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Evaluating the effects of environmental education programming on connectedness to nature

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With a growing movement to re-connect children to nature, an understanding of the ability of environmental education (EE) programs to foster connectedness to nature is needed. The purpose of this exploratory quantitative study is to determine the effect of seven EE programs on participants’ connectedness to nature. Results from the 385 children who participated in this study suggest two of the programs may be associated with a significant increase in connectedness to nature; however, due to the limitations of the study and a potential ‘ceiling effect’ of high initial levels of connectedness, further research is needed.

**Keywords:** environmental education; connectedness to nature; environmental sensitivity

**Introduction**

In response to growing environmental concerns, there have been a range of regulatory, policy, and educational efforts aimed at addressing specific environmental issues. While these interventions have been effective to varying degrees, conservation psychologists are suggesting ‘the magnitude of the environmental problems necessitates a broader intervention’ aimed at changing our cultural worldview and re-connecting humans to nature (Mayer and Frantz 2004, 512); this connection to nature is integral in fostering responsible environmental behavior and environmental protection (Fisher 2002 in Mayer and Frantz 2004).

A similar perspective is echoed in environmental education (EE) research, since environmental sensitivity is associated with responsible environmental behavior (Sia, Hungerford, and Tomera 1985–1986). While environmental sensitivity appears to be rooted in childhood experiences in nature (Chawla and Cushing 2007), today’s youth are spending less time in natural surroundings (Louv 2005). Louv writes in his book, *Last Child in the Woods: Saving our Children from Nature-Deficit Disorder*, ‘at the very moment that the bond is breaking between the young and the natural world, a growing body of research links our mental, physical, and spiritual health directly to our association with nature’ (2005, 3). Louv poses this question: If this gap between children and nature continues to widen, where will future conservationists come from?
Many US organizations and agencies with conservation missions are asking a similar question. In response to trends of decreasing time spent outdoors, decreasing interest in hunting and fishing, and increased societal attention on this nature-deficit phenomenon (Louv 2005), US public land management agencies are focusing efforts toward re-connecting children with nature. The National Park Service, in conjunction with the National Association of State Parks Directors, has a national ‘Children in Nature Initiative’ underway aimed toward engaging children and families in outdoor recreation activities and rediscovering their natural and cultural heritage (National Park Service-National Association of State Park Directors [NPS-NASPD], n.d.). The US Forest Service, in an effort to encourage children and their parents to re-connect with nature, joined the Ad Council to launch a public service advertising campaign, ‘Discover the Forest,’ to get children outside experiencing nature first-hand. According to Chief Gail Kimbell, children ‘need a direct connection to both forests and nature for their health and personal growth – and for the future of conservation’ (US Forest Service Press Office 2009). The Bureau of Land Management’s ‘Take it Outside’ program further promotes outdoor activities and experiences of children on public lands. Similarly, the US Fish and Wildlife Service (USFWS) Director Dale Hall, issued ‘connecting people with nature: ensuring the future of conservation’ as one of six top priorities for the Service, and a ‘Let’s Go Outside’ campaign is underway (National Conservation Training Center 2007, 2).

In further support of these efforts, and in response to concerns over future conservation leaders, eight US federal land and water management agencies (Army Corps of Engineers, Bureau of Indian Affairs, Bureau of Land Management, Bureau of Reclamation, Fish and Wildlife Service, National Park Service, US Forest Service, and US Geological Society) are participating in an interagency campaign, ‘Get Outdoors, It’s Yours,’ to raise awareness of opportunities for youth to connect with nature on public land and waterways. Additionally, the Secretary of the US Department of the Interior Ken Salazar launched a ‘Youth in the Great Outdoors Initiative,’ emphasizing the importance of nature to youth, as well as youth to nature. Through youth employment opportunities and education and recreation programs, the aim is not only to prepare youth for conservation careers, but also to connect them to the outdoors (US Department of the Interior 2010). These efforts support President Obama’s ‘America’s Great Outdoors Initiative,’ which focuses on re-connecting Americans to the outdoors.

As sites within these US federal land agencies develop new programs or revise existing ones to address this emphasis on getting children outside experiencing nature, it is important to know what these programs are accomplishing. An understanding of whether or not programs are connecting children to nature can be used to guide further research into specific program characteristics associated with this outcome. Ultimately, this understanding can be used for developing program models and resources to guide future development of educational experiences toward this outcome of connecting children to nature. For example, when the Director of the USFWS issued his statement indicating connecting people with nature as one of the six top priorities for the USFWS, a Connecting People with Nature Working Group was formed to support USFWS sites in carrying out this priority. Ultimately, the Working Group aims to identify program characteristics that foster connectedness to nature and use them to develop a set of planning and assessment tools to guide USFWS sites nationwide in the development of outreach and education programs that
foster connectedness to nature. It is in this context that the following exploratory study of seven USFWS youth EE programs was conducted.

**Literature review**

*Connectedness to nature and related terminology*

In his chapter entitled ‘The Land Ethic,’ Leopold (1966) describes the land ethic as a re-characterization of the role of humans ‘from conqueror of the land community to plain member and citizen of it’ (240), and insists that our obligations as members of the land community require us to act so as to ‘preserve the integrity, stability and beauty of the biotic community’ (262). Leopold’s land ethic provides a starting point for an exploration of recent discussions of ideas about how humans are connected to nature. Since Leopold’s articulation of the land ethic, which has continued to be explored in the environmental ethics literature review, other conceptions of the human–nature relationship have emerged in the EE literature and more recently in the environmental psychology literature.

As stated in the Tbilisi Declaration (UNESCO 1978), the objectives for EE include awareness, knowledge, attitudes, skills, and participation. While the human–nature relationship is not specifically mentioned, the descriptions for two objectives in particular provide insight into the EE community’s ideas about it at that time. The international community defined awareness (awareness of and sensitivity to the total environment) and attitude (a set of values and feelings of concern for the environment) as important objectives for EE programs, alluding to attributes of the human–nature relationship. Further, a descriptive list of guiding principles for EE includes the text, ‘Environmental education should relate environmental sensitivity … to every age, but with special emphasis on environmental sensitivity to the learner’s own community in early years’ (UNESCO 1978, 26–7).

