

Article

Connectedness to Nature and Pro-Environmental Behaviour from Early Adolescence to Adulthood: A Comparison of Urban and Rural Canada

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Abstract: Previous research has demonstrated that emotional connectedness to nature is among the strongest predictors of pro-environmental behaviour. This study investigated the influence of age, gender and living context on emotional connectedness to nature and pro-environmental behaviour in a Canadian sample. Study participants completed an environmental survey, which assessed demographic data as well as levels of emotional connectedness to nature and pro-environmental behaviour. The study contained 1251 participants equally divided across gender, sampled from four different age groups in rural versus urban living contexts throughout Canada. Study results revealed that emotional connectedness to nature was the strongest predictor of pro-environmental behaviour in comparison to the other factors. It was found that adults displayed significantly higher levels of emotional connectedness to nature and pro-environmental behaviour in comparison to adolescents, and that females displayed higher levels of both emotional connectedness to nature and pro-environmental behaviour in comparison to males. Moreover, urban and rural participants significantly differed in their levels of pro-environmental behaviour, but not in their levels of emotional connectedness to nature.

Keywords: emotional connectedness to nature; pro-environmental behavior; Canada; adolescence



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1. Introduction

Many psychological factors influence pro-environmental behaviour, e.g., risk-perception, self-efficacy, norms and values [1,2]. Yet, there is one factor that stands out for theoretical and practical reasons: emotional connectedness to nature (ECN). Numerous studies have identified ECN as an important predictor of pro-environmental behaviour (PEB) in childhood, adolescence and adulthood [3–9]. A more recent meta-analysis yielded a strong relationship between emotional connectedness to nature (ECN) and pro-environmental behaviour (PEB) across cultures, supporting empirical evidence for a causal pathway that leads from ECN to PEB [10]. While any predictor of PEB is typically part of a complex network of relationships, ECN exerts a strong effect as a single predictor variable. From an applied perspective, this is remarkable, since ECN could be targeted by programs designed to enhance individuals' feelings of connectedness with the natural environment (e.g., Otto and Pensini, 2017). In turn, emotional connectedness with nature might be easier to manipulate than, for instance, social norms or cultural values, as it derives from biophilia, which is a basic human propensity to affiliate with life [11,12].

While analyzing the potential impact of programs designed to strengthen emotional connectedness with nature, it is also important to take into account the macro-, exo-, meso- and microsystems that influence individuals' levels of emotional connectedness with nature. Identifying different ecologies for ECN might be informative for developing effective programs. Furthermore, it may help to identify groups of individuals who might benefit most by participating in them. The present study was meant to analyze such contextual differences by investigating ECN and its relationship with PEB in a nation-wide

study with Canadian adolescents, young adults and adults. Specifically, we focused on age, gender and urban versus rural living contexts as factors that might influence ECN.

In the following, we first define and contextualize the key constructs used in the present study, ECN and PEB. We then describe findings from previous studies on the relationship between ECN and PEB and age, gender and living context. Finally, we state the hypotheses that guided the empirical study.

1.1. Pro-Environmental Behaviour

Pro-environmental behaviour (PEB) refers to the actions that individuals take to either minimize environmental harm or to help actively restore the natural environment.

Pro-environmental behaviour can take a number of different forms. These include what Stern (2000) terms public sphere environmental activism, an example of which might be seeking participating in environmental protests and demonstrations [13,14]. Second, nonactivist behaviour in the public sphere revolves around environmental citizenship (e.g., voting behaviour and media consumption). Last but not least, PEB in the private sphere concentrates on individuals' daily habits, consumer-decisions and personal practices, such as recycling, waste disposal and transportation use [8]. Private sphere PEBs are typically low-cost behaviours that normally do not require significant investments [15] yet make a significant contribution if widespread in society [16]. The present paper focuses on private sphere PEB, as this behaviour does not require adult legal status (e.g., for voting) or larger financial resources and thus can be performed by teenagers as well as adults.

1.2. Emotional Connectedness to Nature

Children and young people moralize the natural environment [8,17]. However, those who express moral concern for the environment often fail to behave in ways compatible with their stated views. This discrepancy, which is not unique to environmental issues, is commonly referred to as the judgement-action gap [18–21]. Importantly, the judgement-action gap tends to increase as the personal costs of one's moral beliefs grow [22].

Cognitive factors, such as moral judgements [23] and moral reasoning [24], are typically poor predictors of individuals' moral behaviour. Research within environmental psychology has similarly demonstrated that other cognitive factors, such as environmental knowledge, minimally contribute to their PEB [25,26].

Despite these findings, research has demonstrated that personal norms, which contain a cognitive dimension, are a strong predictor of PEB [13,17,27,28]. Personal norms, in this context, can be defined as one's sense of personal obligation to defend nature [13].

