

Nature and the Life Course: Pathways from Childhood Nature Experiences to Adult Environmentalism¹

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Comment on This Article

Abstract

This paper examines connections between childhood involvement with the natural environment and adult environmentalism from a life course perspective. Approximately 2,000 adults age 18-90 living in urban areas throughout the United States were interviewed with respect to their childhood nature experiences and their current, adult attitudes and behaviors relating to the environment. Model testing and cross-validation procedures using structural equation modeling suggest that childhood participation with nature may set an individual on a trajectory toward adult environmentalism. Specifically, childhood participation in "wild" nature such as hiking or playing in the woods, camping, and hunting or fishing, as well as participation with "domesticated" nature such as picking flowers or produce, planting trees or seeds, and caring for plants in childhood have a positive relationship to adult environmental attitudes. "Wild nature" participation is also positively associated with environmental behaviors while "domesticated nature" experiences are marginally related to environmental behaviors.

Keywords: [life course](#), [childhood](#), [nature](#), [environmental attitudes](#), [environmental behaviors](#)

Introduction

When I was in fifth and sixth grade my family owned a small log cabin on a lake in the mountains of Colorado.... I spent a lot of time by myself in the woods, building cabins, making up stories, and feeding birds and squirrels. I would sit for hours waiting for animals to approach and eat from my hands. This... made me an animal advocate.

- respondent, Corcoran 1999, p. 211

The Life Course Perspective

The life course perspective examines individual lives as sets of interwoven pathways or trajectories that together tell a life story (Bronfenbrenner 1995; Bronfenbrenner and Morris 1998; Elder 1995; Moen, Elder and Lüscher 1995; Wheaton and Gotlib 1997). Each individual has a career or work trajectory, a family trajectory, a health trajectory, as well as various other trajectories or life paths. Early experiences can set a person on a particular trajectory toward an outcome, which will persist unless a turning point occurs, resulting in a shift to a different trajectory. For example, with respect to the health trajectory, evidence from life course research indicates that 80 percent of children who grow up in low socioeconomic status (SES) households are set on a trajectory toward an adulthood of being overweight or obese with the associated health risks—compared with 40 percent of those raised in higher SES homes (Olson, Bove and Miller 2005). While the life course perspective has been employed to examine issues associated with poverty (Rank and Hirschl 2005), health (Wethington 2005), housing tenure (Kendig 1990), career (Kim and Moen 2001; Wethington 2002), and family life (Moen and Erickson 1995), the life course approach has not been applied to examine pathways to environmental attitudes and behaviors.

How might childhood interaction with the natural environment begin to shape a life course trajectory with respect to environmental concerns and ecological actions? What specific activities or events in one's youth are likely to put a person on a trajectory toward later life commitment to environmentally-conscious behaviors and attitudes? While a variety of studies have explored children's relationships to the natural environment and some researchers have specifically examined the influence of significant life events among dedicated environmentalists, little research attention has targeted the issues posed here. These questions have compelling implications in terms of the formation of future generations' ecological values, protection and preservation of the environment, and the long-term viability of environmentally sustainable cultures. This research begins to shed light on these issues by using structural equation modeling to examine long-term linkages between childhood nature experiences and adult environmentalism among a large, representative sample of adults from the general population. This paper builds on three areas of prior research: 1) studies examining the effects of outdoor play and access to nature; 2) research examining the efficacy of environmental education programs, and 3) significant life experiences research that focuses on the influential role of early nature experiences among environmental professionals.

Childhood Exposure to the Natural Environment

Outdoor Play and Access to Nature

With the increasing concern about environmental degradation (Starke 2005; Oskamp 2000) and concurrent cautions regarding children's diminishing affiliation with and time spent in nature (Louv 2005), an exploration of linkages between childhood connection with the natural environment and adult environmentalism is indeed timely. While a number of studies have documented that exposure to nature has beneficial effects on children's psychological or cognitive well-being in the relatively short term (Faber Taylor et al. 1998; Faber Taylor, Kuo and Sullivan 2001; Faber Taylor, Kuo and Sullivan 2002; Wells 2000; Wells and Evans 2003), and others describe children's affinity for the natural environment (Chawla 1988; Korpela 2002; Moore 1986; Sobel 1993; Sebba 1995), relatively little research has examined the long-term influence of childhood contact with nature, particularly in terms of environmentalism outcomes over the life course.

The few studies that do examine longer-term associations between childhood time in nature and later outcomes related to environmentalism include a wide range of dependent variables. Several of these studies examine outcomes in adolescence or early adulthood. For example, Bixler, Floyd and Hammitt (2002) examined the relation between play environments prior to age ten and adolescents' environmental preferences within the domains of education, recreation and work. Results support the idea that childhood play location influences later interest in wildlands, environmental preferences, outdoor recreation, and occupations in outdoor environments. Adolescents who, as children, had more often played in wilderness areas were more likely to prefer a wildland walking path than those who had mostly played in the yard before the age of ten. Those who played in wilderness areas also had greater tolerance for living without modern comforts when presented with a hypothetical scenario and had the greatest preference for outdoor occupations. Chipeniuk's (1995) research examined associations between childhood foraging and later environmental knowledge. People who reported having foraged the greatest breadth of things—from acorns, arrowheads, and cattails, to fireflies, fish, and turtles—in childhood had, as teenagers, better knowledge of biodiversity. Ewert, Place and Sibthorp (2005) examined the relation between early-life outdoor experiences and environmental attitudes in early adulthood. Data collected by surveying undergraduate students indicated that appreciative outdoor activities (e.g., time outdoors enjoying nature), consumptive outdoor activities (e.g., hunting and fishing), media exposure (e.g., books and television), and witnessing negative environmental events (e.g., seeing a special outdoor area be developed) during one's youth were predictive of later life eco-centric versus anthropocentric beliefs.

