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THE INFLUENCE OF INTERACTION WITH NATURE IN CHILDHOOD ON FUTURE PRO-ENVIRONMENTAL BEHAVIOR

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Abstract. *Pro-environmental behavior is a key to environmental sustainability. It is important to know which variables influence the development of pro-environmental behavior and how important direct interaction with nature is for future environmental engagement. The aim of the research was to examine the correlation between childhood interaction with nature and pro-environmental behavior as an adult and the mediators influencing this correlation. The respondents (N = 370) were selected by the snowball method and completed an on-line questionnaire. Bivariate correlation and parallel mediation analysis were done. Previous research studies focused mainly on one type of influence, and this research brought a comparison of three mediators. The results confirmed that interaction with nature in childhood affects future pro-environmental behavior. The main mediator seems to be the affective mediator. The cognitive mediator and interaction with nature in adulthood had only a small mediation effect. Children's emotional bonding with nature is the important element for the development of pro-environmental behavior. This appears to be a more effective way of ensuring stronger pro-environmental behavior in the future than building environmental knowledge or relying on sufficient interaction with nature in adulthood.*

Keywords: *affective mediator, interaction with nature, mediation analysis, pro-environmental behavior.*

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Introduction

The public is increasingly aware of today's environmental problems and the ecological consequences of human activities. In order to address these problems, we must try to better understand human behavior and to examine actions in support of ecological sustainability, and other pro-environmental behavior (Schultz & Kaiser, 2012). It is necessary to gain more insights into how individuals become nature conservationists or at least what makes them interested in nature and take good care of it. It is very important to explore what types of experiences lead people to pro-environmental behavior. Several research studies of adult pro-environmental behavior have been done (Bamberg & Möser, 2007; Gifford & Nilsson, 2014) and several models of the causes of pro-environmental behavior have been proposed (Ajzen, 1985; 1991; Hines et al., 1987; Hungerford & Volk, 1990; Schwartz, 1977; Stern et al., 1999) in an attempt to clarify why people do what they do and what facts and instruments can support best practice. People are affected by a series of influences over time; their behavior evolves continually, and influences in childhood can be essential for their future pro-environmental behavior.

One of the possible factors of influence seems to be interaction with nature. The idea that experiences acquired in childhood can have a fundamental effect on children's behavior and can last into adulthood has been often discussed in environmental education as well as in other fields (Cheng & Monroe, 2012; Lamanauskas & Vilkonis, 2005; Mayer & Frantz, 2004; Müller et al., 2009; Wells & Lekies, 2006). Can one's childhood interaction with nature direct one's behavior to act respectfully and responsibly toward the environment? What are the key moments that cause this pro-environmental direction?

Although people are part of nature, we usually think of nature as an environment without an obvious human impact, an environment that includes all the biomes and landscapes, all the living and non-living elements like water, stones, etc. Clayton and Opotow (2003) have used the term nature or natural environment for an environment where there is a minimal or not an obvious human impact on the living creatures of that environment (trees and animals) and also on the non-living parts of nature (like seashores). Further, the term natural environment has been broadly defined to "include any kind of environment, place or setting where vegetation and other natural elements (such as water) are dominantly present" (Steg et al., 2012, p. 50).

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Nature as it is used in the present research refers to the first meaning of Castree´s concept of external nature – "the non-human world, especially those parts barely affected by humans" (Castree, 2013, p. 9-10). Castree also pointed out the social context, that nature "is not really "over there", it is just that we think it is" (p. 12). It is possible to differentiate degrees of naturalness and thus distinguish an "antropogenic" nature from a variously "untouched" nature, bearing in mind that the border line is not obvious and that it is influenced by human socio-cultural perception. In this way the research included experiences taking place not just in "untouched" but also in semi-natural environments. A child who is in interaction with nature is experiencing a direct physical interaction with nature or with one of its parts. The child can play freely in a backyard, a nearby forest, a meadow, near a river, in a park. As Kellert wrote, even if these places have been influenced by human activity, the important characteristic is that they contain areas and creatures independent of human intervention and control (Kellert, 2002, p.118-119).

Many research studies have explored the connection between children and nature, trying to identify the moments when the transformative life experiences that then influence one's behavior in one's future adult life take place. These research studies usually differ in their methodology, research questions and operationalization, and research sample, as well as in their research approach in general. The purpose and the main contribution of the review of the existing research that follows is to sort these various research studies into a comprehensive overview of the correlation between interaction with nature in childhood and pro-environmental behavior in adulthood.

Significant Life Experiences

Early research studies based on Significant Life Experiences (SLE) retrospectively explored whether children who have had important experiences with nature tend to acquire environmental concern and take environmental action (Corcoran, 1999; Furihata et al., 2007; Hsu, 2009; Palmer et al., 1998a; 1998b, 1999; Sivek, 2002; Sward, 1999; Taner, 1980; Wells & Lekies, 2006). These were mostly qualitative research studies and they focused on environmental educators or conservationists. Based on the respondents' memories, the time spent outdoors in childhood (alone or with parents, teachers or other adults) was reported as a significant influence for individuals (Corcoran, 1999; Chawla, 1999; Furihata et al., 2007; Hsu, 2009; Palmer et al., 1998a; 1998b, 1999; Sivek, 2002; Sward, 1999; Taner, 1980). The other important significant experiences included being a witness to the destruction of a nearby natural habitat and being influenced by the media and books (Corcoran, 1999; Chawla, 1999; Ewert et al., 2005; Furihata et al., 2007; Palmer et al., 1999; Sivek, 2002; Sward, 1999).

A lot of critical comments have been brought up about the methodology of the SLE approach (Dillon et al., 1999; Gough, A., 1999; Gough, N., 1999; Gough, S., 1999; Payne, 1999), but these research studies represent an important line of the research on the effect of one's connection with nature. On the one hand, the research studies have shown that childhood experiences with nature may affect adult pro-environmental behavior. On the other hand, the focus on individuals' personal reminiscences has limited the potential for the generalization of the findings, even when the respondents were engaged in environmental careers or when they were environmental activists. SLE are perceived as a methodological approach opening the nature experiences research, but nowadays the correlation analysis is more appropriate and used methodology in research studies.

Correlation and Comparative Research Studies

A later research approach employed in this field has consisted mostly of quantitative correlation or comparative research studies of a direct and indirect connection between interaction with nature in childhood and pro-environmental behavior in adulthood. One research explored the experiences that adults who acted pro-environmentally had interaction with nature before the age of twenty (Finger, 1994). It identified having an experience with an environmental catastrophe and interaction with nature as two of the most frequently mentioned influences. Wells and Lekies (2006) identified the time spent participating in outdoor activities before the age of eleven as the most significant predictor of pro-environmental behavior. Similarly, a German research concluded that positive experiences with nature strengthen environmental action (Bögeholz, 2006).

A direct connection was suggested in several research studies (Bögeholz, 2006; Duerden & Witt, 2010; Finger, 1994; Wells & Lekies, 2006). They concluded that experience with nature in the past influences present interaction with nature, but it has no effect on pro-environmental behavior. There were other research studies that did not confirm a direct connection, but they demonstrated a particular indirect mediated connection between interac-

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tion with nature and pro-environmental behavior or willingness to protect the environment (Cheng & Monroe, 2012; Kals et al., 1999; Nisbet et al., 2009; Tugurian, 2014; Zhang et al., 2014). Even though the researchers reached similar conclusions in general, they used various mediator variables (mostly affective and cognitive ones), and their research methods of the predictors that lead to protecting nature were also diverse.