Emotional affect may assist in explaining why particular moral judgements rise to the status of personal norms, while others do not. Affective factors, notably empathy, have previously been demonstrated to predict a variety of prosocial behaviours and outcomes [29–32]. In the context of environmentalism, research has similarly demonstrated that individuals' emotional connectedness to the environment is an exceptionally strong predictor of their PEB [3–10]. This emotional connection to the environment is sometimes experienced as grief that is linked to environmental degradation, which Glenn Albrecht has previously referred to as "solastalgia" [33].

1.3. Living Context

Previous research has demonstrated that individuals' exposure to, or contact with, nature can influence their levels of emotional connectedness to the environment [3,34,35]. A number of explanations have been proposed to explain why time spent in nature and individuals' emotional affinity for the environment are correlated. Some have proposed that this can be explained by the relationship between familiarity and affinity [9]. Research has previously demonstrated that repeated exposure to an object can increase an individual's affinity for that object and assist in the formation of affective ties to it, which is known as the mere exposure hypothesis [36,37].

Studies have found that individuals who frequently spent time in nature during their early childhood were more likely to engage in PEB than those who had not [38–40]. However, all three of these studies relied upon retrospective accounts of individuals' experiences in nature. It was, therefore, unclear whether the childhood experiences themselves were responsible for individuals' PEB, or alternatively, whether these experiences were merely salient to environmentally-conscious adults [41,42].

Past research has suggested that living context may play an important role in determining individuals' ECN and their PEB [9,38,43]. For example, research has demonstrated that individuals living in rural environments tended to display higher levels of ECN and PEB in comparison to their urban counterparts [9,38]. This may be due, in part, to the frequency of contact with nature that rural individuals experience. Indeed, research has supported this point, showing that individuals living in rural areas tend to have more contact with nature than those living in urban ones [44].

Hinds and Sparks (2008) surveyed a sample of undergraduate students from the United Kingdom [9]. Study participants were asked to fill out a questionnaire, which, among other items, asked them about the places in which they spent time during their childhood (i.e., urban, suburban, or rural), as well as their intention to engage with nature, their environmental attitudes and their affective relationship with the environment [9]. Results revealed that participants' attitudes towards, and affective connections with, the environment significantly predicted their intention to engage with nature. Moreover, individuals who had grown up in rural locations reported higher positive affect, identification, behavioural intentions, and positive environmental attitudes in comparison to those who had grown up in urban locations.

However, recent research has suggested that other factors, such as the landscape, may moderate the relationship between living context and ECN. In Collado and colleagues' (2015) study of Spanish children, they replicated Hinds and Sparks' (2008) finding that rural children had more interactions with nature than their urban counterparts [9,38]. However, they also demonstrated that the type of interaction one has with nature informs the impact that it has on the individual. Although contact with nature was always positively related to PEB, the strength of this relationship was moderated by the *kind* of contact children were experiencing. Rural children living in wilderness settings displayed the strongest relationship between experiences in nature and PEB, whereas rural children in agricultural settings displayed the weakest (the effect of natural experiences on urban children fell in between).

Importantly, these findings demonstrate that living in proximity to nature is not all that matters. Studies have also demonstrated that it is important to consider the type of relationship the individual has with local ecosystems, whether that be leisure, recreation or work. In a study of adults, Von Lindern, Bauer, Frick, Hunziker and Hartig (2013) demonstrated that working in nature can reduce the restorative effects of spending one's leisure time in natural areas [45]. Similarly, it has been found that daily work-related exposure to nature can weaken individuals' motivations to behave in a pro-environmental manner [46].

Another factor that may play an important role is industrialization. Müller, Kals and Pansa (2009) conducted a study that compared the levels of affinity for nature and commitment to engage in PEB between German and Lithuanian citizens [43]. Their study aimed to investigate both the effect of living context (urban versus rural) as well as the effects of industrialization, since Germany is typically considered to be a much more industrialized nation in comparison to Lithuania. The study's findings demonstrated that Lithuanian citizens had significantly higher levels of affinity for nature and were more committed to engaging in pro-environmental protection when compared to their German counterparts. Urban and rural differences did not appear in either country's affinity for nature scores, but did appear in their pro-environmental commitment scores, with Lithuanian rural participants scoring the highest and German rural participants scoring the lowest. The study's findings suggest that a nation's level of industrialization may be more

significant than its living context when determining individuals' environmental attitudes and behaviours.

Although it is clear that factors such as rurality, landscape and industrialization are correlated with levels of ECN and PEB, some studies have produced conflicting results. For instance, Berenguer and colleagues (2005) demonstrated that adults living in urban settings held more pro-environmental beliefs than their rural counterparts [47]. Despite this finding, rural participants in their study engaged in more PEB. Bjerke and Kaltenborn (1999) discovered that environmental attitudes could also differ depending on the particular topic being surveyed, with rural farmers scoring lower on their concern for predatory species than urban participants [48].