Two prior studies examine connections between childhood exposure to nature and adult attitudes about nature or plants. Based on a questionnaire administered to German adults (including both members of the general population and members of environmental protection organizations), Kals, Schumacher and Montada (1999) reported a modest but significant correlation between time spent in nature from age 7 to 12 and adulthood "indignation about insufficient nature protection."

Indignation about protecting nature, in turn, is predictive of willingness to engage in nature-protective behaviors. Lohr and Pearson-Mims (2005) examined the relation between childhood contact with nature and adult attitudes toward plants. Results indicated that childhood activities such as picking vegetables, planting trees, and taking care of plants as well as having grown up living next to a garden or flower bed were among the most significant predictors of adulthood beliefs that “trees are calming” and “trees have personal meaning,” as well as having taken a gardening class in the prior year. Other predictors included having spent time outdoors with trees or in parks during childhood. Together, these studies suggest that children’s playtime in the natural environment as well as other experiences impact later life attitudes, knowledge, or behaviors regarding the environment. Other research examines the effects of more structured activities such as environmental education programs.

Environmental Education

Numerous studies have assessed the efficacy of environmental education programs (for review see Rickinson 2001). This research tends to focus on whether environmental education programs bring about change in knowledge and attitudes. Typically, these assessments compare participants to non-participants or examine pre-intervention versus post-intervention environmental knowledge, attitudes, or sensitivity scores within a fairly short time frame (e.g., Armstrong and Impara 1991; Pooley and O’Connor 2000; Ramsey and Hungerford 1989). For example, Jaus (1982) examined the effectiveness of a ten-week environmental education program addressed to fifth graders. He found significant differences in environmental attitude scores of the participants compared to a control group of students who did not take part in the program. When the control group subsequently received the same instruction, they also showed significantly more positive environmental attitudes, in comparison with the pre-test. Cross-sectional data from Kellert (1985) indicates that children who primarily learned about animals in the context of school or at the zoo were generally less appreciative, less knowledgeable, and less concerned about animals than were children who engaged in bird watching, hunting, or belonged to animal-related clubs. While many environmental education studies focus on knowledge and/or attitudes, some examine environmental behaviors as well. Ramsey and Hungerford (1989) found that an “issue investigation and action training” (IIAT) program among seventh graders yielded significant changes in overt environmental behaviors as well as in outcomes related to knowledge and sensitivity. One aspect notably lacking from the environmental education literature is examinations of long-term efficacy of programs beyond days, weeks, or months. A greater understanding of how environmental education programs might influence individuals’ environmental attitudes and behaviors over years, decades and lifetimes would indeed be valuable.

Significant Life Experiences

Significant life experiences research is an area within the field of environmental education that has attempted to explore connections between childhood experiences with nature and adult environmental commitment by employing autobiographical reminiscence. This work bears some resemblance to a life course

approach, although the studies typically employ qualitative methods only and focus exclusively on environmental professionals or activists. These studies do suggest that childhood experience with nature plays a critical role in setting such individuals on a trajectory toward environmentalism.

In the first study of its kind, Tanner (1980) asked 45 dedicated conservationists to describe formative influences in their lives. Hunting, fishing and bird watching during childhood or adolescence were activities most often mentioned by individuals who specified the influence of outdoor activities. Tanner (1980, 23) states that “youthful experience of outdoors and relatively pristine environments emerges as a dominant influence in these lives.” Several subsequent studies have provided support for Tanner’s findings. Peterson and Hungerford (1981) and Corcoran (1999) posed similar questions to environmental educators in the United States; Palmer (1993) studied environmental educators in the United Kingdom; Chawla (1999) conducted open-ended structured interviews with established environmentalists in the U.S. and Norway; and Sward (1999) studied El Salvadoran environmental professionals. The single most important influence on individuals that emerged from these studies was many hours spent outdoors in natural habitats during childhood or adolescence—alone or with others. Other important childhood experiences included the example of parents, teachers, or other adults who fostered an interest in nature; scouting and camping; hunting and fishing; witnessing the destruction or alteration of landscapes or habitats; and media or books.

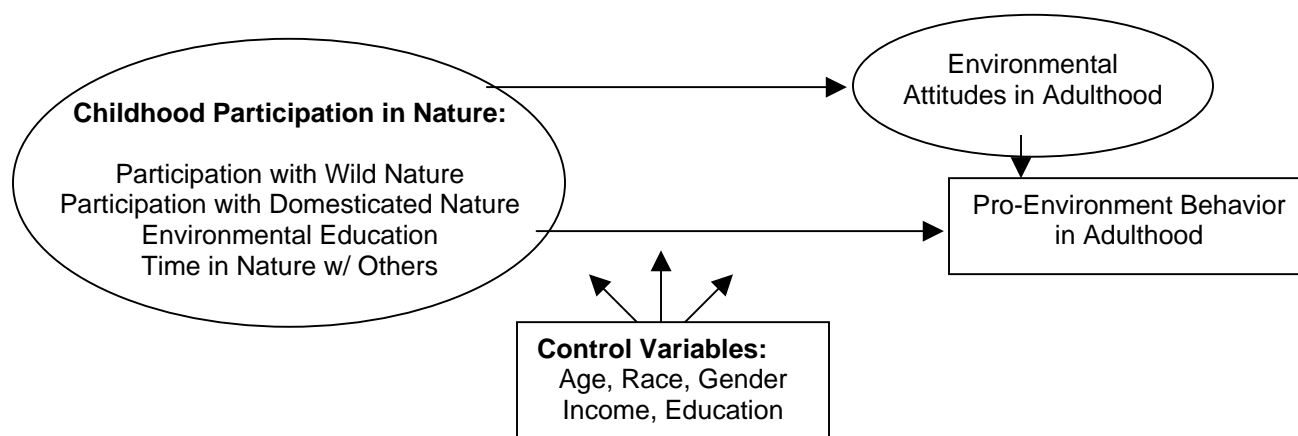
The significant life experiences literature provides further evidence that childhood nature experiences may impact later life environmentalism. However, the exclusive focus on individuals engaged in environmental careers or activism limits the generalizability of these findings. There is need for further research examining the long-term effects of childhood experiences with nature among the general population.