Research Studies of a Mediated Connection

Several research studies have proposed that affective factors are the most important predictors of pro-environmental behavior (Kals et al., 1999; Mayer & Frantz, 2004; Otto & Pensini, 2017). Kals et al. (1999) explored *Emotional Affinity toward Nature* (EAN) as an affective predictor of pro-environmental behavior in contrast to a cognitive interest in nature. They assumed that time spent in nature, especially in childhood, can cause an emotional bond with nature that subsequently acts as motivation for nature conservation. The results showed that one's emotional affinity toward nature, interest in nature, and indignation about insufficient nature protection explained 47% of the variance in one's willingness to engage in pro-environmental behavior. EAN as a predictor of pro-environmental behavior was confirmed also by the Müller et al. (2009) research. Affinity toward nature has been studied as several slightly different variables. Mayer and Frantz (2004) used *The Connectedness to Nature Scale* to measure individuals' trait levels of feeling emotionally connected to the natural world. Similarly, other researchers used various other kinds of scales to measure one's sense of connection with the natural environment: *Connectivity to Nature* (Dutcher et al., 2007), nature relatedness measured by *The Nature Relatedness Scale* (Nisbet et al., 2009), *Connection to Nature* (Cheng & Monroe, 2012), *Inclusion with Nature* (Schultz et al., 2004), *Interconnectedness* (Davis et al., 2009) and *The Disposition to Connect to Nature Scale* (Brügger et al., 2011; Otto & Pensini, 2017). The last one seems better suited for research with children because it only minimally relies on self-reflection.

Some researchers have been interested in cognitive factors. They suppose that one's beliefs regarding certain facts are important for one's later commitments. According to Stern's value-belief-norm theory, a direct predictor for environmental responsibility is one's awareness of the consequences for valued objects that can be negative for the environment (Stern, 2000). *Environmental Concern* (Dutcher et al., 2007) and *Awareness of Risks to Nature* (Müller et al. 2009) are other possibilities used as variables for cognitive mediators of pro-environmental behavior. Both studies also qualified them as predictors, although to a lesser degree. According to Larson et al. (2001) and Rosa et al. (2018), greater interaction with nature during childhood is associated with greater interaction with nature in adulthood, which is positively associated with pro-environmental behavior.

In summary, the above overview of the research available to date showed that people's connection with nature and nature's importance in one's life can play a role in pro-environmental behavior. The research studies conducted to date have been aimed at specific aspects of the connection. There are research studies of a direct connection between interaction with nature and pro-environmental behavior or willingness to engage in pro-environmental behavior (Bögeholz, 2006; Duerden & Witt, 2010; Finger, 1994; Wells & Lekies, 2006) or research studies of the importance of affective mediation (Dutcher et al., 2007; Finger, 1994; Kals et al., 1999; Mayer & Frantz, 2004; Nisbet et al., 2009; Wells & Lekies, 2006) and cognitive mediation (Müller et al., 2009). Comprehensive research studies comparing the direct and indirect connections have been conducted only rarely (Müller et al., 2009; Otto & Pensini, 2017). Despite some conceptual differences, these research studies have shown that one's connection with nature varies among individuals and can be considered a relatively constant trait. Most of the research studies concerned with affective connectedness have confirmed that one's connection with nature is based on affective experiences rather than on cognitive appraisals only (Kals & Müller, 2012). The limitation of these research studies is that they have used different variables and different measuring tools. They have mainly focused on one type of influence, they have not compared several types together. This research brought a comparison of three mediators which are discussed below.

Research Aim and Research Questions

The aim of this research was to explore the connection between one's experiences in nature as well as the amount of time spent in nature as a child and one's pro-environmental behavior as an adult. The above review of existing research has indicated that one's experiences in nature may lead to pro-environmental behavior. Therefore, identifying the connection in more detail can be useful in further research as well as in the practice of environmental protection.

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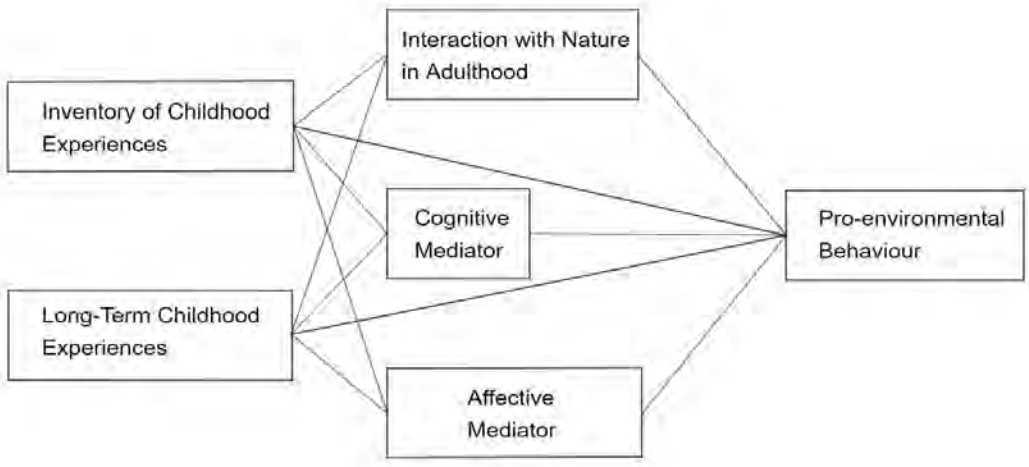
The present research attempted to answer three research questions. Firstly, is there a correlation between interaction with nature in childhood and pro-environmental behavior in adulthood, and what is the strength of this correlation? Secondly, is the connection between interaction with nature and pro-environmental behavior mediated by a predictor? And thirdly, what is the strength of the mediated influence?

Research Methodology

General Background

The research was designed as an exploratory quantitative research, with the data gathered by a questionnaire. There were three predictors of the connection between interaction with nature in childhood and pro-environmental behavior in adulthood: Interaction with Nature in Adulthood, the Cognitive Mediator, and the Affective Mediator (see Figure 1). Interaction with Nature in Childhood was measured retrospectively by the activities that the respondents experienced in childhood. Recalling previous behavior and expressing rather concrete personal preferences did not require any connection with nature-related self-reflection. In other words, behavioral self-reports and specific evaluative statements concerning nature were easy to answer because they primarily rest on recollection; as such, they were probably not particularly vulnerable to response biases (Brügger et al., 2011). Pro-environmental Behavior and the Affective Mediator and the Cognitive Mediator measured the respondents' present behavior.

Figure 1
Explanatory design



Participants

The respondents in the sample (N = 370, female = 255, male = 115) were adults who were not interested in nature conservation, they did not study or work in this field. The respondents were chosen from the Moravian part of the Czech Republic and randomly selected online by the snow-ball method (Fricker, 2008). The first respondents were asked to recruit more informants with the same characteristics as mentioned above. Virtual snowball sampling was used as a cost-effective alternative to a representative random sampling while recognizing all the limitations of this type of sampling (Johnson, 2014). The sample size was determined using the rule suggested by Hair et al. (2014). They recommended that sample size should be equal or greater than 5 observations per variable (Hair et al., 2014). The questionnaire for this research has 54 items, so the number of respondents needed to exceed 270.