1.4. Age-Related Differences in Adolescence

Adolescence is typically characterized as a developmental period associated with increased moral sensitivity. This is typically attributed to the development of abstract thoughts, a greater ability to adopt the perspectives of others and an increased awareness of large societal issues [49,50]. However, despite this positive characterization of adolescence, this developmental period is also linked to declines in social responsibility and prosocial action [51,52].

One such decline is found in adolescents' environmental behaviour. PEB has been found to decline over the course of adolescence within Western industrialized societies [8,53]. In light of these findings, some have even gone so far as to characterize adolescence as a "time out" in humans' relationship with nature [54]. Age-related declines in PEB were found to be mediated by corresponding declines in adolescents' ECN [8,55].

Declines in PEB may also be due, in part, to cognitive factors, such as individuals' normative beliefs. PEB was not only mediated by affective factors but also by the prescriptivity of moral judgements (i.e., the degree to which a behaviour was judged to be obligatory or not) [8]. Social Domain Theory suggests that all moral judgements share a particular set of qualities, which differentiate them from other kinds of judgements [56]. For instance, moral issues are typically considered universal (i.e., obligatory regardless of one's identity or group) and noncontingent (i.e., obligatory whether or not a recognized authority reinforces the rule). This is in contrast to personal issues, which are merely a matter of individual discretion, or conventional issues, which are context-dependent (i.e., dependent upon a particular set of customs or circumstances). Although the classification of actions as moral, conventional and personal is typically stable throughout the course of development [57], it was found that some obligatory behaviours were considered to be discretionary by teenagers during the adolescent period [51]. Thus, declines in PEB may be a function of adolescents viewing certain pro-environmental behaviours as a matter of convention.

It is unclear whether the declines identified during adolescence are permanent or whether they instead represent an "adolescent dip" ([58], p. 35). Some studies with adults have pointed toward a positive relationship between age and environmental concern [44,59]. However, it is difficult to know whether these findings reflect cohort differences or whether they are attributed to more general trends in moral and personality development characteristics of adulthood [60,61].

1.5. Gender

Another noteworthy factor which influences ECN and PEB is gender. Research has demonstrated that there are significant gender differences with regard to individuals' connections to the environment and individuals' PEB, with females typically displaying higher mean levels than their male counterparts beginning as early as childhood [43,62–66].

Chawla (1988) noted that males typically demonstrate more knowledge about environmental issues but, in spite of this, females are more likely to express concern for environmental welfare [62]. Chawla suggested that these differences may be explained by the sociocultural emphasis placed on stereotypical feminine qualities, such as empathy and nurturing, versus the emphasis placed on stereotypical masculine qualities, such as

independence and dominance [62]. She draws support for this theory based on the developmental timing at which these differences tend to emerge. Boys and girls diverge in their environmental concern around sixth grade, which is well known as the time period when gender roles become most pronounced during childhood [62].

Another explanation for these findings is the affective differences that exist between the genders. Past research has demonstrated that females are typically more empathetic than their male counterparts [67]. Although there are some sociocultural explanations for these affective differences [68], there is also some evidence to suggest that these differences are driven in part by biological factors, such as hormones [69] or sex-based brain differences [70].

As pointed out by Stern and colleagues (1993), it is also important to consider environmental studies that have failed to identify gender differences [65]. For instance, in one study by Lyons and Breakwell (1994), there were no differences between the genders regarding their respective concerns about pollution [71]. Similarly, Hines, Hungerford and Tomera (1987) found no gender differences when surveying individuals about undertaking various pro-environmental behaviours [72].

The lack of gender differences found in these studies might be attributable to the topics surveyed (e.g., pollution) or to the focus of environmentalism during the historical period, which, as Stern and colleagues (1993) speculated, might emphasize particular value orientations that are either shared by both the genders or asymmetrically distributed between males and females [65].

1.6. The Present Study

The present study was designed to investigate the factors that contributed to ECN and PEB in Canadians. The study investigated the role of living context, age and gender on ECN and PEB. There are a number of gaps in the previous literature on these topics. First, most studies that have investigated the relationship between environmentalism and living context have focused on European samples. The present study helped to address whether or not these previous findings hold true within a North American context. Second, with the exception of Krettenauer's (2017) study on the topic, few studies have investigated the age-related differences in the relationship between ECN and PEB [8]. This study is of particular importance, because it assists in identifying the factors that are responsible for driving pro-environmental behaviours in developed nations. A model of the study can be found in Figure 1.

This study consisted of three key goals. The first goal of the study was to investigate age-related differences in ECN and PEB from adolescence into adulthood. Previous research has revealed an age-related decline in the levels of ECN and PEB during adolescence [8]. Therefore, it was hypothesized that ECN and PEB levels would decline between early and late adolescence. It is possible that this decline reverses itself or that it plateaus or increases. Age-related differences beyond late adolescence were explored in the present study.

