4 5	14 10 1	0.89	2	0.64
8) Likes to play with sticks, leaves and pinecones. <i>Does not like to play with sticks, leaves and pinecones.</i>	7 2	19 5	0.01	1	0.93
9) Likes to listen to birds singing. <i>Does not like to listen to birds singing.</i>	7 2	18 7	0.11	1	0.74
10) Likes to look at the stars and moon at night. <i>Does not like to look at the stars and moon at night.</i>	5 4	16 9	0.20	1	0.66
11) Likes to learn about wild animals. <i>Does not like to learn about wild animals.</i>	6 3	15 10	0.13	1	0.72

*Non-biophilic response is in italics; Rural n = 9; Urban n = 27; Children's nonresponse to a question was coded as missing; *asymptotic significance (2-sided)*

Again, when asked if it would be all right for people in the neighboring town to throw trash in a lake, 78% of rural and 78% of urban children agreed it was “not all right.” A pattern emerged across the questions in which the majority of children agreed that trash in the lake would negatively affect the fish, water, and people, and that it mattered to them, individually, that fish, water, and people would be affected this way, repeating that fish will die or people will get sick. Birds, however, were an exception. Children from urban (52%) and rural (44%) areas agreed that throwing trash in the lake would affect the birds and all responding children in both geographic areas agreed it would be “bad” for the birds as articulated by one child, “Because they couldn’t go in to the water and get their food.” However, a minority in each group noted it mattered to them that birds were treated this way (11% rural and 33% urban).

Discussion

The purpose of this study was to compare preschool children’s biophilia as well as attitudes toward nature by the geographical area in which the children live (classified as either urban or rural). We expected that preschoolers living in rural areas would have greater exposure to nature in their day-to-day routines compared to their urban counterparts and hypothesized that they would demonstrate higher levels of biophilia. The results from this initial study, however, are not supportive. Rather, results suggest there is little difference in biophilia between preschoolers living in urban and rural areas indicating a weak biophilic relationship with children’s location at this age. These findings are similar to those of Rice and Torquati (2013) who found no relationship between the biophilic attitudes of preschoolers enrolled in programs with natural green spaces and those with few or none of these elements.

Researchers also hypothesized that preschoolers living in rural areas would express greater positive attitudes about nature than their urban counterparts. Consistent differences did not emerge to support this hypothesis. Children’s responses in the conservation interview suggest that children in both urban and rural areas have similar ideas and judgments. Children spontaneously demonstrated a narrow understanding of nature, identifying predominantly animals and plants; but not elements such as water, weather, or insects, other common elements each child would have likely also experienced. Children’s examples appear to draw upon their daily experiences (such as caring for pets and watering plants), and what they have learned through popular media and/or books. These experiences have a noticeable (significant) impact on children’s biophilia and relationship to nature (Chawla, 2009). Young children demonstrated the ability to articulate a basic causal relationship: that people’s behavior (throwing trash in a lake) may negatively affect the natural environment (dirty water and fish will die). Additionally, among these children, nature was characterized as something needing care or death will result.

Children in both locations frequently used the words *die*, *kill*, *dead*, and *take care of*, as descriptors or explanations of nature. Slaughter (2005) suggests that understanding life and death is related tightly to cognitive maturity. Drawing from a domain-general cognitive perspective (e.g. cognition is understood as one global structure where all knowledge is interdependent), Slaughter concluded that the overall developmental trajectory for understanding death is highly robust irrespective of the child’s socio-cultural background and individual experiences. Consequently, the lack of inter-individual differences between urban and rural areas revealed in this study may not be surprising.

These findings may also be understood from a domain-specific perspective (e.g., cognition is structured by uniquely defined, independent areas of knowledge). Wellman and Gelman (1992) suggested that intuitive biological knowledge is one of three “core” or specific domains of understanding (the remaining two are intuitive physics and intuitive psychology). Research on intuitive biological thinking examines change over time in children’s knowledge of living things and their related processes (Slaughter & Lyons, 2003). Carey (1985) studied extensively children’s understanding of the domain of intuitive biology and concluded that prior to the age of 10 years, children determine an entity’s biological status by its similarity with human beings. Consequently, it may be developmentally appropriate that children in this study initially identified animals (domestic and wild) as nature over insects and rocks. Additionally, Slaughter (2005) suggests that children begin to understand death as a biological event around the age of 5 or 6 years and, consistent with their cognitive maturity, death may be a temporary state represented by concrete behaviors such as eyes closed or being still. Young children struggle with understanding its finality (the dead cannot wake up or come back). Therefore, we may conclude that these preschool children are utilizing their early and emerging understanding of life and death as a way to understand nature, i.e., death is a biological event

in nature. The preschool children in this study also displayed high levels of concern for the proper care and well-being of pets/animals, which is consistent with the findings of Myers and Saunders (2002) that young children's concern about animals moved children to care about nature.

These results contrast with Kellert's (1996) study exploring nature-appreciation differences among people of various ages. Kellert found that children under the age of six tend to express a fear of the natural world, showing little to no concern regarding animals. Overall, this was not the case with these children; however, one child in each group did express discomfort with nature including a dislike for animals, worms, being outside.