The questionnaire was self-completed by the respondents. The age ranged from 19 to 66, the mean age was 28.85. Of this sample, 261 had attained a college degree and 96 had completed a post-graduate degree. The size of the towns in which the respondents grew up was distributed equally from rural areas to large cities. The relevant APA ethical, legal, and professional standards in publishing were followed (APA, 2019).

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Instrument and Procedures

All of the participants received an identical, online, five-part questionnaire and instructions how to fill it in. They anonymously supplied their basic sociodemographic information, including age, gender, education level, the size of the town in which they grew up, and whether their college education was related to nature conservation. In addition, all of the participants completed the following scales (see Table 1). As recommended by Šorgo (2017), for the questionnaire see the Appendix A.

Table 1
Scales used in the questionnaire

Measured variable	Scale	Items (*N*)	Researcher(s)	Reliability
Interaction with Nature in Childhood	Long-Term Childhood Experiences	10		
	Inventory of Childhood Experiences	30	Krajhanzl & Vostradovska (2005); Zhang et al. (2014)	α = .88; α = .71
Pro-environmental Behavior	General Ecological Behavior scale (GEB)	20	Kaiser (1998), Kaiser & Wilson (2000, 2004)	α = .72-.88
Interaction with Nature in Adulthood	Interaction with Nature in Adulthood	4		
Affective Mediator	Disposition to Connect with Nature	40	Brügger, Kaiser, & Rozcen (2011)	α = .89
Cognitive Mediator	Environmental Concern	5	Dutcher et al. (2007)	α = .77
	Awareness of Risks to Nature	9	Müller, Kals, & Pansa (2009)	α = .76

Interaction with Nature in Childhood was measured retrospectively by the activities that the respondents experienced in nature in childhood. Having just one experience or spending time in nature repeatedly may have a different effect. Therefore, Interaction with Nature in Childhood was divided into two parts: One-Time Childhood Experiences and Long-Term Childhood Experiences. Pilot testing of both scales was done to validate the comprehension and meaning of the items ($N = 12$). The basic criteria for the selection of the items were the factuality and measurability of the nature experiences remembered from childhood. The respondents only determined if they had had the experience or not, without any deep reflection on how important this experience was for their future behavior.

Long-Term Childhood Experiences were measured by 10 items; the respondents reported how many years they had practiced a particular activity in nature. There were activities like: "We had a garden near the house or in community gardens;" or: "We spent one weekend a month at a country cottage." These activities are typical in the Czech context and there is a strong probability of more frequent and more intense interaction with nature. The range was supplemented by the years spent by doing these types of activities. The reliability of the measured Long-Term Childhood Experiences was rather low, α = .59; therefore, exploratory factor analysis was conducted to extract different factors. Two major factors were identified: Rural Nature Experiences (four items) and Leisure-Time Nature Experiences (three items; see Appendix A). Rural Nature Experiences explained 24 % of the variance in the scores, whereas Leisure-Time Nature Experiences explained 18 % of the variance. Finally, the Long-Term Childhood Experiences variable was substituted by two other variables: Children's Rural Nature Experiences (α = .64) and Children's Leisure-Time Nature Experiences (α = .61).

One-time Childhood Experiences were assessed with an abbreviated version of the 69-item Inventory of Childhood Experiences (Krajhanzl & Vostradovska, 2005). 26 items from the original Inventory were used, supplemented by 3 items connected with interaction with nature from Zhang et al. (2014) and one new item (see Appendix A). The abbreviated scale contained the items with high internal consistency and, simultaneously, the items mentioned by all of the respondents in the pilot testing were excluded. The respondents reported whether they had gained the experience before or after they were 18 years old or never. The reliability of the Inventory of Childhood Experiences scale used was α = .82.

Pro-environmental Behavior was measured by the General Ecological Behavior (GEB) scale, a well-known and often-used instrument based on Campbell's paradigm, providing comprehensive data for the present research

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(Kaiser, 1998; Kaiser et al., 2010; Kaiser & Wilson, 2000; 2004). According to Campbell (1963, p. 160), any performed behavior involves costs (personal effort and resources) that constitute the difficulty level of the behavior (Kaiser et al., 2010, p. 3). The fewer the costs that the behavior has, the more likely a person is to carry it out. The levels of behavior difficulty are approximated by the number of people who behave in a certain way (Kaiser & Wilson, 2000, p. 954). Thus, the more demanding the behavior that a person engages in, the more pro-environmentally this person generally behaves.

The 50-item GEB scale was translated and adapted to Czech conditions in the same way as in Urban's (2015) research, and then a shortened version of 20 items was used. In terms of the normal distribution of the items' difficulty levels, the same number of items was selected from each decile. The second condition was the inclusion of all the six behavior domains. The scale was shortened because of the overall length of the questionnaire. A yes/no format was used for the 10 items of behaviors related to waste disposal, and for the other 10 items, a 5-point polytomous response format was used. The answers "I don't know" as a response option were coded as missing values. The reliability of the GEB scale was Cronbach's alpha = .66.

Three mediators were tested: Interaction with Nature in Adulthood, a Cognitive Mediator, and an Affective Mediator. Interaction with Nature in Adulthood was measured by the amount of time spent in nature last week and last month. The aim was to measure the frequency and the time that the respondents spent in nature as a possible motivator toward pro-environmental behavior.

The Affective Mediator was measured by the Disposition to Connect with Nature scale (Brügger et al., 2011). It is an attitude measurement assessing people's connection with nature that only minimally relies on self-reflection (Brügger et al., 2011, p. 332). An alternative approach is grounded in Campbell's paradigm (Kaiser et al., 2010). Brügger et al. (2011, p. 325) proposed that Campbell's paradigm requires the presupposition that the extent of a person's overall connection with nature can be indirectly derived from an inspection of both (a) reports of past activities that provide a bonding with nature and (b) responses to evaluative statements that reflect one's view of nature. The higher the appreciation in the evaluative statements and the more of the reported bonding activities, the more obvious a person's connection with nature is expected to be. A participant's Disposition to Connect with Nature was measured by 40 items with two different response formats: for 17 items, a 3-point frequency scale from 1 (never) to 3 (often) was used, and for 23 items, a dichotomous yes/no format was used.

The Cognitive Mediators that were measured were Environmental Concern and Awareness of Risks to Nature. For measuring Environmental Concern, a scale from Ellis and Thompson (1997) as cited by Dutcher et al. (2007) was used. Five items were scored using a 5-point Likert scale (1 = strongly disagree and 5 = strongly agree), and the second and fourth items were reverse-coded (see Appendix A). The reliability of the original scale was alpha = .77, and the reliability of this measurement was alpha = .86. Awareness of Risks to Nature was measured by a scale used in Müller et al. (2009). Nine items were used to measure Awareness of Risks to Nature on a 5-point Likert scale, where 1 = strongly disagree and 5 = strongly agree (see Appendix A). Six out of the nine items were negatively formulated. The responses to these items were reversed in coding. The reliability of the Disposition to Connect with Nature scale as an Affective Mediator was $\alpha = .90$ and the reliability of the Cognitive Mediator was $\alpha = .86$.