The second goal of this study was to determine how much unique variance ECN, age and living context contributed towards predicting PEB. Previous research has frequently demonstrated that ECN is among the strongest predictors of PEB, and accounts for up to 60% of the variance found in the construct [26]. However, many studies have failed to observe the effects of age and living context alongside ECN. Nevertheless, based on past findings, it was hypothesized that ECN would remain the strongest predictor among the three factors being analyzed.

The third goal of this study was to determine whether the age-related variance found in PEB was mediated by age-related changes in levels of ECN. Many past studies have shown that ECN significantly contributes to PEB [8,10,26]. Based on these past findings, it was hypothesized that ECN would mediate the relationship between age and PEB.

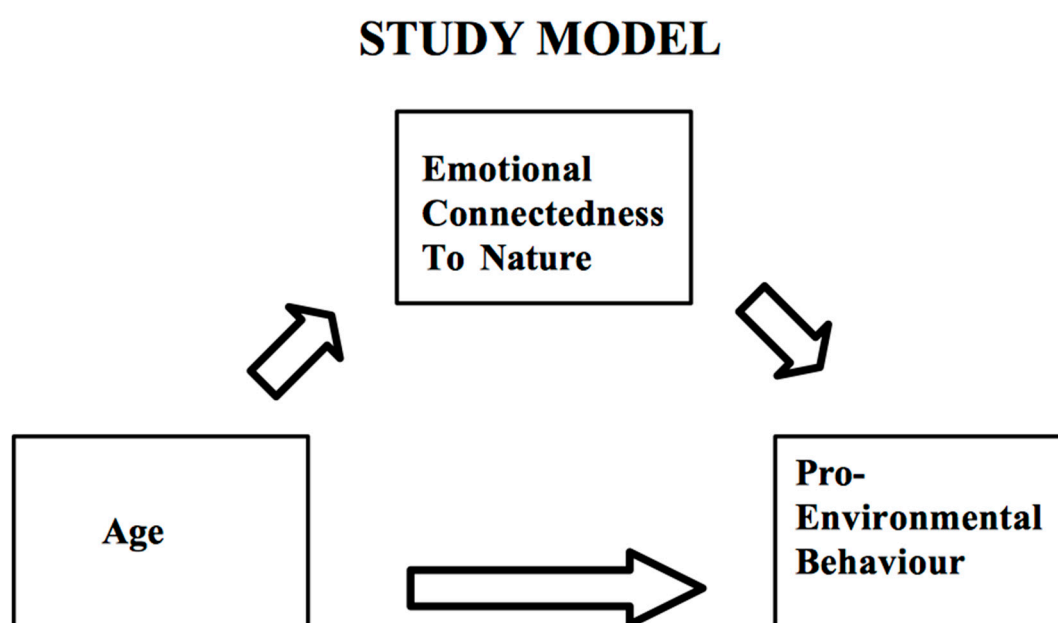


Figure 1. Study model.

2. Materials and Methods

2.1. Sample

Four age groups were included in this project: young adolescence (12–15 years), late adolescence (16–19 years), young adulthood (24–29 years) and adulthood (35–40 years). Age was measured according to birthdate. These age groups were chosen in order to fully capture the age range of adolescence and to enable the study of the potential rebound effects of PEB and ECN in adulthood. A total of 1251 participants from urban and rural locations were recruited by a major Canadian polling company for this project. Following the classifications provided by Statistics Canada (2016), rural participants were defined as individuals living in a rural area or population centre with up to 29,999 occupants, while urban participants were defined as individuals living in a city of 100,000 or more occupants [73]. Approximately 90% of the participants were born in Canada, and 10% were born outside of Canada. Those from outside of Canada originated from 54 different countries. Participants that were included in the study were from a variety of locations across the 10 Canadian provinces and include both Anglophone and Francophone Canadians. A summary of the sample's demographic distribution can be found in Table 1.

Table 1. Sample characteristics.

	12–15 Years	16–19 Years	24–29 Years	35–40 Years	Total
Rural	Male: 61 Female: 53	Male: 74 Female: 76	Male: 74 Female: 76	Male: 74 Female: 76	564
Urban	Male: 129 Female: 106	Male: 78 Female: 74	Male: 76 Female: 74	Male: 76 Female: 74	687
Total	349	302	300	300	1251

2.2. Measures

Participants were recruited and administered the same questionnaire used by Krettenauer (2017); only this time, data collection was online [8]. Two of the survey's scales were used in the present study: pro-environmental behaviour and connectedness with nature.

Pro-environmental behaviour. Self-reported pro-environmental behaviour serves as this study's measure of PEB. This construct was assessed using a collection of items from

various instruments that have been successfully employed in previous research [53,72,74–76]. The response format that was used was taken from antisocial and prosocial questionnaires, which ask participants to report their levels of particular behaviours [77]. Participants were asked to indicate how often they had engaged in various pro-environmental behaviours in the last year (ranging from 0 = never do this to 4 = always do this).