Despite this early attention, in an article outlining EE curriculum goals, Hungerford, Peyton, and Wilke (1980) chose to not include environmental sensitivity as a curricular goal. They wrote, ‘[while] some level of ‘environmental sensitivity’ is probably critical … [we] have arbitrarily omitted goals dealing with sensitivity’ (45). They cite difficulties in its operationalization, and difficulties in determining participants’ varying sensitivity prior to interventions as grounds for this omission. In spite of these difficulties, environmental sensitivity continued to appear in the literature as an affective dimension of the human–nature relationship construct.

In the early 1980s, studies by Tanner (1980) and Peterson and Hungerford (1981) explored memories of experiences from environmental and conservation professionals. These studies attempted to identify formative experiences that contributed to participants’ environmental sensitivity. Their results showed a complex pathway to the development of environmental sensitivity that included not only affective components, but also cognitive and behavioral components as well. Regarding this, Sward and Marcinkowski (2005) write, ‘While [environmental] sensitivity itself is viewed as an affective variable, its development appears to result from an interplay of outdoor experiences, favorable human interactions, and knowledge about the natural environment’ (303). However, the definition of environmental sensitivity that emerged from Peterson’s work (1982) and that has been consistently used in the literature was, ‘a set of *affective* characteristics that result in an individual viewing the environment from an empathetic perspective’ (cited in Sward and Marcinkowski 2005, 303, emphasis added). These studies also founded an area of study now referred to as significant life
experience (SLE) and inspired further work (see Chawla 1999; Palmer 1993; Sward 1999). According to Chawla (1998), environmental sensitivity is ‘a predisposition to take an interest in learning about the environment, feeling concern for it, and acting to conserve it, on the basis of formative experiences’ (19). Based on these studies, it appears that the field of EE was initially more interested in understanding how to develop environmental sensitivity, rather than how to operationalize it. In the introduction to their review, Sward and Marcinkowski (2005) write, ‘while some progress has been made in defining environmental sensitivity as a psychological construct, that progress remains very limited’ (302).

Another thread in the literature exploring the human–nature relationship is human–place bonding, referring to the emotional bond that develops between an individual and the environment. One conceptualization, stemming from environmental psychology, describes the human–place bond as place attachment, which consists of two dimensions: place identity and place dependence (Moore and Graefe 1994). They suggest place identity is an affective bond between a person and a specific place, and place dependence as the extent to which a particular setting serves a person’s needs for a desired activity (Vaske and Kobrin 2001). The other conceptualization, stemming from human geography, is referred to as sense of place, which includes place attachment as one of three dimensions, along with place identity and place dependence (Jorgensen and Stedman 2001).

In the field of environmental psychology, the human–nature relationship has been explored in numerous ways, often with an emphasis on the ‘affective’ domain, but some incorporating cognitive (knowledge and beliefs) and behavioral/psychomotor (actions and experiences) aspects as well. Kals, Schumacher, and Montada (1999) used the term affinity to describe the emotional bonds and cognitive interest in nature. The term environmental identity is used by Clayton and Opoitow (2003) to describe ‘a sense of connection to some part of the non-human natural environment … a belief that the environment is important to us and an important part of who we are’ (45). Nature relatedness (Nisbet, Zelenski, and Murphy 2008) is comprised of three factors: a self-factor (an internalized identification with nature, reflecting feelings, and thoughts about one’s connection to nature), a perspective factor (reflecting an external, nature-related worldview), and an experience factor (reflecting a physical connection to the natural world).

Schultz (2002) used the term inclusion with nature as a broad overview of the human–nature relationship. Schultz presented inclusion as consisting of three broad dimensions, which he calls caring (affective), connectedness (cognitive), and commitment (behavioral). His component, caring, which he described as a feeling of intimacy, closeness, and affection for nature, is similar to the term connectedness to nature used by Mayer and Frantz (2004). While Schultz (2002) used the term connectedness to describe the degree to which people associate themselves with nature from more of a cognitive perspective, Mayer and Frantz (2004) define connectedness to nature as one’s ‘affective, experiential sense of oneness with the natural world’ (504). Their conceptualization builds on the work of Leopold, who emphasized the need for people to feel connected to nature as a member of the natural community in order to form them to feel responsible for nature and engage in conservation of nature. Research by Schultz et al. (2004) supports the importance of connectedness to nature, as the degree to which an individual associates oneself with nature is ‘directly related to the types of attitudes s/he develops’ (40); those who associate themselves with the natural environment tend to hold more biospheric attitudes, while those with less of
an association may still be concerned about the environment, but focused more narrowly on issues that directly affect the individual.

There are only a few studies that have operationalized connectedness to nature (Schultz et al. 2004). One of these is by Mayer and Frantz (2004). As part of their work, they developed a scale for measuring one’s affective sense of connectedness to nature. Their scale, the connectedness to nature scale, is based on ‘the extent to which people experientially view themselves as egalitarian members of the broader natural community; feel a sense of kinship with it; view themselves as belonging to the natural world as much as it belongs to them; and view their welfare as related to the welfare of the natural world’ (505). It consists of 14 items with responses given on a five-point scale. Based on five studies, there is strong evidence that the connectedness to nature scale is reliable and valid (Mayer and Frantz 2004). They suggest using this scale to ‘evaluate whether interventions aimed at increasing the contact of children or adults with nature actually increase their sense of feeling connected to nature’ (512).