Data Analysis

Missing data were excluded, and Spearman Rank-order correlation analysis for the main variables was conducted at the significance level of $p < .05$. Due to using Bonferroni correction, the significance level for mediation analysis was set to $p < .017$. For mediator analysis, the parallel mediator analysis (Hayes, 2018) was used because of the weak correlations among the mediators. The data were analyzed with the Statistical Package for the Social Sciences (SPSS) Version 22.0 with Process 3.2 macro and R 3.2.2 software and with the Statistica data analysis software system, version 13.

Research Results

The results described below present the general findings regarding the explanation of the connection between interaction with nature and pro-environmental behavior.

In order to find out what the correlations between these variables were like, the first step was to use bivariate correlation (for correlation matrix, see Table 2). The Inventory of Childhood Experiences correlated with all the variables except the Cognitive Mediator. GEB related significantly to almost all of the dependent variables. The

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correlations significantly rose mutually between mediators, $r = .42$, $p < .0001$ between the Cognitive and Affective Mediators, $r = .35$, $p < .0001$ between the Affective Mediator and Interaction with Nature in Adulthood.

Table 2
Inter-correlations for the main variables (N = 325-370)

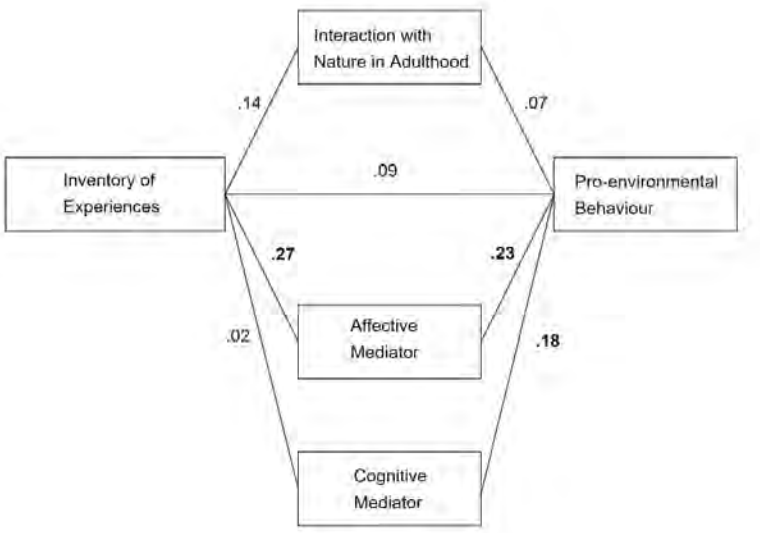
Scale	1	2	3	4	5	6	7
1. GEB	-	.17**	-.02	.02	.31**	.38**	.32**
2. Inventory of Childhood Experiences		-	.23**	.31**	.29**	.31**	.04
3. Rural Nature Experiences			-	-.01	.03	.22**	.11**
4. Leisure-Time Nature Experiences				-	.19**	.16**	.03
5. Interaction with Nature in Adulthood					-	.35**	.11*
6. Affective Mediator						-	.42**
7. Cognitive Mediator							-

*** p <.01, * p <.05*

As the second step, a parallel mediator analysis with three mediators (Interaction with Nature in Adulthood, Affective Mediator, Cognitive Mediator) was conducted for each of the observed types of Interaction with Nature in Childhood (the Inventory of Childhood Experiences, Rural Nature Experiences, and Leisure-Time Nature Experiences).

The Inventory of Childhood Experiences had no significant direct effect on environmental behavior ($p = .08$), but there was a significant indirect effect with full mediation of the Affective Mediator (Figure 2). The other two mediators did not mediate GEB significantly.

Figure 2
Model of the effect of the Inventory of childhood experiences on GEB with three mediators (regression coefficients in bold are significant on level p <.017)



Rural Nature Experiences did not have a significant effect on Pro-environmental Behavior while the effect was significantly indirectly mediated by the Affective Mediator. Interaction with Nature in Adulthood and the Cognitive Mediator did not mediate GEB significantly. Therefore, in this model (Figure 3), there was a full mediation by the Affective Mediator.

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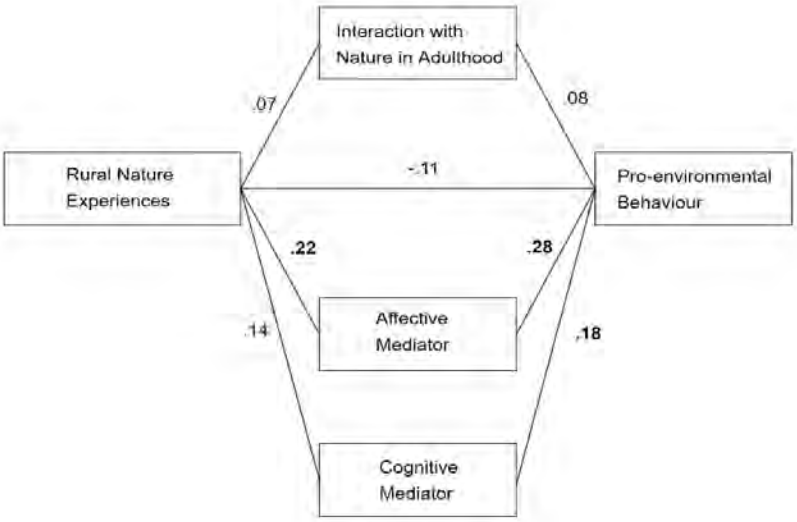
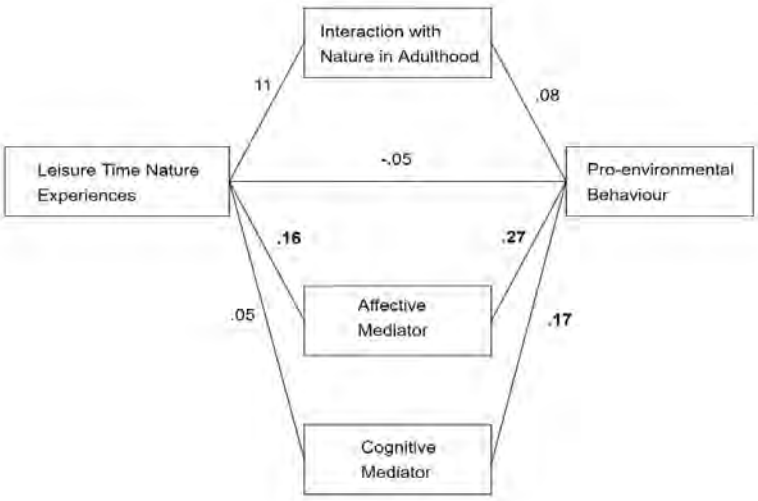
Figure 3
Model of the effect of Rural nature experiences on GEB with three mediators (regression coefficients in bold are significant on level p <.017)



Leisure-Time Nature Experiences had no significant direct effect on environmental behavior (p = .28). In the model (Figure 4), the indirect effect was fully mediated by the Affective Mediator while the other two mediators did not mediate environmental behavior significantly.