Krettenauer (2017) selected items, guided by two major criteria [8]. First, only age-relevant behaviours were included. That is to say, adult-focused items such as purchasing vehicles or performing home renovations were excluded from the instrument's item list. Second, the items corresponded to the scenarios individuals had responded to in the moral judgement and moral emotions sections of the survey. These sections had participants imagine a scenario where their family, or a neighbourhood family, performed either an environmentally sustainable behaviour or an environmentally unsustainable behaviour. Participants were then asked to report their anticipated moral emotions and moral judgements of the scenario. Most of the instrument's items fell within the categories of energy conservation, waste reduction, recycling and the disposal of hazardous waste (including e-waste). However, a few of the items also concerned extracurricular activities, such as volunteering and media consumption.

For all twenty-nine items included in the measure, participants were asked to respond using the five-point Likert scale previously mentioned. Energy conservation was assessed using nine items in the survey (e.g., I use public transportation). Waste reduction was assessed using five items (e.g., I use refillable water bottles). Recycling behaviour was assessed using six items (e.g., I collect used paper and put it in the blue box). Lastly, hazardous household waste disposal was assessed using five items (e.g., I put dead batteries in the garbage (reverse-scored item)). The last four items concerned other pro-environmental behaviours, such as volunteering on environmental projects, following environmental issues on the news, participation in environmental clubs and cleaning up after oneself.

PEB captures a wide range of different behaviours across various domains; still, it is possible to aggregate them into a single scale as others have shown in the past [68]. Nevertheless, when this measure was generated, Krettenauer (2017) confirmed that the different types of PEB could be combined into a single scale by running a confirmatory factor analysis [8]. Accordingly, the twenty-nine items used to assess PEB were combined into a single scale with an acceptable internal consistency of $\alpha = 0.81$ [78].

Connectedness with nature. Participants' emotional connection to nature was assessed using Krettenauer's adapted version of the measure developed by Br gger and colleagues [5]. Unlike previous measures used to assess this construct, which heavily relied upon abstract concepts and ideas (i.e., "I often feel a kinship with animals and plants"; "I recognize and appreciate the intelligence of other living organisms"; p. 28), the present measure was made much more concrete for younger participants by describing specific behaviours children and young people might engage in as a means of connecting with nature or expressing their appreciation for the environment.

Another reason this measure was chosen was its minimal reliance on self-reflection. Many of the other scales that assess ECN require individuals to engage in introspection before answering. Br gger and colleagues' (2011) scale avoids this by asking individuals how much they enjoy various activities rather than asking participants to explore their feelings [5]. This particular instrument was also chosen because it did not overlap with the pro-environmental measure in its scope, and assessed individuals' appreciation for environmental recreational activities and pastimes without assessing their pro-environmental activity.

In this study, four aspects of emotional connectedness with nature were included, enjoying nature, hands-on engagement with nature, interest in nature and empathy for living beings. Past research has demonstrated that these four aspects of emotional connectedness with nature can be combined into a single scale [43]. Participants responded to this measure using a five-point Likert scale (i.e., strongly disagree, disagree, neither agree nor disagree, agree and strongly agree).

The full scale was used for analysis in this study. The twenty-one items were combined into a single scale of sufficient reliability, $\alpha = 0.90$.

3. Results

The main purpose of this study was to investigate the relationship among age, gender, living context, ECN and PEB. In order to investigate these relationships, a 4 (age) $\times$ 2 (living context) $\times$ 2 (gender) between-group factorial ANOVA was conducted to examine ECN differences between the groups, as well as a second 4 (age) $\times$ 2 (living context) $\times$ 2 (gender) between-group factorial ANOVA examining PEB differences between the groups. For a general overview of the means, standard deviations and bivariate correlations of these variables, see Table 2.

Table 2. Means, standard deviations and bivariate correlations of study variables.

	1	2	3	4	5	<i>M</i>	<i>SD</i>
1. Emotional Connectedness to Nature						3.64	0.57
2. Pro-Environmental Behaviour	0.53 **					2.77	0.51
3. Exact Age	0.08 **	0.09 **				23.25	9.47
4. Gender	−0.19 **	−0.08	−0.02			0.51	0.50
5. Living Context	−0.05	0.08 **	−0.11 **	0.02		0.55	0.50

** $p < 0.01$.

In addition to these analyses, a Hierarchical Multiple Regression Analysis was conducted to examine which continuous variables predicted PEB. Finally, Mediation Analysis was conducted [79], in order to determine whether ECN mediated the relationship between age and PEB.