**Relationship to environmental behavior**

Behavior is relevant to this literature review because public land management agencies seem interested in connecting children to nature because of its implications for conservation behavior. Ecopsychologists have argued for ‘fostering ecological behavior through expanding our sense of self,’ following the logic from human psychology, where expanding one’s sense of self leads to more emphatic and altruistic behavior toward others; thus, ‘if people feel connected to nature, then they will be less likely to harm it, for harming it would in essence harming their very self’ (Mayer and Frantz 2004, 512). There is empirical support for this idea, stemming from studies summarized in Mayer and Frantz (2004); they write, ‘our findings demonstrate that, in general, there is a moderately strong positive relationship between the connectedness to nature scale and eco-friendly actions’ (512).

Within the EE literature, environmental sensitivity has been found to be a significant predictor of environmental behavior (Sia, Hungerford, and Tomera 1985–1986). Hungerford and Volk (1990) characterized variables involved in environmental citizenship behavior as either entry-level, ownership, or empowerment variables. In their model, environmental sensitivity is a major entry-level variable, which suggests it is projected to be a predictor of environmental behavior and one that predisposes people to later work toward environmental protection.

In a study exploring the predictive effects on nature-protective behavior, Kals, Schumacher, and Montada (1999) showed that an emotional affinity toward nature was a strong predictor of nature-protective behavior. Hinds and Sparks (2008) focused their study on intentions to engage with the natural world, since nature experiences have ‘significant correlations with pro-environmental behaviors’ (109). They found that ‘the more one has an affective connection with the natural environment, the greater one’s intentions to engage with it’ (115). Within the place attachment literature, Vaske and Kobrin (2001) found place identity (emotional attachment, or an individual’s connection to a natural setting) to be significantly related to environmentally responsible behaviors.

**Influences on connectedness to nature**

In their measurement work with connectedness to nature, Frantz et al. (2005) write, ‘Given the link between feeling connected to nature and pro-environmental actions,
investigating factors that either promote or inhibit this sense of feeling connected to nature is critical’ (428). Research into influences on affective connections with nature is relatively new, with prior efforts seeming to focus on influencing environmental behaviors, rather than affective connections.

Insight into factors that promote affective connections can be gleaned from the environmental sensitivity or SLE research. Tanner’s (1980) work identified variables perceived by participants to have influenced their choice of conservation work or to have contributed to their environmental attitudes. The most common influences cited are as follows: interaction with natural areas, frequent contact with habitat, family, hunting/fishing, teachers, and other non-familial role models, books, habitat alteration, and solitude. Subsequent studies have found similar categories of influences, inferred to be key developmental variables for environmental sensitivity, with the most cited influence being outdoor experiences in natural or rural settings, usually with family, but also with other role models (Chawla 1999; Palmer 1993; Sivek 2002; Sward 1999).

Collectively, these studies suggest that ‘nature activities in childhood and youth, as well as examples of parents, teachers, and other role models who show an interest in nature, are key “entry-level variables” that predispose people to take an interest in nature themselves and later work for its protection’ (Chawla and Cushing 2007, 440). Consequently, they recommend environmental educators provide time during their programs for children to experience nature, enabling them to bond with nature by just ‘being’ in nature (449). Chawla and Cushing’s (2007) further reference evaluations of EE programs, where programs most effective in increasing young people’s environmental concern exhibited the characteristics of an extended duration of time, opportunities to learn and practice action skills, and success in achieving valued goals.

Within environmental psychology, Kals, Schumacher, and Montada (1999) found the first most significant predictor of affinity toward nature is frequency of time in nature, and the second most significant predictor being past frequency of time in nature (time during childhood). Similarly, results from Schultz and Tabanico (2007) indicate that implicit self-nature associations are malleable, but that change requires long-term or repeated experiences. These two studies are consistent with EE meta-analyses, indicating extended programs are more likely to lead to change (Rickinson 2001; Zelezny 1999).

Work by Kollmuss and Agyeman (2002) suggests factors such as gender and education level influence individuals’ level of environmental concern. While these factors are difficult to influence through educational interventions, Van Petegem, Blieck, and Van Ongevalle (2007) suggest the strategy of providing area-specific, local, hands-on experience for students to help them develop environmental concern, action competence, and critical thinking. Bogner (1999) found that ‘outdoor education experiences with sufficient duration influenced adolescents’ preferences toward the environment and nature usage’ (cited in Van Petegem, Blieck, and Van Ongevalle 2007, 289). The place attachment literature consistently finds that place attachment to be ‘grounded in the intimate knowledge of a place one develops through direct presence and activity at a locale’ (Eisenhauer, Kranich, and Blahna 2000, 423).

In summary, it seems appropriate for EE to include connectedness to nature among its aims, due to its relationship to environmental sensitivity and its potential link to environmental behavior. In addition, because they often incorporate experiences in nature, as well as opportunities to learn and practice action skills in a local and relevant context, it is reasonable to believe that EE programs may have the ability to foster
connectedness to nature, particularly when they include frequent and/or extended experiences.

**Methods**

The purpose of this study was to explore the influence of participation in an EE program on students’ connectedness to nature. In addition to this evaluative purpose of knowing if desired outcomes are being achieved, knowing which particular programs are achieving this outcome can inform future research aimed at identifying program characteristics associated with connectedness to nature. Ultimately this understanding of the potential for EE programs to connect children with nature, along with research-based strategies for creating educational experiences to do so, can guide EE program development when the aim is connecting children to nature.

**Program selection and participants**

The USFWS was approached for participation in this research, due to our familiarity with the agency, as well as the agency’s interest in research-based practices for EE program development, implementation, and evaluation. In addition, the USFWS has a Connecting People with Nature Working Group, tasked with providing guidance, through program development and assessment resources, to aid sites throughout the agency in their efforts to connect children with nature. However, while the USFWS and other public land management agencies would likely be interested in the findings from this study, the following study was neither conducted on behalf of the USFWS, nor did they fund the study, contribute resources, or influence methodology.