Figure 4
Model of the effect of Leisure Time Nature Experiences on GEB with three mediators (regression coefficients in bold are significant on level p <.017)



Discussion

Direct Connection between Interaction with Nature and Pro-Environmental Behavior

A direct connection between the Inventory of Childhood Experiences and General Ecological Behavior (GEB) was confirmed by bivariate correlation. Similar conclusions were also presented in Bögeholz (2006), Finger (1994), and Wells and Lekies (2006). But this direct connection was not identified by parallel mediator analysis. It was

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identified just a negative connection between Rural Nature Experiences and GEB. This is in opposition to the belief that positive emotions connected with nature and pro-environmental behavior are based on recurring interaction with nature as claimed in the Hinds and Sparks research (2008). It could mean that a childhood spent in a rural area is not a predictor of pro-environmental behavior on its own and the participation of other factors is essential.

Indirect Connection between Interaction with Nature and Pro-Environmental Behavior

Parallel mediator analysis confirmed an indirect connection between the Inventory of Childhood Experiences and General Ecological Behavior through the Affective Mediator. A similar mediation effect of the Affective Mediator was also recorded in the case of Rural Nature Experiences and Leisure-Time Nature Experiences. This result agrees with research studies that tested some of the affective types of (Bailey, 2014; Dutcher et al., 2007; Cheng & Monroe, 2012; Hinds & Sparks, 2008; Kals et al., 1999; Nisbet et al., 2009; Tugurian, 2014). A similar survey was presented by Montada et al. (2007). They showed that the psychological impact of emotions is a predictor of long-term conservation action, even though it could be changeable in the short term. The time spent in nature as a child can lead to an affective connection with nature, which is a strong mediator of pro-environmental behavior Müller et al. (2009) (p. 65). Also, in environmental education research, affective connectedness to nature seems to be a premise for engagement in pro-environmental behavior (Frantz & Mayer, 2014; Kossack & Bogner, 2012; Roczen et al., 2014). If the affective connectedness to nature as the degree of the closeness between a person and nature is considered, like other connections, it can be preserved or improved by interaction and nature experiences (Kals & Maes, 2002; Otto & Pensini, 2017).

The mediation effect of the Cognitive Mediator was not registered. According to Stern (2000), Awareness of Risks to Nature is a crucial variable for the development of conservation action regarding the environment. As a mediator of pro-environmental behavior in this research, Awareness of Adverse Consequences for Nature and Environmental Concern as Cognitive Mediators have a negligible effect. The other possibility is to measure environmental knowledge as an alternative Cognitive Mediator like Duerden and Witt (2010) did. Further, Otto and Pensini (2017) examined environmental knowledge and its effect on ecological behavior. They proved the effect, but they emphasized that the effect of affective connectedness to nature on ecological behavior is considerably stronger (Otto & Pensini, 2017).

Only the amount and frequency of interaction with nature correlated with GEB and with two variables that described childhood experiences (the Inventory of Childhood Experiences, and Leisure-Time Nature Experiences). The mediation effect was not proved. How much time a young or adult person spends in nature may contribute to positive feelings and an affective connection toward nature (Müller et al., 2009), which can be confirmed by the correlation between these variables. However, even when nature is valued as part of ourselves, there is a willingness to protect it (Pensini et al., 2016). Positive emotional experiences with nature are fundamental for the development of the connection to nature especially in childhood if these experiences are linked with significant others (Duerden Witt, 2010; Müller et al., 2009).

This finding can be used to support various environmental education programs. Regarding a particular environmental education topic, it is less important whether it fits the children's age than whether it is passed on with positive emotional bonding, creating a positive affective connection between the children and nature that can develop into their pro-environmental behavior. Since an affective connection to nature can be cultivated through interaction with nature (Mayer & Frantz, 2009; Pensini et al., 2016), longer-lasting or more frequent nature-based environmental education programs will have a stronger impact on pro-environmental behavior than shorter or less frequent ones (Chawla & Cushing, 2007; Otto & Pensini, 2017). Furthermore, repeated visits to natural areas (Schultz & Tabanico, 2007), as much natural environment as possible (Mayer & Frantz, 2009), nature close to home (Cheng & Monroe, 2012) as well as children's close assisted interaction with nature during which the children feel entertained and relatively safe (Clayton & Myers, 2009, p. 134) are all positively related to the affective connection to nature.

Limitations

The research was framed as a retrospective research in spite of the limitations inherent in these kinds of research studies. There has been some debate about the positives and the negatives of retrospective research studies. Some researchers have observed that retrospective research studies artificially inflate treatment effects (Taylor et al., 2009). In contrast, Hawkins (2009) argued that the researchers of traditional direct research studies

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did not acknowledge the biases of traditional research studies – social desirability and situational determinants – that may also inflate test scores.

The respondents reported their actual pro-environmental behavior and recalled their experiences regarding interaction with nature when they were children. The retrospective approach could be restricting because the respondents had to remember knowledge and experiences they had in the past instead of their present dispositions (Duerden & Witt, 2010, p. 391). It would be difficult for the respondents to identify the exact period when they had the experience and what it was like, but it is sufficient that they knew for sure that they had had this actual experience.

The self-reported answers of the respondents were minimalized by selecting appropriate measurement scales. Instead of the Significant Life Experiences (Sward, 1999), the respondents named their childhood experiences without any evaluation of their importance. Issues like social desirability and the consistency motive remained, and they could have caused a bias of increased correlations between the variables (Podsakoff et al., 2003).

The research used a non-representative sample for the research because the aim was to measure a general connection between the variables. A virtual snowball sampling method was used for data collection. The convenience sample of the respondents obtained by this method does not allow for the results to be generalized to the whole population because of the sampling bias. Despite the impossibility of generalization, the analyses have been carried out "because the sample can provide useful information for answering questions and hypotheses." (Creswell, 2012, p. 146).

As another limitation, other causal connections are possible. The reported amount of time spent in nature could have been misreported due to emotional distortions. Positive emotions toward nature might cause people to think that they had spent more time in nature as children than they really had (Kals et al., 1999, p. 196). An alternative explanation for the results can be that connection to nature can motivate interaction with nature (Soga & Gaston, 2016).

The methodological limitations include the questionable reliability of the Long-Term Experiences scale (mentioned above).

Further Research

The most suitable experimental approach for minimalizing self-reported bias and retrospective recalling appears to be a longitudinal research. It is valuable for the continual observation of the phenomenon, but it is also time-consuming. Both longitudinal research and retrospective research have their advantages and disadvantages.

The correlation between one's interaction with nature in childhood and one's pro-environmental behavior in adulthood should be explored in different cultural and natural conditions that can have a bearing on one's affective connection with nature (Müller et al., 2009, p. 66). One's connection with nature is also affected by other variables, such as family values, preceding experiences with nature not only in childhood, education, etc. (Kals et al., 1999). Especially the last one mentioned variable is very important for the one's correlation with nature, because of the teachers´ influence and their content knowledge of nature science education (Lamanauskas, 2009).