3.1. Emotional Connectedness to Nature Across Gender, Age Groups and Living Contexts

The findings of 4 (age) $\times$ 2 (living context) $\times$ 2 (gender) ANOVA are summarized in Table 3.

Table 3. Emotional connectedness to nature factorial ANOVA.

Predictor	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>p</i>	Partial η^2
Intercept	16073.158	1	16073.158	52106.771	0.000	0.98
Age	3.618	3	1.206	3.910	0.009	0.009
Context	0.682	1	0.682	2.210	0.137	0.002
Gender	12.756	1	12.756	41.354	0.000	0.032
Age * Context	0.126	3	0.042	0.136	0.939	0.000
Age * Gender	1.586	3	0.529	1.714	0.162	0.004
Context * Gender	0.217	1	0.217	0.704	0.402	0.001
Age * Context * Gender	1.313	3	0.438	1.419	0.236	0.003
Error	380.955	1235	0.308			

The analysis revealed that there was a significant main effect of age on ECN, $F(3, 1235) = 3.91$, $p < 0.05$. Bonferroni post hoc analyses revealed that young adolescents ($M = 3.58$, $SD = 0.57$) significantly differed from young adults ($M = 3.72$, $SD = 0.53$). Similarly, older adolescents ($M = 3.59$, $SD = 0.59$) differed significantly from young adults. There were no significant differences between the younger two age groups or between young adults ($M = 3.72$, $SD = 0.53$) and adults ($M = 3.69$, $SD = 0.57$).

The main effect of living context on ECN was not significant, $F(1, 1235) = 2.21$, $p = 0.14$. However, there was a significant main effect of gender on ECN $F(1, 1235) = 41.35$, $p < 0.001$, such that females ($M = 3.75$, $SD = 0.52$) had significantly higher mean levels of ECN in comparison to their male counterparts ($M = 3.54$, $SD = 0.59$).

There were no significant interactions between age and context, $F(3, 1235) = 0.136$, $p = 0.939$; age and gender $F(3, 1235) = 1.714$, $p = 0.162$; or context and gender $F(1, 1235) = 0.704$, $p = 0.402$. The three-way interaction was also nonsignificant, $F(3, 1235) = 1.419$, $p = 0.236$. These findings demonstrate that the relationship between age and ECN did not differ between urban and rural participants, or between males and females. Moreover, the ECN levels of males and females did not differ between urban and rural participants.

3.2. Fine-Grained Age Analysis

The previous literature has reported a significant decline in levels of ECN from early to late adolescence [8]. Upon not finding this decline in the original analysis, a more fine-grained analysis was conducted. Age was recoded into categories of two-year intervals: early adolescence (12–13 years), early to mid adolescence (14–15 years), mid to late adolescence (16–17 years), late adolescence (18–19 years) and adulthood (20–40 years). This group partitioning was guided, in part, by the tighter age groupings found within Krettenauer's (2017) study [8].

A one-way ANOVA was conducted on ECN and revealed that there were significant differences between these age five groups, $F(4, 1246) = 8.042$, $p < 0.001$. The results of this analysis are summarized in Figure 2.