Modeling Environmentalism across the Life Course

Taken together, prior research evidence suggests that childhood experiences with nature are associated with adulthood environmentalism. Time spent outdoors in childhood (Chawla 1999; Ewert, Place and Sibthorp 2005; Kals, Schumacher and Montada 1999; Peterson and Hungerford 1981)—whether playing (Bixler, Floyd and Hammitt 2002), foraging (Chipeniuk 1995), bird watching, hunting, or camping (Ewert, Place and Sibthorp 2005; Kellert 1985; Tanner 1980), or being with another person (Peterson and Hungerford 1981; Sward 1999)—seems to be associated with various adult outcomes related to environmentalism. Moreover, participation in environmental education programs or classes (Jaus 1982; Palmer 1993) and scouts (Chawla 1999) appear to be salient influences. The current study attempts to further our understanding of pathways to environmentalism by employing a long-term, life course perspective rather than focusing on short-term outcomes; using a large representative sample of urban-dwelling adults rather than a select group of environmentalists; and utilizing structural equation modeling to allow an examination of interrelated influences including engagement with both wild and domesticated nature in childhood, participation in environmental education in one’s

youth, and nature experiences shared with other people during childhood. Figure 1 is a conceptual representation of the model to be tested. We hypothesize that adults who, as children, participated more in nature-related activities will report stronger pro-environment attitudes and more frequent engagement in environmentally-friendly behaviors. We examine these relationships while controlling for demographic and socioeconomic variables (including age, race, gender, income, and education).

Figure 1. Conceptual Model: Childhood Participation with Nature and Adult Environmental Attitudes and Behaviors



Research Method

Participants

The data used for this study were obtained from a larger study of childhood environmental experiences and adult sensitivities to urban and community forests¹ (Lohr et al. 1999). The survey included 108 closed-ended questions, averaged 23 minutes in length, and was administered by telephone in Fall 1998. The sampling frame consisted of adults living in the 112 most populated areas of the United States, including at least one metropolitan area in each state except Alaska and Hawaii. Individuals were selected through a combination of random-digit dialing and listed numbers, and those at the listed numbers received a prior notification letter describing the purpose of the study. The final sample included 2,004 individuals, representing a response rate of 51.8 percent. Similar studies have yielded a response rate between 40 percent and 62 percent (Lohr et al. 1999, 6-7). The demographics of the sample were compared to known characteristics of residents within each metropolitan area in order to evaluate the possible existence of sampling bias. Data were similar, indicating that the sample provides a representative sample of the population (Lohr and Pearson-Mims 2005, 473).

The respondents ranged in age from 18 to 90, with a mean age of 45 ($SD = 15.98$). Fifty-six percent were female and 44 percent were male. The majority (57 percent) of participants were white (non-Hispanic). Approximately 40 percent had attained a college degree or higher. Income levels varied considerably, with the largest proportion (28 percent) in the \$30,000-\$50,000 category. Approximately 9 percent earned less than \$10,000 per year and 7.5 percent earned over \$100,000.

Constructs and Measures

Questions posed to participants included items about the frequency of nature-related experiences during childhood, their current (adulthood) attitudes and behaviors, and their socio-demographic background. Responses were either on a four-point scale or of a dichotomous nature (typically "yes or no"). An exploratory factor analysis using Principal Components procedures with Varimax rotation was conducted on a number of items regarding childhood experiences and environmental attitudes. The independent and dependent variables for this model are described below. **Appendix A** presents additional details on all measures.

Independent Variables: Childhood Participation with Nature

The model includes several latent and continuous variables. The independent variables were: participation with nature in childhood, participation in environmental education in childhood, and childhood experiences in nature with other people.

Childhood participation with nature

Participants were asked how often they participated in nature-related activities before the age of 11, and responses were scored on a four-point scale ranging from "never" to "often." Items with factor loadings above 0.40 were identified and placed into two factors, Participation with "Wild Nature" and Participation with "Domesticated Nature." Experiences with Wild Nature consisted of hiking, walking, or playing in the woods or natural areas; camping; and hunting or fishing (Cronbach alpha = .58). Experiences with "Domesticated Nature" consisted of picking flowers, fruits, or vegetables from a garden; planting trees, seeds, or plants; and taking care of indoor or outdoor plants (Cronbach alpha = .78).

Participation in environmental education

For this scale, respondents were asked if they had participated in any of several organized activities before the age of 11: nature or environmental education in elementary school; nature or environmental education outside of school, such as through Boy Scouts, Girl Scouts, or summer camp; and programs aimed at improving the local environment. Due to the dichotomous nature of these responses (no = 0, yes = 1), a composite score was computed, resulting in a scale ranging from 0-3. Because this scale is comprised of dichotomous items, internal consistency is calculated using Kuder-Richardson 21 (KR-21) rather than Cronbach alpha. The KR-21 value was .51.

Nature experiences with other people

Participants were asked with whom they spent time outdoors prior to the age of 11. The questions inquired whether they spent time with a parent or other significant

adult, a teacher or school group, with a sibling, or with a friend. The responses to these were also dichotomous (no= 0, yes= 1) and a composite score ranging from 0-4 was computed. The KR-21 internal consistency score was .36.

Dependent Variables: Adult Environmentalism

Two dependent variables were included in the model. Environmental attitudes in adulthood, which operated as a mediator between childhood nature experiences and adulthood environmental behaviors, was a latent variable. Environmental behaviors in adulthood was included as a continuous variable.