Another possibility is to test this connection on a sample of children's population with the presumption that if a person behaves pro-environmentally as a child, he or she will behave that way also later as an adult (Cheng & Monroe, 2012, Evans et al., 2007a; 2007b; Zhang et al., 2014).

Conclusions and Implications

Interaction with nature in childhood has been discussed widely in the fields of education, environmental conservation and sustainable living. These discussions and the accompanying research have included not only the benefits of being in nature for children's physical and mental development, but also the potential effect on children's future action which can lead to more pro-environmental behavior in adulthood.

This research has confirmed that children's interaction with nature is associated with their pro-environmental behavior in adulthood. Regardless of the type of nature experience, it has been found that the connection between interaction with nature and pro-environmental behavior seems to be realized mainly through the Affective Mediator – people's affective connection with nature. It has been shown that developing an emotional bond between a child and nature is a much more effective way of ensuring a more pro-environmental behavior in the future than building environmental knowledge or relying on sufficient interaction with nature in adulthood.

The strength of the emotional bond between a child and elements of nature is a fundamental influence on

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that child's future behavior toward the natural environment. Previous research studies had established a number of tools for measuring certain forms of connectedness with nature or have measured solely the cognitive influence of information or solely the influence of time spent in nature. In this research, we put three of the most often used variables into interaction through parallel mediation and we can state (subject to the research limitations mentioned above) that interaction with nature (the form, amount and frequency) in childhood leads to pro-environmental behavior in adulthood. This is so not because of the time spent in nature itself, nor because of the knowledge about the natural environment, but mainly because of the emotional bond that was developed in childhood. This information can be useful mainly for educators in that it can help them to design effective environmental programs and projects.

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References

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl, & J. Beckmann (Eds), *Action control* (pp. 11-39). Springer. https://doi.org/10.1007/978-3-642-69746-3_2

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179-211. https://doi.org/10.1016/0749-5978(91)90020-T

APA (2019). *Publication manual of the American psychological association* (7th Ed.). APA.

Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, *27*(1), 14-25.

Bailey, K. (2014). The role of childhood environment and outdoor exposure on connectedness to nature. Doctoral thesis, Gallaudet University, Washington, DC.

Bögeholz, S. (2006). Nature experience and its importance for environmental knowledge, values and action: Recent German empirical contributions. *Environmental Education Research*, *12*(1), 65-84. https://doi.org/10.1080/13504620500526529

Brügger, A., Kaiser, F. G., & Roczen, N. (2011). One for all? Connectedness to nature, inclusion of nature, environmental identity, and implicit association with nature. *European Psychologist*, *16*, 324-333. https://doi.org/10.1027/1016-9040/a000032

Campbell, D. T. (1963). Social attitudes and other acquired behavioral dispositions. In S. Koch (Ed.), *Psychology: A study of a science* (pp. 94-172). McGraw-Hill.

Castree, N. (2013). *Making sense of nature*. Routledge.

Chawla, L. (1999). Life paths into effective environmental action. *The Journal of Environmental Education*, *31*(1), 15-26. https://doi.org/10.1080/00958969909598628

Chawla, L., & Cushing, D. F. (2007). Education for strategic environmental behavior. *Environmental Education Research*, *13*(4), 437-452. https://doi.org/10.1080/13504620701581539

Cheng, J. C. H., & Monroe, M. C. (2012). Connection to nature: Children's affective attitude toward nature. *Environment and Behavior*, *44*(1), 31-49. https://doi.org/10.1177/0013916510385082

Clayton, S., & Myers, G. (2009). *Conservation psychology: Understanding and promoting human care for nature*. John Wiley & Sons: Hoboken.

Clayton, S. D., & Opotow, S. (2003). *Identity and the natural environment: The psychological significance of nature.* Mass, MIT Press.

Corcoran, P. B. (1999). Formative influences in the lives of environmental educators in the United States. *Environmental Education Research*, *5*(2), 207-220. https://doi.org/10.1080/1350462990050207

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Pearson.

Davis, J. L., Green, J. D., & Reed, A. (2009). Interdependence with the environment: Commitment, interconnectedness, and environmental behavior. *Journal of Environmental Psychology*, *29*(2), 173-180. https://doi.org/10.1016/j.jenvp.2008.11.001

Dillon, J., Kelsey, E., & Duque- Aristizabal, A. M. (1999). Identity and culture: Theorising emergent environmentalism. *Environmental Education Research*, *5*(4), 395-405. https://doi.org/10.1080/1350462990050405

Duerden, M. D., & Witt, P. A. (2010). The impact of direct and indirect experiences on the development of environmental knowledge, attitudes, and behavior. *Journal of Environmental Psychology*, *30*(4), 379-392. http://dx.doi.org/10.1016/j.jenvp.2010.03.007

Dutcher, D. D., Finley, J. C., Luloff, A. E., & Johnson, J. B. (2007). Connectivity with nature as a measure of environmental values. *Environment and Behavior*, *39*(4), 474-493. https://doi.org/10.1177/0013916506298794

Ellis, R. J., & Thompson, F. (1997). Culture and the environment in the Pacific Northwest. *American Political Science Review*, *91*(4), 885-897. https://doi.org/10.2307/2952171

Evans, G. W., Brauchle, G., Haq, A., Stecker, R., Wong, K., & Shapiro, E. (2007). Young children's environmental attitudes and behaviors. *Environment and Behavior*, *39*(5), 635-658. https://doi.org/10.1177/0013916506294252

Evans, G. W., Juen, B., Corral-Verdugo, V., Corraliza, J. A., & Kaiser, F. G. (2007). Children's cross-cultural environmental attitudes and self-reported behaviors. *Children Youth and Environments*, *17*(4), 128-143.

https://doi.org/10.33225/jbse/20.19.536

Ewert, A., Place, G., & Sibthorp, J. (2005). Early-life outdoor experiences and an individual's environmental attitudes. *Leisure Sciences*, *27*(3), 225-239. https://doi.org/10.1080/01490400590930853

Finger, M. (1994). From knowledge to action? Exploring the relationships between environmental experiences, learning, and behavior. *Journal of Social Issues*, *50*(3), 141-160. https://doi.org/10.1111/j.1540-4560.1994.tb02424.x

Frantz, C. M., & Mayer, F. S. (2014). The importance of connection to nature in assessing environmental education programs. *Studies in Educational Evaluation*, *41*, 85-89. https://doi.org/10.1016/j.stueduc.2013.10.001

Fricker, R. (2008). Sampling methods for web and e-mail surveys. In N. Fielding, R. M. Lee, & G. Blank (Eds.), *The SAGE handbook of online research methods* (pp. 195-216). SAGE Publications.

Furihata, S., Ishizaka, T., Hatakeyama, M., Hitsumoto, M., & Ito, S. (2007). Potentials and challenges of research on "Significant Life Experiences" in Japan. *Children Youth and Environments*, *17*(4), 207-226.

Gifford, R., & Nilsson, A. (2014). Personal and social factors that influence pro-environmental concern and behaviour: A review. *International Journal of Psychology*, *49*(3), 141-157.