These responses to nature derive from our family values, according to Cheng & Monroe (2010). Parents control where their family lives and, as a result, may determine the physical distance between children and natural areas as well as ease of accessibility. Not only is the location reflected in children's attitudes toward nature, but also the parents' own attitudes and behavior or modeling affects how children feel about nature (Cheng & Monroe, 2010). These "nature values" are transferred to children through their parents' actions (Chawla, 2009). As children grow exposed to these different values, they develop their own environmental identity. This identity allows children to "define themselves as part of nature and caring for nature as part of their role in the world" (Chawla, 2009, p. 10). For further study, a measure that includes parents' perspectives and a focus on their familial values on nature would widen the scope of how children's own attitudes towards nature develop, as they grow older.

The role of the family as the primary nurturer of the child's environmental education allows children to develop a relationship with nature first. White & Stoecklin (2008) suggest that children develop the emotional connection and values of nature before they even begin to think logistically about nature. The early experiences with nature that allow a child to form values and sentiment towards living things, creates a solid foundation for future rational and academic perspectives about nature (White & Stoecklin, 2008).

Perhaps urban children will not grow up to be the de-natured individuals that Louv (2005) warned about in high-populated areas. Louv suggested that children who are exposed to nature and have interactions with outdoor environments tend to show a higher awareness and appreciation for nature. Clearly, the preschool children in this study have the ability to form their own ideas about nature despite having more access to television and video media than ever before (2005).

As an initial comparative study, the generalizability of the results is limited by the small sample size as well as the interview process, comments from which may be influenced by the child's immediate context, the presence of an unfamiliar interviewer and the general context of the environment on that day. Additionally, our study suggests that children draw from personal experience to understand nature; consequently, they may not be able to generalize beyond their own experiences. Replication of this study with a larger sample of children as well as including children from a more densely populated urban area than the one used in this study may reveal a point at which differences emerge because of geographical exposure. More importantly, following children over time may further document the relationship between early attitudes and experiences and later attitudes and behaviors. Further research with young children should also include additional sources and measures of the time spent in nature children's behaviors in order to triangulate the data, establishing greater trustworthiness. Such measures could include direct observations of children's behavior, which may be more objective and measurable, and parent observations or reflections on children's activity outside as well as exposure to a wide range of media sources.

These results suggest that children 3- to 5- years of age are beginning to form their own ideas about nature and how to interact with it. Consequently, preschool is an appropriate time to engage children in nature-related experiences with adult guidance. Early childhood experiences may be foundational to developing a lifetime appreciation for nature as well as understanding of the relationship between their actions and nature's well-being.

Implications for Practitioners

Implications of these findings for teachers, parents, and other adults suggest that young children are in the process of creating their personal “folk theory” (Slaughter, 2005) of nature and biology constructed from discrete pieces of information, not yet a coherent, integrated understanding of representing the inclusivity of nature. Children are able to identify some elements of nature and the relationship between one’s behavior and the quality of environment. A primary role of the teacher and other adults, therefore, is to provide not only a wide range of experiences with a variety of natural elements to integrate knowledge (Wilson, 1993; 2012) but also developmentally appropriate conversations with children asking them to observe and explain their ideas (NAEYC, 2009). Drawing from these explanations, adults can identify children’s current levels knowledge and provide provocative opportunities to gradually elevate the child’s thinking to a more sophisticated and integrated level of understanding (Vygotsky, 1986). Indeed, Slaughter & Lyons (2003) demonstrated that young children can be taught about vitality successfully thus suggesting adults (teachers, parents and others) play a vital role in helping children develop logical connections between their actions and nature’s outcomes.

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Appendix A

Conservation Interview Conducted with Children

1. Do you think about nature? What kinds of things do you think about when you think about nature?
2. Do you think pets (domestic animals) are important or not important? Why?
3. Do you think wild animals are important or not important? Why?
4. Do you think plants are important or not important? Why?
5. Do you think the parks and gardens around the city are important or not important? Why?
6. Do you know about any problems that might hurt nature or the environment? Which ones?
7. Do you do anything to protect or take care of the environment?
8. Let's say there is a person who threw trash into [name] Creek. Is that all right or not all right? Why? What if everybody in [area] threw trash into [name] Creek. Would that be all right or not all right? Why?
9. Do you think that throwing trash into the lake might affect the fish? If yes, would it be good or bad for the fish? Does it matter to you that the fish would be affected in this way?
10. Do you think that throwing trash into the lake would affect the water? If yes, would the trash be good or bad for the water? Does it matter to you that the water would be affected in this way?
11. Do you think throwing trash into the lake would affect the birds?
12. Would it be good for the birds or bad for the birds? Does it matter to you that the birds would be affected this way?
13. Do you think throwing trash into the lake would affect the people who live near the lake? If yes, how might it affect the people near the lake? If bad, does it matter to you that the people would be affected this way? Why?
14. Let's say that there is another city next to the different lake much like [blinded] creek and there was a law that said it was okay to throw trash into the lake. Would that be alright or not alright? Why?

(Kahn, 1999; Rice & Torquati, 2013)

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