Environmental attitudes

This scale consisted of three items reflecting attitudes toward various aspects of the environment. Participants were asked to what extent they agreed or disagreed with the following statements: "You consider trees to be important to your quality of life," "Natural areas that are untouched by humans should exist," and "Humans have a responsibility to protect nature and the environment." Responses were scored on a four-point Likert scale ranging from "strongly disagree" to "strongly agree." The Cronbach alpha was .47. This variable was treated as a mediating variable, as it was hypothesized to function as both a dependent variable—affected by childhood nature participation—and as an influence on environmental behaviors.

Environmental behavior

This (0-4 point) scale was computed from the dichotomous responses to four questions: "Have you ever voted for or against a candidate for public office based mainly on their views about the environment?" (no= 0, yes= 1); "During the past year, how often have you recycled materials, such as newspapers, glass, or aluminum cans, in your home?" (not at all= 0, somewhat or very often= 1); "During the past year, have you participated in any activity or program to enhance the environment, such as a clean-up on Earth Day?" (no= 0, yes= 1); and, "When you have free time, do you usually prefer to be indoors or outdoors?" (indoors= 0, outdoors= 1). The KR-21 was .30.

Control Variables

The model controlled for five socio-demographic variables. These consisted of age, gender, race (white/nonwhite), highest level of educational attainment (less than college/college degree), and income (seven categories ranging from \$10,000 or less to \$100,000 and over).

Statistical Method

Structural equation modeling (SEM) (Byrne 1994; Kline 1998) was used to test the hypothesized model and to determine the degree to which it fit the sample data. SEM was chosen as it allows for the inclusion of latent and observed variables, as well as multiple dependent variables. In addition, SEM incorporates measurement error, which is of particular relevance because some of the scales used demonstrated only moderate levels of internal consistency. Furthermore, the procedure provides an opportunity to find the parsimonious model with the best fit. Typically, the structural equation modeling process includes the specification of a particular model and subsequent testing, modification, and further evaluation. The

ultimate goal is to find the best-fitting model that yields parameters having practical significance and substantive meaning (Kline 1998; Hoyle 1995; Schumacker and Lomax 2004).

As the first step, the total sample of 2,004 was randomly divided in half to allow for separate model testing and cross-verification. Cross-validation with a random half of the sample is a rigorous and recommended analytic approach to assess whether idiosyncrasies of a sample led to a specific model (Crowley and Fan 1997). Amos 5.0 was used to compute the parameter estimates and fit indices using Maximum Likelihood procedures on one of the two subsamples ($n_1 = 1,002$). A series of nested model comparisons (Bollen 1989) was then examined using the chi-square difference test to determine the best-fitting model. Compared were the baseline null model (M_0), revised model (M_1), fully recursive model (M_2), and parsimonious model (M_3).

The null model (M_0) or “uncorrelated factor model” served as a baseline model (Bentler and Bonett 1980). In this model, there were no paths included between the independent and dependent variables, or between the two dependent variables. The null model included only the factor analysis aspects of the model. The revised model (M_1) included indirect paths from the control variables through the four childhood nature experience independent variables—participation with wild nature, participation with domesticated nature, experiences with environmental education, and shared outdoor experiences—to the dependent variables. Indirect paths were included from the four independent variables through environmental attitudes to environmental behaviors. The fully recursive model (M_2) expanded upon the revised model by adding direct paths from the independent variables to environmental behavior. In the fully recursive model, all independent and dependent variables were linked.

A parsimonious model (M_3) was developed by deleting paths one by one from the fully recursive model, starting with those with the least significant estimates, until a model was found that represented an optimal fit with the fewest necessary paths. As the final step, this parsimonious model was cross-validated using the second subsample to ensure that any idiosyncrasies from the data were not influencing the research results (Crowley and Fan 1997).

Model fit was assessed using the conventional chi-square test, but because the size of the sample ($n_1 = 1,002$) would undoubtedly lead to a significant chi-square value (Hu and Bentler 1995), two additional fit indices were used. The root mean square error of approximation (RMSEA) is insensitive to sample size; an RMSEA of $< .10$ is considered good and $< .05$ is very good (Loehlin 1998). The Comparative Fit Index (CFI) has been recommended for large samples; a CFI over $.90$ is considered to be a good fit (Hu and Bentler 1995).

Results

Model Testing and Evaluation

Null and revised models

As shown in Table 1, the chi-square statistic for the null model (M_0) was 825.46 (120, $N= 1002$), $p < .001$ with a CFI of .727 and RMSEA of .077. Fit indices for the revised model (M_1) indicated a better model fit, χ^2 (94, $N= 1,002$) = 435.35, $p < .001$, with a CFI of .868 and RMSEA of .060. Comparisons between the null (M_0) and revised model (M_1) indicated that the revised model was a significant improvement over the null model, $\Delta\chi^2$ (390.11, 26 df, $N= 1,002$), $p < .001$.

Table 1. Structural model comparisons, $N= 1,002$ (Group 1)

Model	df	χ^2	$\Delta\chi^2$	CFI	Δ df	RMSEA	p value
M_0 Null	120	825.46		.727		.077	.000
M_1 Revised	94	435.35	390.11	.868	26	.068	.000
M_2 Fully Recursive	90	411.45	23.90	.876	4	.060	.001
M_3 Parsimonious	100	417.53	17.82 ^a	.877	6	.056	.03
			6.08 ^b	.881	10	.058	.87

^a M1 - M3

^b M2 - M3

Fully recursive model

For the fully recursive model (M_2), the chi-square statistic was 411.45 (90, $N= 1,002$), $p < .001$, with a CFI of .876 and RMSEA of .060. Model comparisons with the revised model (M_1) indicated a change in χ^2 of 23.90, (4, $N= 1,002$), $p < .001$. This indicated a significantly better fit for the fully recursive model (M_2) than the revised (M_1) (see Table 1).