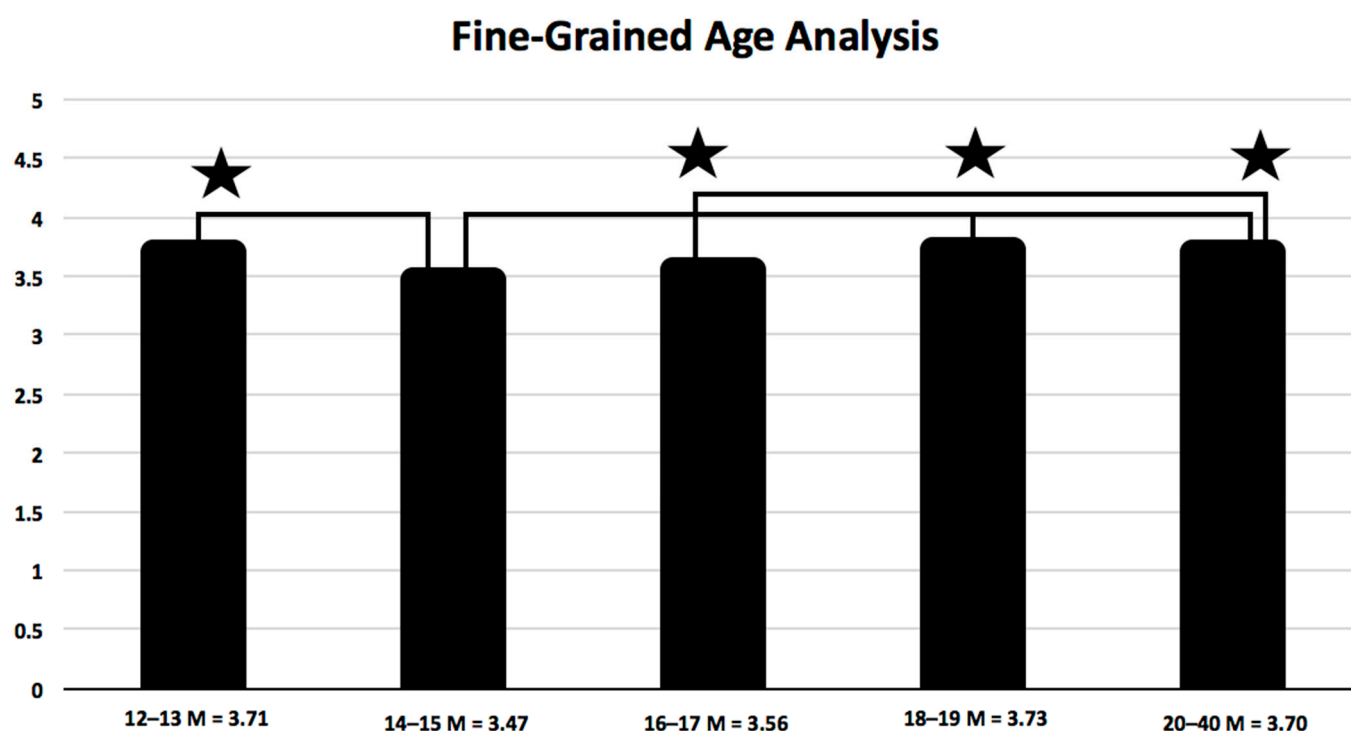


Figure 2. Fine-grained age analysis.

Bonferroni post hoc tests revealed a nonlinear relationship between age and ECN. Those within the youngest age group ($M = 3.71$, $SD = 0.54$) differed significantly in their levels of ECN from those that were in the 14–15 age group ($M = 3.47$, $SD = 0.57$), but not from the older three age groups ($M = 3.56$, $SD = 0.60$; $M = 3.73$, $SD = 0.50$; $M = 3.70$, $SD = 0.55$). Findings also revealed that those in the 14–15 age group ($M = 3.47$, $SD = 0.57$) differed significantly from those who were 18–19 age group, as well as from those in the 20–40 age group ($M = 3.73$, $SD = 0.50$; $M = 3.70$, $SD = 0.55$). Those in the 16–17 age group ($M = 3.56$, $SD = 0.60$) differed significantly from those in the 20–40 age group ($M = 3.70$, $SD = 0.55$). No other age differences between the five age groups were significant.

3.3. Pro-Environmental Behaviour across Gender, Age Groups and Living Contexts

A 4 (age) $\times$ 2 (living context) $\times$ 2 (gender) ANOVA was conducted with PEB as the dependent variable. The results of this ANOVA are summarized in Table 4.

Table 4. Pro-environmental behaviour factorial ANOVA.

Predictor	Sum of Squares	df	Mean Square	F	p	Partial η^2
Intercept	9212.104	1	9212.104	35630.119	0.000	0.97
Age	3.757	3	1.252	4.843	0.002	0.012
Context	2.565	1	2.565	9.921	0.002	0.008
Gender	2.102	1	2.102	8.130	0.004	0.007
Age * Context	0.194	3	0.065	0.250	0.861	0.001
Age * Gender	0.340	3	0.113	0.438	0.726	0.001
Context * Gender	0.442	1	0.442	1.710	0.191	0.001
Age * Context * Gender	0.323	3	0.108	0.416	0.742	0.001
Error	319.307	1235	0.259			

There was a significant main effect of age on PEB, $F(3, 1235) = 4.84$, $p < 0.001$. Bonferroni post hoc analyses revealed that young adolescents ($M = 2.71$, $SD = 0.52$) had significantly lower levels of PEB in comparison to adults ($M = 2.85$, $SD = 0.43$). Older adolescents ($M = 2.75$, $SD = 0.54$) displayed no significant differences to other groups. Young adults ($M = 2.75$, $SD = 0.53$) displayed marginally significant differences from adults, $p = 0.07$. No other age group differences were significant.

There was a significant main effect of gender on PEB, $F(1, 1235) = 8.13$, $p < 0.05$, such that females ($M = 2.81$, $SD = 0.51$) reported significantly more PEB than males ($M = 2.72$, $SD = 0.52$).

There was a significant main effect of context on PEB, $F(1, 1235) = 9.92$, $p < 0.05$, such that individuals living in urban settings ($M = 2.80$, $SD = 0.50$) reported significantly higher levels of PEB in comparison to those living in rural settings ($M = 2.72$, $SD = 0.53$). This effect was in the opposite direction of what was originally hypothesized.