To select programs, we asked the Connecting People with Nature Working Group to generate a list of EE programs from throughout the USFWS (publicly available information) that aimed to connect children to nature and provided opportunities for direct experiences in a local, natural environment, whether at the USFWS site or in a natural area on or near school groups. This list was supplemented by an Internet search of National Wildlife Refuge websites for EE programs. Driven by budget and timeline parameters of the funder, the aim was to select 5–10 programs that represented a range of EE program formats and methods, we selected seven programs using maximum variation sampling, as well as the following criteria: (1) the program was an EE program, as defined by UNESCO (1978); (2) the program exhibited a theoretical possibility for increasing participants’ connectedness to nature; (3) one of the desired outcomes of the program, but not necessarily the primary outcome, was connecting children to nature; (4) the USFWS site/program indicated an initial willingness to be ‘studied’; and (5) there was at least one teacher whose students participate in the program (treatment) who was willing to administer pretest and posttest to their students and one teacher of a similar grade level, either at the school or within the district, that was willing to have students serve as a control group. These seven programs are described in Table 1.

**Research instruments**

Two research instruments were used in this study. The first was a 16-item Children’s Connection to Nature Index (Cheng 2008; Cheng and Monroe 2010), used with permission from the author. This instrument was built on Mayer and Frantz’s
Table 1. Description of participating programs.

<table>
<thead>
<tr>
<th>Number</th>
<th>Region</th>
<th>Grade level</th>
<th>Description</th>
<th>Methods for experiences/interactions with the local natural environment</th>
<th>Implementation by</th>
<th>Duration of student participation</th>
<th>Program participants/research participants</th>
<th>Control group</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Pacific</td>
<td>10th–12th</td>
<td>Alternative, environment-based high school program located on a natural area off school grounds for students experiencing difficulty succeeding in a traditional high school setting; in addition to an environmental context for academic content, which is the program focus, students learn about environmental topics such as orienteering, natural resource management, and fisheries.</td>
<td>Mentoring by agency staff; vocational experiences; environmental service-learning (leading community events relating to natural resource management)</td>
<td>Classroom teachers and agency staff</td>
<td>Daily, for part of one semester up to multiple years</td>
<td>Approximately 25 from one school district/ n = 22</td>
<td>Students from the traditional high school; n = 13</td>
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<td>2</td>
<td>Pacific</td>
<td>5th</td>
<td>Voluntary after school club with activities in natural history, outdoor skills and recreation, such as orienteering, casting, disecting owl pellets, making bird feeders, and plant identification and pressing.</td>
<td>Outdoor recreation experiences; story-telling; field trip</td>
<td>Staff from three partnering agencies</td>
<td>90 minutes every other week after school and one day-long field trip</td>
<td>Approximately 20 from three fifth grade classes in one school/ n = 11</td>
<td>Students from the same fifth grade classes as program participants; n = 33</td>
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<td>3</td>
<td>Southeast</td>
<td>4th</td>
<td>Field-day based program focused on aquatic resources, where students rotate through activity stations such as aquatic life and habitat observations, water quality sampling, interviewing a biologist, ecology games, and species identification.</td>
<td>Field observations and identification; ecology games</td>
<td>Stations led by agency staff and teachers; some student guided</td>
<td>Two day-long events, one in fall and one in spring</td>
<td>All fourth grade students in the county participate/ research participants are from two of the schools; n = 68</td>
<td>Third grade students from one of the two participating elementary schools; n = 20</td>
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Table 1. (Continued).

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<tr>
<th>Number</th>
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<tr>
<td>4</td>
<td>Northeast</td>
<td>3rd–5th</td>
<td>Voluntary summer day camp program for students to learn how human actions affect plant and animals within habitats, with activities focused on themes of ecosystems, climate, pollution, and positive action; rotation through a variety of large and small group activities, such as habitat exploration, aquatic life identification, insect netting, scavenger hunts, bluebird box investigations, and predator–prey games; an emphasis is on learning skills to help them protect habitats.</td>
<td>Field observation, exploration, and species identification; ecology games; environmental service-learning (bat houses, wood duck and song bird boxes for local natural areas; rain and pollinator gardens)</td>
<td>Agency staff, volunteers, interns, and classroom teachers</td>
<td>Week-long day camp, six hours/day</td>
<td>Approximately 25, third to fifth graders from one school participate/research participants were fourth graders from the same classroom who had chosen to attend camp, who may or may have attended the year prior/ $n = 15$</td>
<td>Students from the same fourth grade class as program participants; $n = 12$</td>
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<td>Number</td>
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<td>5</td>
<td>Midwest</td>
<td>5th</td>
<td>Environment-based program, which uses an off-site natural environment as a context for learning in science, writing, math, and health; students return to middle school for remaining subject areas; while focus is on core-subject area learning, learning takes place through long-distance expeditions through natural areas, free-writing in nature, wetland water monitoring, skiing, and snowshoeing, prairie restoration activities, amphibian monitoring, and duck banding. Participation is by parent request and lottery, with greater demand than room.</td>
<td>Interdisciplinary field-based instruction; Seton watches (contemplative, solitary observation); environmental service-learning (resource management)</td>
<td>Classroom teachers; occasional instruction by agency staff</td>
<td>Daily participation for half of each school day throughout school year</td>
<td>60 students (two of the four sections of fifth grade classes from one middle school)/n = 57</td>
<td>Two sections of fifth grade students from the same middle school as program participants; n = 46</td>
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<td>6</td>
<td>West</td>
<td>10th–12th</td>
<td>Integrated science class at an alternative high school, with monthly field trips for learning about native plants and endangered species, habitat studies, and projects such as seed collection, wildlife surveys, and habitat restoration.</td>
<td>Field-based learning; environmental-service projects</td>
<td>Classroom teacher teaches the science class, with agency staff leading service projects</td>
<td>Usually one semester, with participants entering and leaving the program throughout the school year; 90-minute field trips once/month</td>
<td>Approximately 25–35 students per semester, with new students joining the class throughout the year/n = 33</td>
<td>10th–12th grade students from a different core class within the alternative high school; n = 31</td>
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<td>Number</td>
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<td>Description</td>
<td>Methods for experiences/interactions with the local natural environment</td>
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<td>7</td>
<td>West</td>
<td>3rd–6th</td>
<td>Field trips to natural sites oriented around topics such as watershed, food webs, native plans, geology, and wildlife; field trips supported by two previsit classroom activities related to field trip topics.</td>
<td>Field trips; environmental service-learning (native plant restoration)</td>
<td>Hired field instructors during field trips; classroom teachers assist with previsit activities</td>
<td>Three field trips, two to four hours each during May</td>
<td>Approximately 250, third to sixth grade students from one elementary school/research participants were third grade students; &lt;i&gt;n = 11&lt;/i&gt;</td>
<td>Second grade students from the same elementary school as program participants; &lt;i&gt;n = 13&lt;/i&gt;</td>
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<sup>a</sup>Research participants were those students who were willing to participate, had parent consent to participate, and completed both pre- and posttests.
J. Ernst and S. Theimer