Best-fitting parsimonious model

The results of the previous models were then used to develop a parsimonious model (M_3). Paths between variables were deleted from the fully recursive model, beginning with those that had the smallest coefficients which were not statistically significant. For each path removed, a chi-square difference test was used to determine if this model was significantly better than the revised model (M_1) without being significantly worse than the fully recursive model (M_2). Paths continued to be deleted until significant findings for the nested model comparisons were obtained. The chi-square for the resulting model was 417.53 (100, $N= 1,002$), $p < .001$ with a CFI of .877 and RMSEA of .056. Comparison with the revised model (M_1) indicated that the parsimonious model was a significantly better fit than the revised model χ^2 (6, $N= 1,002$) = 17.82, $p < .03$. Comparison with the fully recursive model (M_2) indicated that the parsimonious model was not significantly worse than the full model, χ^2 , (10, $N= 1,002$) = 6.08, $p < .87$ (see Table 1). The parsimonious

model (M_3) resulting from the model-testing and evaluation process with the first half of the sample included paths from experiences with wild nature, experiences with domesticated nature, and time in nature with other people during childhood to both adulthood environmental attitudes and adulthood environmental behaviors. In addition, there was a path from environmental education to environmental attitudes and from attitudes to behaviors.

Cross-Validation: Direct, Indirect, and Total Effects

To cross-validate the findings, the parsimonious model was re-run using the second sample subgroup ($n_2 = 1,002$). Results were similar to the first group, $\chi^2(100, N = 1,002) = 405.37, p < .001$, with a CFI of .868 and RMSEA of .055, suggesting that the initial results were not biased by idiosyncrasies of the first sample. R^2 values were .13 for environmental attitudes and .13 for environmental behavior. Standardized coefficients, direct, indirect, and total effects are presented in Figure 2 and in Tables 2 and 3.

Table 2. Standardized Direct Effects for Environmental Attitudes, $N = 1,002$ (Group 2)

Variable	Direct
Wild Nature	.21 **
Domesticated Nature	.16 **
Environmental Education	--
Nature with People	-.08 *

Notes: Dashes represent non-significant paths.

** $p < .05$

* $p < .10$

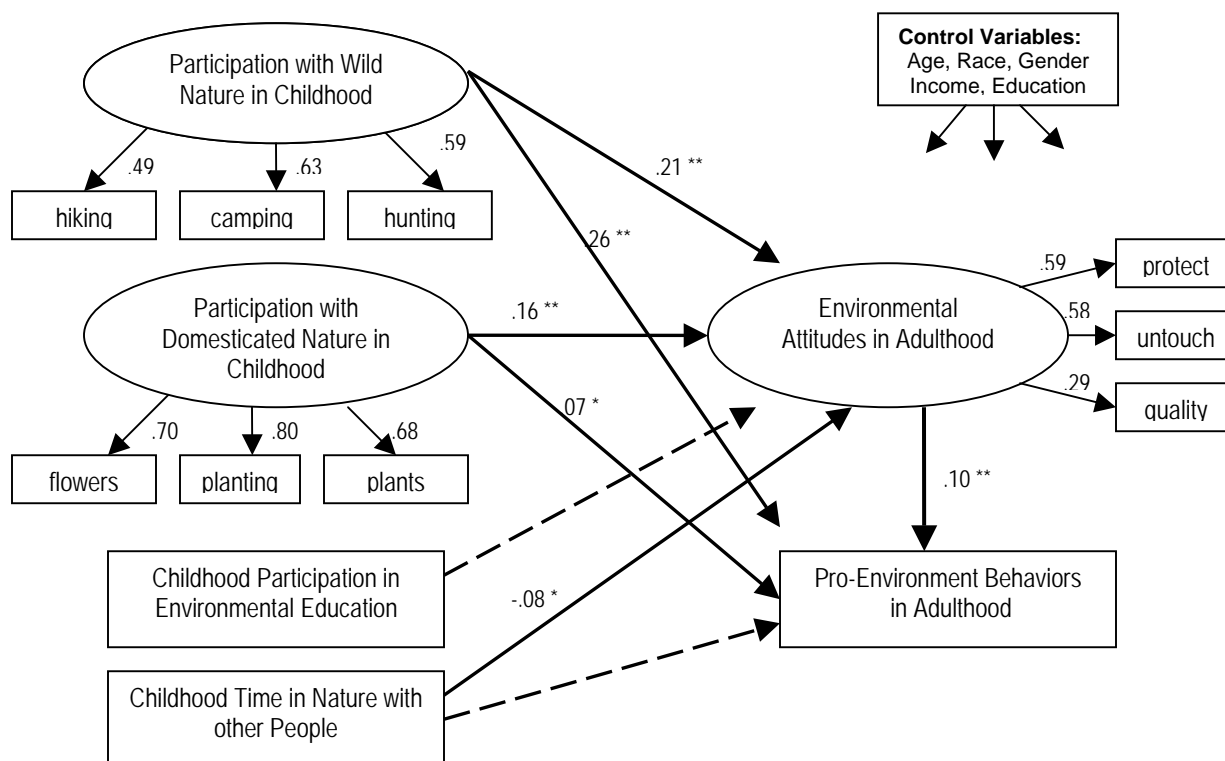
Table 3. Standardized Direct, Indirect, and Total Effects for Environmental Behavior, $N = 1,002$ (Group 2)

Variable	Direct	Indirect	Total
Wild Nature	.26 ***	.02	.28
Domesticated Nature	.07 *	.02	.09
Environmental Education	---	.00	.00
Nature with People	---	.01	.01
Environmental Attitudes	.10 **	---	.10

Note: Significance tests are only reported for direct effects. Dashes represent non-significant paths.

*** $p < .001$ ** $p < .05$ * $p < .10$

Figure 2. The influence of childhood participation with nature on adulthood environmental attitudes and behaviors—the final parsimonious model with standardized estimates, $N = 1,002$ (Group 2)



Notes: Model fit statistics: $\chi^2 = 405.37$, $df = 100$; CFI = .868; RMSEA = .055.

** $p < .05$ * $p < .10$

Dashed pathways indicate non-significance when cross-validated with Group 2.