Gough, A. (1999). Kids don't like wearing the same jeans as their mums and dads: So whose 'life'should be in significant life experiences research? *Environmental Education Research*, *5*(4), 383-394. https://doi.org/10.1080/1350462990050404

Gough, N. (1999). Surpassing our own histories: Autobiographical methods for environmental education research. *Environmental Education Research*, *5*(4), 407-418. https://doi.org/10.1080/1350462990050406

Gough, S. (1999). Significant life experiences (SLE) research: A view from somewhere. *Environmental Education Research*, *5*(4), 353-363. https://doi.org/10.1080/1350462990050402

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Pearson New International Edition. Multivariate Data Analysis.* Harlow: Pearson Education.

Hayes, A. F. (2018). *Introduction to mediation, moderation and conditional process analysis: a regression-based approach* (2nd Ed.). Guilford Press.

Hawkins, A. J. (2009). Retrospective deflation vs. situational inflation. *American Journal of Evaluation*, *30*(3), 440-441.

Hinds, J., & Sparks, P. (2008). Engaging with the natural environment: The role of affective connection and identity. *Journal of Environmental Psychology*, *28*(2), 109-120. https://doi.org/10.1016/j.jenvp.2007.11.001

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *The Journal of Environmental Education*, *18*(2), 1-8. https://doi.org/10.1080/00958964.1987.9943482

Hsu, S. J. (2009). Significant life experiences affect environmental action: A confirmation study in eastern Taiwan. *Environmental Education Research*, *15*(4), 497-517. https://doi.org/10.1080/13504620903076973

Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *The Journal of Environmental Education*, *21*(3), 8-21. https://doi.org/10.1080/00958964.1990.10753743

Johnson, T. P. (2014). Snowball sampling: Introduction. *Wiley StatsRef: Statistics Reference Online*. doi:10.1002/9781118445112.stat05720

Kaiser, F. G. (1998). A general measure of ecological behavior 1. *Journal of Applied Social Psychology*, *28*(5), 395-422. https://doi.org/10.1111/j.1559-1816.1998.tb01712.x

Kaiser, F. G., & Wilson, M. (2000). Assessing People's General Ecological Behavior: A Cross-Cultural Measure 1. *Journal of Applied Social Psychology*, *30*(5), 952-978. https://doi.org/10.1111/j.1559-1816.2000.tb02505.x

Kaiser, F. G., & Wilson, M. (2004). Goal-directed conservation behavior: The specific composition of a general performance. *Personality and Individual Differences*, *36*(7), 1531-1544. https://doi.org/10.1016/j.paid.2003.06.003

Kaiser, F. G., Byrka, K., & Hartig, T. (2010). Reviving Campbell's paradigm for attitude research. *Personality and Social Psychology Review*, *14*(4), 351-367. https://doi.org/10.1177/1088868310366452

Kals, E., & Maes, J. (2002). Sustainable development and emotions. In P. Schmuck, & P. W. Schultz (Eds.). *Psychology of sustainable development* (pp. 97-122). Springer. https://doi.org/10.1007/978-1-4615-0995-0_6

Kals, E., & Müller, M. M. (2012). Emotions and Environment. In S. D. Clayton, (Ed.), *The Oxford handbook of environmental and conservation psychology* (pp. 128-147). Oxford University Press.

Kals, E., Schumacher, D., & Montada, L. (1999). Emotional affinity toward nature as a motivational basis to protect nature. *Environment and Behavior*, *31*(2), 178-202. https://doi.org/10.1177/00139169921972056

Kellert, S. R. (2002). Experiencing Nature: Affective, Cognitive, and Evaluative Development in Children. In P. H. Kahn, & S. R. Kellert (Eds.), *Children and nature: psychological, sociocultural, and evolutionary investigations*. Mass, MIT Press.

Kossack, A., & Bogner, F. X. (2012). How does a one-day environmental education programme support individual connectedness with nature? *Journal of Biological Education*, *46*(3), 180-187. https://doi.org/10.1080/00219266.2011.634016

Krajhanzl, J., & Vostradovska, H. (2005). Children and Nature: Living through and experience. In E. Strejčková (Ed.), *Výzkum odcizování člověka přírodě: Závěrečná zpráva* (pp. 178-229). Toulcův dvůr.

Lamanauskas, V. (2009). Learners' interaction with nature: Some educational issues. *Problems of Education in the 21st Century, 17*, 5-9. http://www.scientiasocialis.lt/pec/node/files/pdf/vol17/5-9.Lamanauskas_Vol.17.pdf

Lamanauskas, V., & Vilkonis, R. (2005). The characteristics of the learners' (forms 5 to 12) interaction with nature: The evaluation aspects of behavioural situations. *Journal of Baltic Science Education, 4*(2), 55-67. http://www.scientiasocialis.lt/jbse/?q=node/99

Larson, L. R., Whiting, J. W., & Green, G. T. (2011). Exploring the influence of outdoor recreation participation on pro-environmental behaviour in a demographically diverse population. *Local Environment*, *16*(1), 67-86.

Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, *24*(4), 503-515. https://doi.org/10.1016/j.jenvp.2004.10.001

Mayer, F. S., Frantz, C. M., Bruehlman-Senecal, E., & Dolliver, K. (2009). Why is nature beneficial? The role of connectedness to nature. *Environment and Behavior*, *41*(5), 607-643. https://doi.org/10.1177/0013916508319745

https://doi.org/10.33225/jbse/20.19.536

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Montada, L., Kals, E., & Becker, R. (2007). Willingness for continued social commitment: A new concept in environmental research. *Environment and Behavior*, *39*(3), 287-316. https://doi.org/10.1177/0013916506290953

Müller, M. M., Kals, E., & Pansa, R. (2009). Adolescents' emotional affinity toward nature: A cross-societal study. *Journal of Developmental Processes*, *4*(1), 59-69.

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The nature relatedness scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior*, *41*(5), 715-740. https://doi.org/10.1177/0013916508318748

Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behaviour. *Global Environmental Change*, *47*, 88-94. https://doi.org/10.1016/j.gloenvcha.2017.09.009

Payne, P. (1999). The significance of experience in SLE research. *Environmental Education Research*, *5*(4), 365-381. https://doi.org/10.1080/1350462990050403

Palmer, J. A., Suggate, J., Bajd, B., & Tsaliki, E. (1998a). Significant influences on the development of adults' environmental awareness in the UK, Slovenia and Greece. *Environmental Education Research*, *4*(4), 429-444. https://doi.org/10.1080/1350462980040407

Palmer, J. A., Suggate, J., Bajd, B., KP, P. H., Ho, R. K., Ofwono-Orecho, J. K. W., ... & Staden, C. V. (1998b). An overview of significant influences and formative experiences on the development of adults' environmental awareness in nine countries. *Environmental Education Research*, *4*(4), 445-464. https://doi.org/10.1080/1350462980040408

Palmer, J. A., Suggate, J., Robottom, I. A. N., & Hart, P. (1999). Significant life experiences and formative influences on the development of adults' environmental awareness in the UK, Australia and Canada. *Environmental Education Research*, *5*(2), 181-200. https://doi.org/10.1080/1350462990050205

Pensini, P., Horn, E., & Caltabiano, N. J. (2016). An exploration of the relationships between adults' childhood and current nature exposure and their mental well-being. *Children, Youth and Environments*, *26*(1), 125-147.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879-903. https://doi.org/10.1037/0021-9010.88.5.879

Roczen, N., Kaiser, F. G., Bogner, F. X., & Wilson, M. (2014). A competence model for environmental education. *Environment and Behavior*, *46*(8), 972-992. https://doi.org/10.1177/0013916513492416

Rosa, C. D., Profice, C. C., & Collado, S. (2018). Nature experiences and adults' self-reported pro-environmental behaviors: The role of connectedness to nature and childhood nature experiences. *Frontiers in Psychology*, *9*, 1055. https://doi.org/10.3389/fpsyg.2018.01055

Schultz, P., & Kaiser, F. G. (2012). Promoting pro-environmental behavior. In S. D. Clayton (Ed.), *The Oxford handbook of environmental and conservation psychology* (pp. 556–580). Oxford University Press.