Connection to Nature Scale (2004), and drew from elements that appear to influence environmental attitudes (Musser and Malkus 1994; Schultz 2000). It includes items relating to children’s feelings when in nature, their perception of the human–nature relationship, and their concern for plants and animals. Examples of items are as follows: ‘I like to go outside and enjoy nature’; ‘Humans are a part of the natural environment’; and ‘I feel sad when wild animals are hurt.’ The response format for items are on a five-point scale (1 = strongly disagree and 5 = strongly agree). After testing the original 22-item index for reliability, six items were deleted, resulting in the 16-item instrument with a reliability of $\alpha = 0.87$. Similar to one of the purposes for the Mayer and Frantz’s (2004) Connection to Nature Scale (determining if interventions aimed toward increasing the contact of children or adults with nature actually increase their sense of feeling connected to nature), Cheng (2008) intended one of the uses of this instrument to be program evaluation, particularly for long-term programs. This research instrument is scored by creating a mean of the 16 items, with the possible total scores for this section ranging from one to five, with higher scores indicating a stronger connectedness to nature than lower scores.

The second research instrument, the Nature Connectedness Inventory, was developed specifically for this study to reduce the threat to construct validity from mono-method (single measure) bias. It included 11 items, addressing the same areas that served as the basis for the Mayer and Frantz’s (2004) Connection to Nature Scale: the extent to which people experientially view themselves as egalitarian members of the broader natural community (two items); feel a sense of kinship with it (two items); view themselves as belonging to the natural world as much as it belongs to them (two items); and view their welfare as related to the welfare of the natural world (two items). The remaining three items addressed children’s feelings when in nature, as this was a component of the Cheng’s (2008) Children’s Connection to Nature Index. While this component, children’s feelings when in nature, was not part of the Mayer and Frantz’s (2004) Connection to Nature Scale, it is consistent with their definition of connectedness as being an affective, experiential sense of oneness with the natural world (Mayer and Frantz 2004).

The response format for this instrument was adapted from the Children’s Attitudes toward the Environment Scale (Musser and Malkus 1994). We chose this response format as it seemed to lessen the potential for socially desirable responses, since children might respond more honestly, knowing that there are other children similar to them regardless of how connected or disconnected they feel to nature. When administered, children are first instructed to choose which of the two groups of children described in the statements they are most like (e.g., kids who feel a part of nature or kids who feel separate from nature). Then, children indicate how much they are like the children described in the statements they chose – a lot or only a little. For this study, we adapted the format so that after children chose which of the two groups of children they felt most like, they indicated how much they are like that group of children by checking one of three boxes: a little like them, somewhat like them, or a lot like them. For each item, responses are scored on a scale of one to six, with one corresponding to children who felt ‘a lot’ like the children who were not connected to nature and six corresponding to children who felt ‘a lot’ like the children who were connected to nature. The scoring for this instrument involved computing mean scores for the 11 items, with the range of possible resulting scores being one to six (higher scores reflecting higher levels of connectedness to nature). This instrument was pilot-tested prior to its use in the study; because none of the
items had negative inter-item correlations and because deleting any of the items would not have led to increased reliability, the instrument as developed was the instrument used in the study.

It should be noted that, ‘despite the centrality of the concept of connectedness in the environmental literature, only a few studies have operationalized it using explicit measures’ (Schultz et al. 2004, 40), and these studies have focused primarily on adults. While there are attitudinal measures designed for administration with children, general environmental attitudes are not the same construct as connectedness. Consequently, the options for suitable research instruments were limited.

**Design**

A pretest–posttest nonequivalent comparison group design was used for this study, due to the intact groups and lack of opportunity for random assignment. A total of 385 students participated in this study. While in general the treatment for this study can be considered USFWS EE programs, or perhaps even EE, the seven programs studied do not comprise the range of possible EE programs and are not being portrayed as representative of all EE. Because the programs differed in methods, duration, format, location, age level, etc., each program was considered individually as a treatment, resulting in a treatment group for each of the seven specific EE programs. These seven treatments were intact, existing programs; thus, the research involved data collection, but not a development or manipulation of the treatment.

Students in the control groups (one group for each of the seven programs) were from the same school as students in the treatment groups. When possible students in the control group were from the same grade level as treatment students, however, for two programs, students in the control groups were from a grade level below the treatment students, as all students of that particular grade level participated in the program (see Table 1). Because of the potential for initial differences between the two groups, particularly due to several of the programs where participation was voluntary, a pretest measuring initial level of connectedness to nature was used to help address this validity threat of selection differences.