Effects of Childhood Participation with Nature on Adult Environmentalism

Effects on adult environmental attitudes

Consistent with the hypotheses, childhood “wild nature” participation and “domesticated nature” participation in childhood both had significant direct effects on adult environmental attitudes. The coefficients were .21 and .16 respectively, and were both significant at the $p < .05$ level. Childhood experiences in nature with other people also had a marginally significant ($p < .10$) negative effect on adult environmental attitudes (-.08). However, the effect of environmental education on adult environmental attitudes was non-significant.

Effects on adult environmental behaviors

In the model, the latent variable, adult environmental attitudes, was expected to predict adult environmental behavior. Consistent with the hypothesis, environmental attitudes did operate as a mediator. Specifically, environmental attitudes are both influenced by various forms of childhood participation with the environment and have a positive influence (.10) on environmental behaviors.

Moreover, as hypothesized, childhood participation with wild nature had a significant direct effect on environmental behaviors, as well as an indirect effect through environmental attitudes. As shown in Table 3 and in Figure 2, the direct effect was .26, and the indirect effect was .02, yielding a total effect of .28. Participation with domesticated nature in childhood also was positively associated with environmental behaviors—with a marginally significant ($p < .10$) direct effect of .07 and an indirect effect of .02. Neither childhood participation in environmental education nor childhood experiences in nature with other people had significant effects on adult environmental behaviors.

Discussion

The results of this study indicate that participation with “wild nature” in childhood such as walking, playing or hiking in natural areas; camping; or hunting or fishing has a significant, positive association with both adult environmental attitudes and behaviors. People who engaged in these kinds of activities before the age of 11 were more likely as adults to express pro-environment attitudes and to indicate that they engaged in pro-environment behaviors. In addition, participation with “domesticated” nature during childhood such as harvesting flowers or vegetables, planting trees or seeds, and caring for indoor or outdoor plants, is also positively associated with environmental attitudes, although only marginally associated with environmental behaviors. Also, as predicted, adult environmental attitudes partially mediates the relationship between childhood participation with nature and adult environmental behaviors.

In general, the result linking childhood nature experiences with later life outcomes is consistent with research findings connecting childhood participation with nature and various adolescence or adulthood outcomes including attitudes about plants and trees (Lohr and Pearson-Mims 2005), knowledge of biodiversity (Chipeniuk 1995), indignation about natural protection (Kals, Schumacher and Montada 1999), occupational and recreational preferences (Bixler, Floyd and Hammitt 2002), and ecocentric versus anthropocentric beliefs (Ewert, Place and Sibthorp 2005). The current work also builds on previous findings within the realm of significant life experiences literature that has documented a relation between childhood experiences and adult attitudes among environmental professionals (Chawla 1999; Corcoran 1999; Palmer 1993; Peterson and Hungerford 1981; Sward 1999; Tanner 1980).

The results of the current study suggest that while involvement with “wild” and “domesticated” natural environments both play a role, participation with “wild” nature before age 11 is a particularly potent pathway toward shaping both environmental attitudes and behaviors in adulthood. When children become truly

engaged with the natural world at a young age, the experience is likely to stay with them in a powerful way—shaping their subsequent environmental path. Our findings regarding participation with “wild” and “domesticated” nature are particularly related to those of Ewert and his colleagues (2005), who found “consumptive” outdoor activities during childhood (e.g., hunting or fishing) and “appreciative” outdoor activities during childhood (i.e., time alone in the outdoors enjoying nature) to be predictive of eco-centric versus anthropocentric beliefs among university undergraduate students. Although Ewert and associates provide relatively little detail concerning the measurement of the independent variable constructs, their constructs and findings seem to parallel those of the present study. By including participants from ages 18 to 90, the current study examines longer-term influences of childhood nature participation, thereby extending the work of Ewert, Place and Sibthorp (2005).

Some additional context for interpreting the findings of the current study is provided by Kellert (2002), who argues that it is particularly critical developmentally for children to spontaneously engage with healthy, diverse natural environments. The childhood nature experiences that we, in this study, have characterized as participation with “wild nature” (i.e., hiking, camping or hunting) may be the most likely to provide the kind natural environment engagement that Kellert (2002) describes. Conversely, harvesting flowers or vegetables, planting trees or seeds, and caring for plants may be more structured or programmed, thereby not allowing for extensive, spontaneous engagement with nature. Kellert suggests that “It may be tentatively concluded that ... children’s [orchestrated or restricted] contact with nature in modern society does not exert major or long-term developmental impacts on most young people” (Kellert 2002, 145). This may, in part, shed light on our finding that childhood participation with “domesticated” nature had less influence than participation with “wild” nature on adult environmental attitudes and only a marginal effect on environmental behaviors.

Some findings were contrary to our hypotheses and inconsistent with prior research. First, participation in environmental education programs (in school, in scouts, at camp, or in community environmental improvement programs) was not a significant predictor of either environmental attitudes or behaviors. This result may reflect the limitations of our operationalization of childhood participation in environmental education. Perhaps we have tapped into relatively structured modes of environmental education, rather than more engaging, hands-on versions that may be more likely to have long-term impacts. In other words, this finding ought not be interpreted as an indictment of environmental education, but rather viewed within the context of the specific and somewhat narrow way that we operationalized environmental education. The items used here may not be an adequate representation of environmental education programs and also may not be easily recollected by adults. Moreover, as Rickinson (2001) notes in his review, lack of specific detail about the kind of environmental education people experienced makes it difficult to predict positive outcomes.

A second contradictory finding is that time spent in nature with other people during childhood was marginally negatively associated with adult environmental attitudes,

and not associated with adult environmental behaviors. This finding indicates that the more people spent time in nature with others (i.e., parents, teachers, siblings, friends) during childhood, the *less* pro-environmental attitudes they are likely to have as adults. This is contrary to the results of Peterson and Hungerford (1981) who found that time in nature with others during childhood was among the influences cited by environmental educators as being influential in their own environmental path. One interpretation of our finding is that the way this item was constructed in this study may have tapped into nature-related activities that were mandatory or in some way unpleasant, rather than providing insight regarding positive nature experiences with other significant individuals. Moreover, perhaps solitary play in nature, without the demands or distractions posed by other individuals, may be particularly critical in influencing long-term environmentalism.