Schultz, P. W., Shriver, C., Tabanico, J. J., & Khazian, A. M. (2004). Implicit connections with nature. *Journal of Environmental Psychology*, *24*(1), 31-42. https://doi.org/10.1016/S0272-4944(03)00022-7

Schultz, P. W., & Tabanico, J. (2007). Self, identity, and the natural environment: Exploring implicit connections with nature. *Journal of Applied Social Psychology*, *37*(6), 1219-1247. https://doi.org/10.1111/j.1559-1816.2007.00210.x

Schwartz, S. H. (1977). Normative influences on altruism. *Advances in Experimental Social Psychology*, *10*(1), 221-279. https://doi.org/10.1016/S0065-2601(08)60358-5

Sivek, D. J. (2002). Environmental sensitivity among Wisconsin high school students. *Environmental Education Research*, *8*(2), 155-170. https://doi.org/10.1080/13504620220128220

Soga, M., & Gaston, K. J. (2016). Extinction of experience: The loss of human–nature interactions. *Frontiers in Ecology and the Environment*, *14*(2), 94-101. https://doi.org/10.1002/fee.1225

Šorgo, A. (2017). User-friendly reporting of research findings from a questionnaire. *Journal of Baltic Science Education, 16*(5), 632-633. http://www.scientiasocialis.lt/jbse/files/pdf/vol16/632-633.Sorgo_JBSE_Vol.16_No.5.pdf

Steg, L., Berg, A. E., & De Groot, J. I. (2012). *Environmental psychology: An introduction*. Wiley-Blackwell.

Stern, P. C. (2000). New environmental theories: toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, *56*(3), 407-424. https://doi.org/10.1111/0022-4537.00175

Stern, P. C., Dietz, T., Abel, T., Guagnano, G. A., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review, 6*(2), 81-97.

Sward, L. L. (1999). Significant life experiences affecting the environmental sensitivity of El Salvadoran environmental professionals. *Environmental Education Research*, *5*(2), 201-206. https://doi.org/10.1080/1350462990050206

Tanner, T. (1980). Significant life experiences: A new research area in environmental education. *The Journal of Environmental Education*, *11*(4), 20-24. https://doi.org/10.1080/00958964.1980.9941386

Taylor, P. J., Russ-Eft, D. F., & Taylor, H. (2009). Gilding the outcome by tarnishing the past: Inflationary biases in retrospective pretests. *American Journal of Evaluation*, *30*(1), 31-43.

Tugurian, L. P. (2014) *An exploratory investigation of children's connectedness with the natural world*. Doctoral thesis, North Carolina State University, Raleigh.

Urban, J. (2015). Predicting pro-environmental behaviours: comparison of the theory of planned behavior and Campbells paradigm. In *11th Biennial Conference on Environmental Psychology*. Paper presented at 11th Biennial Conference on Environmental Psychology, Groningen, Netherlands

Wells, N. M., & Lekies, K. S. (2006). Nature and the life course: Pathways from childhood nature experiences to adult environmentalism. *Children Youth and Environments*, *16*(1), 1-24.

Zhang, W., Goodale, E., & Chen, J. (2014). How contact with nature affects children's biophilia, biophobia and conservation attitude in China. *Biological Conservation*, *177*, 109-116. https://doi.org/10.1016/j.biocon.2014.06.011

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Appendix A

Scales

Long-term Experiences in Nature (a new scale)

α = .59; number of years

Divided into rural nature experiences (items 1, 4, 5 and 9; α = .64) and leisure-time nature experiences (items 6, 7 and 8; α = .61).

1. We lived in a village.
2. We spent one weekend a month at a country cottage.
3. I spent holidays at my grandparents' rural house.
4. We had a garden near the house or in community gardens.
5. I helped with planting in the garden.
6. I went to a science club about nature.
7. I attended scouts or some other informal children's or youth group.
8. I went to summer camps.
9. I played outdoors with my friends.
10. We went on a nature trip with my parents at least once a month.

Inventory of Experiences (Krajhanzl & Vostradovska, 2005; Zhang et al., 2014)

Items from Zhang et al. (2014) in italics and one new item in bold.

α= .82; yes-no format

1. I saw a bird of prey in flight.
2. *I saw the pollination of a flower by an insect.*
3. *I saw a bird's nest with eggs.*
4. I saw the killing of an animal.
5. I heard the stomping of a hedgehog.
6. I held a frog in my hand.
7. I walked barefoot on the grass or the ground.
8. I walked over a ploughed field.
9. I crossed a river by (a non-motorized) boat.
10. I planted a tree.
11. I climbed rocks without belays (security equipment).
12. I cut grass with a scythe or sickle.
13. I slept outdoors (bivouacking).
14. I fed a wild animal in its natural habitat.
15. I treated or handled an ill or injured animal.
16. I was in the forest after dark.
17. *I played and explored in the soil.*
18. I went fishing.
19. I lay in tall grass.
20. I cleared snow off a path.
21. I got totally drenched by rain.
22. I built a forest shelter.
23. I trail-blazed through bushes or a forest.
24. *I went home in muddy clothes.*
25. I chopped wood.
26. I recycled materials/waste.
27. I cooked a meal using a natural campfire.
28. I swam in a pond.
29. I saw a snake in nature.
30. I got lost in the forest.

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Environmental Concern (Dutcher et al., 2007)

α = .86; 5-point Likert scale

1. If things continue on their present course, we will soon experience a major ecological catastrophe.
2. The problems of the environment are not as bad as most people think. (-)
3. We are fast using up the world's natural resources.
4. People worry too much about human progress harming the environment. (-)
5. We are spending too little money on improving and protecting the environment.

Awareness of Risks to Nature (Müller et al., 2009)

α = .86; 5-point Likert scale

1. Without any major changes, nature will be threatened even more in the coming years.
2. The problems of nature already have many negative consequences today (endangered species, resource scarcity, etc.)
3. Contamination and pollution are increasingly becoming a problem.
4. It will probably not be necessary to worry about the extent and consequences of natural problems over the next few years. (-)
5. There are enough natural resources. We don't have to be economical with them or waste money on renewable energies. (-)
6. Whenever I see a burning pile of garbage, I don't think it's anything bad, but that it's good that the waste is taken off the street. (-)
7. I think there is too much importance placed by others on the protection of nature. (-)
8. I don't think that the climate change caused by the "greenhouse effect" is dangerous. (-)
9. Nuclear power plants and radioactive waste are less dangerous than is proclaimed to the public. (-)

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