**Procedures**

After reaffirming willingness to be included in this study with the USFWS program staff at each site/program, as well as reaffirming that the treatment and control teachers for each program were willing to participate by assisting with data-collection, approval was sought from the Institutional Review Board and from each of the seven schools/districts for student participation in this study. After the assent process for students was completed and parental consent was obtained, classroom teachers of the students in the treatment and control groups at each program site administered the pretest, prior to the treatment, and the posttests, following the treatment, during the 2008–2009 school year. The teachers were encouraged to administer the tests as close as possible to the beginning and ending of the treatment, with teachers of the control groups administering the tests on a similar timeline. If classroom teachers were also instructors of the USFWS EE programs, they were encouraged to find another teacher to administer the pre/posttests for them. In appreciation for their assistance with data collection, teachers received a $75 gift card to Acorn Naturalist (an online site that sells nature education resources).
Data analysis

Two analysis of covariance (ANCOVA) tests were conducted for each of the seven programs, one using data from the Cheng’s (2008) Children’s Connection to Nature Index and one using data from the Nature Connectedness Inventory (the instrument developed specifically for this study). The purpose of these tests was to determine if students in the USFWS EE programs had higher connectedness to nature scores than students who had not participated, after controlling for the variance in scores due to students’ initial level of connectedness to nature, as measured by the pretest. Because of the varying forms of treatment across the seven programs, an ANCOVA was conducted for each program, rather than a single ANCOVA for participants in all of the programs combined. Before conducting the ANCOVA tests, the homogeneity-of-slopes and homogeneity-of-variances assumptions were tested. The Type 1 error was set at $\alpha = .05$.

Results

A reliability analysis of the pretest Cheng’s (2008) Children’s Connection to Nature Index data from all participants indicated a Cronbach’s $\alpha$ of .84; the reliability of the pretest data from the research instrument developed for this study was .73. The correlation between the pretest data from the two instruments was .60, and the correlation between the posttest data from the two instruments was .72. This indicates approximately 36–49% shared variance between the two instruments. Preliminary analyses evaluating the homogeneity-of-variance assumption indicated that the variances of the dependent variable did not differ significantly across treatment and control groups. Preliminary analyses evaluating the homogeneity-of-slopes assumption indicated that the relationship between the covariate and the dependent variable did not differ significantly as a function of the independent variable.

Results from the ANCOVA tests using the Cheng’s (2008) Children’s Connection to Nature Index suggest that none of the seven programs (treatments) were associated with an increase in participants’ connectedness to nature. When controlling for initial level of connectedness as measured by the pretest, students in the treatment groups did not score significantly higher on the posttest than students in the control group (see Table 2).

<table>
<thead>
<tr>
<th>Program</th>
<th>F</th>
<th>df</th>
<th>p</th>
<th>Adjusted mean (SE) for control group$^a$</th>
<th>Adjusted mean (SE) for treatment group$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>3.86 (.07)</td>
</tr>
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<tr>
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<tr>
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<td>1,24</td>
<td>.44</td>
<td>3.87 (.11)</td>
<td>3.97 (.10)</td>
</tr>
<tr>
<td>5</td>
<td>4.48</td>
<td>1,100</td>
<td>.04$^b$</td>
<td>4.05 (.07)</td>
<td>3.86 (.06)</td>
</tr>
<tr>
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<td>.70</td>
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<tr>
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<td>1.74</td>
<td>1,22</td>
<td>.20</td>
<td>4.04 (.22)</td>
<td>4.49 (.25)</td>
</tr>
</tbody>
</table>

$^a$Response scale is 1–5, with higher values corresponding to higher levels of connectedness to nature.

$^b$Significant difference, with control students scoring significantly higher than treatment (thus treatment is not considered to have a significant influence on connectedness to nature).
Results from the ANCOVA tests using the Nature Connectedness Inventory suggest that the two of the seven programs (treatments) may have been associated with an increase in participants’ connectedness to nature. When controlling for initial level of connectedness, students in the treatment groups for two programs scored significantly higher than students in the control groups, Program 4: $F(1, 24) = 12.08, p = .002$; and Program 7: $F(1, 22) = 11.70, p = .002$. For Program 4, the treatment accounted for 33.5% of the variance of the dependent variable, holding constant the pretest value, as assessed by partial $\eta^2$. The mean connectedness to nature score for students in the treatment group, when adjusting for initial differences as measured by the pretest, was 5.20 (SE = .14); the adjusted mean for students in the control group was 4.43 (SE = .16). For Program 7, the treatment accounted for 34.7% of the variance. The mean connectedness to nature score for students in the treatment group, when adjusting for initial differences as measured by the pretest, was 5.75 (SE = .20); the adjusted mean for students in the control group was 4.81 (SE = .18). The results of the ANCOVA tests for remaining programs suggest that students in the treatment groups did not score significantly higher on the posttest measure than students in the control group, when controlling for initial level of connectedness, as measured by the pretest (see Table 3).

Discussion

A significant limitation to this study is the non-equivalent control group design, with students in the control group potentially differing from treatment students in a way that influenced connectedness to nature (preexisting differences). For example, with several programs, participation was voluntary; thus, students in the treatment group may have had more of an interest in nature, confounding their connectedness to nature scores or related constructs that influence connectedness. On the other hand, lack of participation was not necessarily due to lack of interest, as lack of parent permission or participation in other extra-curricular activities, for example, may have precluded participation, which presents less of a concern for initial differences. While this was partially addressed through the use of a pretest serving as a covariate in the analyses, there may be other initial differences between the groups. Due to this naturalistic setting of intact, existing programs, the study could not be conducted feasibly through an experimental design; this weakened the internal validity of the study and makes the results more difficult to interpret. External validity, however, was strengthened through the inclusion of a diversity of programs and settings.
Due to concerns regarding the amount of time that would be involved in participation in data-collection activities, several principals and teachers were initially hesitant to agree to participate and due to lack of available instruments for measuring connectedness to nature for children, two short quantitative instruments, the Cheng’s (2008) Children’s Connection to Nature and a self-developed instrument, the Nature Connectedness Inventory, were used in this study. While this minimized the intrusiveness of assessment on class time and student learning (approximately 15 minutes needed for completion of the combined instruments), the use of this quantitative method may have resulted in mono-method threats to construct validity; in hindsight, a mixed-methods approach may have been more appropriate if schools were willing to provide additional time for data-collection activities. Further, the Cheng (2008) instrument was written for fourth graders; thus, use with older students may have been problematic. Another limitation affecting Programs 1 and 6 was the transient nature of participation, with students entering and leaving the program throughout the semester and/year. This posed a difficulty for determining the extent of treatment students in the treatment group received.