Contributions

This study makes several contributions. First, it extends the life course perspective to the exploration of human-natural environment relations with a large sample from the general population. Identifying connections between children's engagement with nature and their later life environmentalism is an important empirical and practical concern. Evidence provided here indicates that early experiences with the natural environment may indeed set a child on a trajectory toward environmentalism. While the significant life experiences literature (e.g., Corcoran 1999; Chawla 1989; 1999; 2001; Kellert 1985; Peterson and Hungerford 1981; Sward 1999; Tanner 1980) has attempted to examine linkages between childhood nature experiences and adulthood, the focus has been explicitly on a select group of individuals—environmental educators and activists—not on the population more broadly. The current study suggests that connections between childhood engagement with the natural environment and later life environmentalism are not limited to individuals who work as environmental educators or activists. In addition, by using structural equation modeling, this study provides a holistic representation of the overall network of influences on the development of environmentalism. In particular, this approach provides insight concerning both direct and indirect (i.e., mediated) pathways to environmentalism.

Limitations

It is important to articulate the limitations of this study so that they might be improved upon in future research. First, due to the use of secondary data, this study did not employ scales with established reliability and validity regarding the various types of childhood participation with nature, adult environmental attitudes or adult environmental behaviors. Issues related to scale reliability are particularly evident in some low internal consistency scores (see Appendix A). One might argue however, that this is not a significant weakness due to the nature of what is being measured. In particular, for the environmental behavior scale ($KR-21 = .30$), it may be reasonable not to expect high inter-item correlations. Each item may reflect a different level of commitment to the environment, such that a person with modest environmental commitment might recycle but not engage in any of the other pro-environment behaviors. Future efforts in scale development might employ the Rasch method. The Rasch approach (Bond and Fox 2001) adopts a probabilistic measurement approach that reflects the variable difficulty of doing various

behaviors (e.g., taking a bath rather than a shower, versus giving up one's car), and the fact that there are various influences and constraints affecting people's ecological behaviors (e.g., whether one's town has public transportation) (Kaiser 1998). A valuable next step in future studies would be to improve the construct validity by using standardized measures. These scales might include Kaiser's (1998) general measure of ecological behavior (using the Rasch method), or the New Environmental Paradigm (NEP) Scale (Dunlap et al. 2000), for example.

Another related limitation of this study was its reliance on retrospective self-report. This methodology compromises the internal validity of the study because causal directionality is ambiguous. In other words, individuals who perceive themselves to be environmentalists as adults might mis-recollect the type or frequency of interaction with the natural environment that occurred during their childhood. In fact, there has been considerable debate regarding the value of significant life experiences literature (Chawla 1998; Chawla 2001; Dillon, Kelsey and Duque-Aristizabal 1999; A. Gough 1999; S. Gough 1999; N. Gough 1999; Payne 1999), focused partly on the validity and reliability of autobiographical reminiscence. The current study included participants ranging in age from 18 to 90, the time span of the retrospective recollection ranges widely—from eight years to eight decades. This may also affect the validity and reliability of the self-report measure.

Future Research

Ideally, future research ought to employ prospective, longitudinal data—objectively recording the children's participation with the natural environment and then tracking these individuals over 20 years, or more, into adulthood. There would be multiple advantages to such an approach. First, issues of causal directionality would be virtually eliminated due to both temporal order and better construct validity. Measures of participation would have greater validity and reliability than those relying on retrospective self-report. We would, therefore, have more confidence that childhood nature experiences do indeed impact adult environmentalism and not the opposite—that adulthood attitudes color or distort recollection of what one did during childhood. Second, a prospective longitudinal approach would allow a more thorough application of the life course perspective. With multiple data points from childhood to adulthood, trajectories and turning points could be more clearly identified and traced over time. For example, one theme in the literature, but not included in this study, concerns experiences of having a special childhood natural area destroyed by development (Corcoran 1999; Chawla 1999; Ewert, Place and Sibthorp 2005). A prospective study would allow a greater understanding of whether such an experience might constitute a turning point—shifting a person from a pathway of environmental indifference toward one of environmental advocacy or commitment.

Even in future cross-sectional or retrospective studies, efforts could be made to improve the validity of the measurement of childhood participation with nature by moving away from self-report. If a prospective study were not possible, another approach might be to ask a parent or sibling to retrospectively report the individual's childhood engagement with nature. This would be another strategy to move the research beyond the mono-method bias threat to internal validity due to

the potentially spurious relationship between childhood nature participation and adult environmentalism.

An additional area for future study concerns gaining an understanding of how different people might follow different pathways from childhood experiences to adulthood environmentalism. The current study suggests that types of nature experiences people have as children partially explain differences in adult environmentalism. Yet, these paths may differ from one person or group to another. In fact, different types of engagement with nature in childhood may mediate associations between socio-demographic characteristics—such as gender, race, and socioeconomic status—and environmentalism. Future research might examine whether boys versus girls, white versus black, or wealthy versus poor children are more likely to engage with nature in specific ways and how that participation in turn may influence environmental attitudes and behaviors. Further exploration of the varied pathways to environmentalism would contribute to the development of environmental programs and targeting of specific outdoor opportunities toward particular youth populations.