Thus, in light of the limitations, cautious interpretation of the results is necessary, and much of this discussion is conjecture. It is difficult to know if the treatments that appeared ineffective in influencing connectedness were actually ineffective, or if they just appeared not to ‘work’ due to one or a combination of possible reasons: confounding variables; the use of a single data-collection method; or the instruments used and their potential lack of construct validity. It is also worth noting that there may have been a ‘ceiling effect,’ as the mean pretest score on the Cheng (2008) instrument was 3.90 on a five-point scale, and the mean pretest score on the instrument developed for this study was 4.64 on a six-point scale. As noted in Pedhazur and Schmelkin (1991), if many participants have high scores or scores close to the maximum value, the instrument may not be sensitive enough to validly differentiate among participants on the construct of interest.

Based on the literature presented earlier as to influences on connectedness, it appears that program duration is critical. Two of the programs, Programs 1 and 5, seemed to best exhibit this characteristic of sustained experiences over time, yet these programs were not associated with an increase in connectedness. Program 1 participants, however, were 10th and 12th graders, and they may have been too old to expect to see affective changes, even with quality program implementation (see Wells and Lekies 2006). Both of these programs had a focus on academic learning in the core-subject areas, using an environmental context for integrated learning across the subject areas. While programs such as these often demonstrate improved academic outcomes, there is little research into the effectiveness of these programs on conservation outcomes (Monroe 2003). Thus, perhaps the focus on learning in the core-subject areas drew attention away from opportunities to form emotional connections to nature.

For the two programs, Programs 4 and 7, that appeared to potentially be fostering connectedness, as indicated by the results from the Nature Connectedness Inventory, they shared a similar grade level of participants (the research participants from these programs, third and fourth graders, were the youngest research participants in the study), as well as what might be described as a condensed time frame of sufficient duration (week-long day camp for one program, and for the second, three field trips and accompanying classroom-related activities in one month). While there was another program with fourth grade research participants, the duration of this program was somewhat shorter (two field trips) and spread out over the course of the school year,
with one field trip in the fall and one in the spring. In addition to the characteristics of
duration and participant age, Program 4 had an emphasis on learning how human
actions affect plant and animals within habitats and learning action skills for habitat
conservation. It could be that this emphasis was particularly successful in influencing
participants’ views of their roles as ‘egalitarian members of a broader community.’

The differing results based on research instrument used (one instrument suggest-
ing none of the treatments were fostering connectedness, with the other instrument
suggesting two programs may be fostering connectedness) provide the opportunity for
looking more closely at the instruments used in this study. The pretest mean for the
Cheng’s (2008) instrument was closer to the maximum score than the pretest mean for
the Nature Connectedness Inventory, and the standard deviation for the Cheng’s
(2008) instrument was lower than the standard deviation for the Nature Connected-
ness Inventory. Thus, perhaps the instrument developed for this study, the Nature
Connectedness Inventory, which used a response format intended to reduce social
desirability and increase variation in responses, may have better captured differences
between the treatment and the control groups. This difference, as well as other differ-
ences between the instruments, is in need of further study.

Implications

The research surrounding connectedness and related terms suggest this is a relatively
stable construct; according to Schultz et al. (2004), ‘Our results show a moderate
suggest, in reference to their use of the instrument as a pre- and postmeasure for an
in-class activity/field trip program, ‘because attitudes change slowly, it is not reason-
able to expect a significant difference between a pre and post measure of connection
to nature’ (9). Assuming connectedness of nature continues to be a primary outcome
desired by the USFWS and other public land management agencies, what should EE
programs emphasize?

One implication tentatively suggested by this study and fully supported by the
research literature is time. Kals, Schumacher, and Montada (1999) found the two most
significant predictors of affinity toward nature are frequency of time in nature and
frequency of childhood time in nature. Studies using the implicit association test to
measure one’s connections nature indicted it is a malleable construct, but that change
requires long-term or repeated experience (Schultz and Tabanico 2007). While more
research is needed to determine what frequency and duration is needed, as well as the
role of a condensed time frame, perhaps in the meantime, agencies need to continue
to provide frequent, sustained experiences in nature, realizing change may be happen-
ing, but slowly.

A second implication for consideration, based tentatively on this study’s results
and the research literature, is age of the participants. As noted earlier, research by
Wells and Lekies (2006) suggest the importance of early opportunities in nature, with
sufficient experiences prior to age 11. This is consistent with LaHart (1978), who
found attitudes toward wildlife appear to be well formed by eighth graders, and with
Kellert and Westervelt (1983), who found second through fifth graders were charac-
terized by changes in affective and emotional concern for animals. According to
Westervelt and Llewellyn (1985), because 10- to 12-year-old students are actively
searching for more information about animals and their attitudes toward animals are
still forming, this age provides excellent opportunities for fostering an appreciation for
the natural world. Thus, programs may have a greater potential to foster connectedness if they reach younger, rather than older students.

It is important to note that this exploratory study was not intended to be a definitive response to the question of whether or not EE programs influence connectedness to nature. Insight into this outcome can still be gained, in spite of the study’s limitations. One of these insights relates to the USFWS and their ultimate interest in behavior driven by their mission: the USFWS is interested in fostering a conservation ethic through connecting children to nature, due to its implications for conservation (pro-environmental) behavior. While there is research suggesting a relationship between connectedness to nature and pro-environmental behavior, it is unclear as to the strength and nature of this relationship. While it seems to be assumed that connectedness influences behavior, perhaps pro-environmental behavior (actions in the environment, where children act on behalf of the environment and see their actions make a difference) instead promotes a feeling of oneness or connectedness with the environmental around them. If this conjecture was to be the case, aiming to increase pro-environmental behavior may in turn help programs meet the outcome of connectedness to nature.