On another level, research might look more closely at explanatory or mediating mechanisms concerning how or why childhood nature experiences bolster environmental attitudes and behaviors. What is (are) the underlying mechanism(s)? For example, by spending time in nature, do people develop a sense of connection to the environment, build a greater knowledge structure regarding plants and animals, or gain a sense of responsibility or stewardship for nature which ultimately leads to environmental commitment? Ewert and colleagues (2005) speculate how early childhood outdoor experiences may influence subsequent environmentalism. They suggest three ways that childhood participation in nature may affect the development of individual's values. First, involvement with nature may "precondition" a child toward pro-environment beliefs and attitudes. Second, the social context within which a youngster participates in natural environment activities may exert pro-environment social influences. Third, early nature experiences may lead a child to first feel attached to a specific natural place and later to generalize those feelings to the natural environment more broadly. Chipeniuk (1995), who documents a relationship between childhood foraging for natural objects and adolescent knowledge of biodiversity, provides additional insight. It may be that by foraging or perhaps otherwise engaging with or informally cataloging one's local environment, children build a framework for understanding the world around them. Chipeniuk (1995, 507-508) suggests:

If in fact children do much of their learning about biodiversity and about the effects people have on biodiversity by making use of natural resources, then societies pursuing the goal of sustainability might do better to encourage childhood foraging.

Gaining a clearer understanding of the specific cognitive, affective, social or other mechanisms that underlie the pathways from childhood nature experiences to adult environmentalism is not only of theoretical interest, but can also help us to identify

leverage points that might be targeted in the development of effective, engaging natural environment opportunities for youth.

Conclusions and Implications

I like to play indoors better 'cause that's where all the electrical outlets are
- fourth grader (Louv 2005)

Children living in the United States today reportedly spend, on average, 30 minutes of unstructured time outdoors each week (Hofferth and Sandberg 2000). Increasingly, children spend time indoors—watching television, playing video games, and using computers. In fact, while children age 3 to 12 spend 1 percent of their time outdoors, they spend 27 percent of their time watching television (Hofferth and Sandberg 2000). In addition to its likely contributions to epidemics of childhood inactivity and obesity (Luepker 1999; Sturm 2005) and possibly to rates of Attention Deficit Disorder (Kuo and Faber Taylor 2004), youth spending so little time outside may also lead to a dwindling knowledge about biodiversity (Chipeniuk 1995) and, as this study suggests, less pro-environmental attitudes and reduced participation in environmentally friendly behaviors as adults. Encouraging children to become engaged with the natural world, preserving habitats where they can do so, and creating programs and opportunities for this to occur may be critical to the future of healthy children, healthy adults, and a healthy planet.

Endnote

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**Appendix A. Items comprising Independent and Dependent Variables
(N=2004)**

INDEPENDENT VARIABLES	Internal Consistency¹	ITEMS (With \bar{X} (sd) for continuous items and percent Yes and No for dichotomous items)
Wild Nature Participation [♦] $\bar{X} = 2.75 (.78)$	$\alpha = .58$ (3 items)	<ul style="list-style-type: none"> ▪ Hiking, walking, or playing in the woods or natural areas $\bar{X} = 3.45 (.81)$ ▪ Camping $\bar{X} = 2.42 (1.14)$ ▪ Hunting or fishing $\bar{X} = 2.39 (1.19)$
Domesticated Nature Participation [♦] $\bar{X} = 2.81 (.89)$	$\alpha = .78$ (3 items)	<ul style="list-style-type: none"> ▪ Picking flowers, fruits, or vegetables from a garden $\bar{X} = 3.02 (1.03)$ ▪ Planting trees, seeds, or plants $\bar{X} = 2.64 (1.07)$ ▪ Taking care of indoor or outdoor plants $\bar{X} = 2.75 (1.10)$
Environmental Education* $\bar{X} = 1.18 (1.0)$	KR-21=.51 (3 items)	Participation in activities before the age of 11: <ul style="list-style-type: none"> ▪ Nature or environmental education (EE) in elementary school 31% Y, 69% N ▪ Nature or EE outside of school, such as through Boy Scouts, Girl Scouts, or summer camp 60% Y, 40% N ▪ Programs to improve the local environment 27% Y, 72% N
Time in Nature with Others [♦] $\bar{X} = 2.66 (1.02)$	KR-21=.36 (4 items)	With whom did you spend time outdoors prior to the age of 11: <ul style="list-style-type: none"> ▪ Parent or other significant adult 63% Y, 37% N ▪ Teacher or school group 39% Y, 61% N ▪ Sibling 76% Y, 34% N ▪ Friend 88% Y, 12% N
DEPENDENT VARIABLES		
Environmental Attitudes in Adulthood [♦] $\bar{X} = 3.80 (.33)$	$\alpha = .47$ (3 items)	<ul style="list-style-type: none"> ▪ You consider trees to be important to your quality of life. $\bar{X} = 3.80 (.50)$ ▪ Natural areas that are untouched by humans should exist. $\bar{X} = 3.74 (.61)$ ▪ Humans have a responsibility to protect nature and the environment. $\bar{X} = 3.90 (.34)$
Pro-Environment Behavior in Adulthood [♦] $\bar{X} = 2.11 (.92)$	KR-21=.30 (4 items)	<ul style="list-style-type: none"> ▪ When you have free time, do you usually prefer to be indoors or outdoors? 76% Y, 24% N ▪ Have you ever voted for or against a candidate for public office based mainly on their views about the environment? 25% Y, 75% N ▪ During the past year, how often have you recycled materials, such as newspapers, glass, or aluminum cans, in your home? (0=not at all, 1=somewhat or very often). 89% Y, 11% N ▪ During the past year, have you participated in any activity or program to enhance the environment, such as clean-up on Earth Day? 25% Y, 75% N <p><i>Dichotomous (no=0, yes=1); composite score 0-4 was computed by summing.</i></p>

1. For scales consisting of items measured on a continuous scale, Cronbach alpha was calculated. For scales employing dichotomous items, Kuder-Richardson 21 (KR21) was calculated.
 - ♦ 1-4 score based on mean of 3 items (strongly agree to strongly disagree).
 - ▲ 0-4 score, computed by summing 4 dichotomous items.
 - * 0-3 score, computed by summing 3 dichotomous items.