In a similar vein, while these programs did not appear to be fostering connectedness to nature, most incorporated environmental service-learning, which does, with quality implementation, appears to support environmental literacy and pro-environmental behavior (Chawla and Cushing 2007; Monroe 2003). Thus, while the programs may not have been increasing connectedness to nature, it is possible that they were influencing pro-environmental behavior through this incorporation of environmental service-learning.

If pro-environmental behavior is the ultimate outcome, it is important to note that strategies other than, or in addition to, getting children into nature are important. Research suggests targeting areas such as knowledge about environmental issues; building self-efficacy; developing skills in problem-solving, decision-making, and action-taking through ‘empowering students with choice, using local real problems, and enabling youth to witness the results of their activity’ (Monroe 2003, 123). This is consistent with Chawla and Cushing’s review (2007) of research relating to pro-environmental behavior, which emphasizes conditions and strategies such as knowledge about environmental issues, practicing action skills, taking ownership of environmental issues, participation in environmental clubs and organizations, and everyday life experiences/positive experiences in nature. Because the programs studied seem to draw from these strategies, there seems to be theoretical grounding to support the possibility of these programs increasing pro-environmental behaviors, which should be of interest to public land management agencies with conservation-oriented missions. This is even more likely to be the case for programs that incorporated these methods over an extended period of time (Chawla and Cushing 2007) and for the programs where participation was voluntary (Wells and Lekies 2006).

While recognizing the potential for experiences in nature to develop positive and caring attitudes toward the environment, Malone and Tranter (2003) state that access to outdoor space is not enough to engender such attitudes (cited in Maynard and Waters 2007). Thus, it is also helpful to remind our field that while connectedness to nature may be an appropriate goal for EE, and while getting children outside to experience nature may be an appropriate method for achieving this goal, connectedness it is not the sole aim for EE; a willingness or disposition to act in pro-environmental ways, without accompanying knowledge and skills, is unlikely to lead to effective action. Further, for programs in this study whose primary goals were not connectedness to nature, the
methods chosen to achieve those other goals may not be as effective in fostering connectedness to nature as programs whose primary or only goal was connectedness. The programs in this study may have been influencing academic achievement or pro-environmental behaviors, but these outcomes were not measured in this study.

**Recommendations for further research**

Initially it seemed advantageous to evaluate multiple programs from an external validity perspective. In hindsight, perhaps a stronger understanding of the ability of these EE programs to increase connectedness to nature may have been obtained by a more rigorous design with one program, perhaps using multiple instruments, or mixed methods, to determine not only if a program was successful, but also why. By focusing on one program, it would have been more feasible to control for confounding variables, and even perhaps stagger the program components, allowing for a time-series design or for assigning students to different combinations of program components to identify key characteristics associated with increasing connectedness to nature. Thus, there is a need for further research using multiple measures and multiple methods to better understand if EE programs are effective in fostering connectedness to nature, and if so what particular characteristics are important. Alternatively, based on potential implications from this exploratory study, research is needed to further explore the role of program duration and age of participants on a program’s ability to foster connectedness to nature. It may also be useful to investigate program emphasis and how this relates to student interest and engagement, as in this study, a program emphasizing environmental issues and actions seemed to foster connectedness to nature, whereas outdoor recreation, natural history, and natural resource-oriented programs did not appear to foster connectedness, nor did programs whose primary emphasis was on academic/core-subject learning.

Another area for further research lies in the area of the term popularized by Louv (2005), nature-deficit disorder, and a general decrease in the amount of time children spend outdoors. In spite of this ‘disorder,’ the participants in this study showed a relatively high level of connectedness, even prior to participation in the EE programs. Based on their pretest scores, both treatment and control students appeared to already be connected to nature.

It may be that youth are not as disconnected from nature as we might think, or perhaps, and probably more likely, there is an important difference between lack of nature experiences (a decrease of time outdoors) and low levels of connectedness (the psychological construct). Perhaps in spite of infrequent experiences in nature, children can exhibit a high level of ‘connectedness,’ due to a natural affinity to nature (Cohen and Horm-Wingerd 1993 in Monroe 2003). Or perhaps there are ways other than direct experiences in nature (as a method) that foster connectedness (the outcome). This may, in part, be due to the difficulty in separating emotional affinity toward nature (affective) from interest in nature (cognition) (Picard et al. 2004). This difficulty is apparent in critiques of the connectedness to nature scale (Mayer and Frantz 2004), as further research using this scale indicates it may not be measuring connectedness (as in emotional connection or affinity), but instead measuring a cognitive interest in nature, or a cognitive belief about one’s relationship with nature (Perrin and Benassi 2009). Thus, it may be that today’s youth are disconnected in the sense of lacking frequent activities in nature, yet ‘connected’ in the sense of having an interest in nature or a cognitive belief that they are part of nature. Further, there is a need for exploring what the agencies mean by ‘connecting children with nature,’ as based on
this study, connecting children to nature in the form of providing opportunities for children to experience that nature was not the same as connecting children to nature in the form of increasing their levels of connectedness to nature. These areas of conjecture are opportunities for further research.

Conclusion
In the midst of this attention on ‘nature-deficit disorder,’ it is not surprising that organizations and agencies are revising programs to emphasize nature experiences, given the potential impact of emotional connectedness to nature on a child’s life course toward environmentalism. However, literature grounding EE reminds us that effective EE is more than going outside. Similarly, providing experiences for children to get into nature (a method) is not necessarily the same as fostering connectedness to nature (an outcome). While the research literature suggests the theoretical potential for the programs in this study to foster connectedness to nature, only two of the programs appeared to do so. This suggests that EE programs do have the potential for achieving this outcome, but further research is needed to identify program characteristics associated with this outcome. However, this exploratory study raises more questions than conclusions about the role of connectedness to nature in EE. The limitations of this study, as well as the literature discussed, signal opportunities for further research exploring the role of EE programs in fostering connectedness to nature.

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References