There were no significant interactions between age and context $F(3, 1235) = 0.25$, $p = 0.861$; age and gender $F(3, 1235) = 0.438$, $p = 0.726$; or context and gender $F(1, 1235) = 1.710$, $p = 0.191$. The three-way interaction was also nonsignificant $F(3, 1235) = 0.416$, $p = 0.742$. These findings demonstrate that the relationship between age and PEB did not differ between urban and rural participants. Moreover, the relationship between age and PEB was consistent for both males and females. Lastly, the relationship between gender and PEB did not differ between urban and rural participants.

3.4. Continuous Predictors of Pro-Environmental Behaviour

A Hierarchical Multiple Regression Analysis was conducted in order to determine the variables that significantly contributed to PEB. For this analysis, exact age was used so it could be analyzed as a continuous variable. All the continuous variables (ECN, age and PEB) were centered. Living context was dummy coded for the regression analysis, assigning urban participants "0", and rural participants "1".

A summary of the Hierarchical Multiple Regression findings can be found in Table 5.

A three-step hierarchical multiple regression was conducted with PEB as the dependent variable. The main effects of age, ECN and living context were entered at Step 1. The three two-way interactions between age and ECN, age and living context and living context and ECN were entered at Step 2. Finally, the three-way interaction among ECN, age and living context was entered at Step 3.

The Hierarchical Multiple Regression revealed that at Step 1, age, living context and ECN significantly contributed to the model $F(3, 1247) = 171.76$, $p < 0.001$. The analysis revealed that age positively predicted PEB ($\beta = 0.07$, $p < 0.05$), such that older individuals reported higher levels of PEB than younger individuals. ECN strongly predicted PEB ($\beta = 0.53$, $p < 0.001$), such that those with higher levels of ECN reported higher levels of

PEB. Finally, living context significantly predicted PEB ($\beta = 0.11, p < 0.001$), such that urban participants reported higher levels of PEB than their rural counterparts.

Table 5. Hierarchical multiple regression on pro-environmental behaviour.

Variable	β	R	R^2	ΔR^2	F	F Change
Step 1		0.54	0.29	0.29	171.76 **	171.76 **
Age	0.07 *					
ECN	0.53 **					
Context	0.11 **					
Step 2		0.54	0.29	0.29	86.44 **	1.078
Age	0.06 *					
ECN	0.54 **					
Context	0.11 **					
Age * ECN	−0.04					
Age * Context	−0.03					
Context * ECN	−0.02					
Step 3		0.54	0.29	0.29	74.03 **	0.007
Age	0.06 *					
ECN	0.54 **					
Context	0.11 **					
Age * ECN	−0.04					
Age * Context	−0.02					
Context * ECN	−0.02					
Age * ECN * Context	−0.003					

Note: $N = 1251$, * $p < 0.05$, ** $p < 0.01$.

In Step 2, adding two-way interactions to the regression model made no significant difference ($\Delta R^2 = 0.002$, $\Delta F = 1.08$, $p = 0.36$). The interactions between age and ECN ($\beta = -0.04$, $p = 0.10$), age and context ($\beta = -0.03$, $p = 0.50$) and ECN and context ($\beta = -0.02$, $p = 0.65$) were all nonsignificant.

In Step 3, adding the three-way interaction to the regression model made no significant difference ($\Delta R^2 = 0.00$, $\Delta F = 0.007$, $p = 0.93$). The three-way interaction among the three predictors was nonsignificant ($\beta = -0.003$, $p = 0.93$).

Taken together, these findings indicate that the relationship between age and PEB was consistent across levels of ECN. The relationship between age and PEB was the same for both urban and rural participants. Furthermore, the relationship with ECN was the same for both urban and rural participants.

3.5. Emotional Connectedness as a Mediator

Based on previous findings [8], it was hypothesized that there was an indirect effect of age on PEB, such that ECN would mediate the relationship between the two. In order to test this assumption, Hayes process model 4 was used [79].

A preliminary analysis was conducted to determine the relationship among the three variables in question. Bivariate correlations were run between all of the variables in the study. All correlation results can be found in Table 5. Initial analyses revealed a significant but weak positive relationship between age and PEB ($r = 0.086$, $p < 0.01$).

The mediation model revealed that age significantly predicted ECN, $b = 0.0049$, $p < 0.05$, 95% CI [0.0016, 0.0082]. The effect of ECN on PEB was likewise significant, $b = 0.4729$, $p < 0.001$, 95% CI [0.4303, 0.5156]. However, after mediation, the direct effect of age on PEB was no longer significant, $b = 0.0024$, $p = 0.07$, 95% CI [−0.0002, 0.0049]. A bias-corrected bootstrap confidence interval based on 5000 samples for the indirect effect ($b = 0.0023$) did not include “0”, CI [0.0007, 0.0039]. These findings demonstrate that ECN significantly mediated the relationship between age and PEB, such that, as individuals get older, their levels of ECN increase, which, in turn, leads to an increase in levels of PEB, $R^2 = 0.28$, $F(2, 1248) = 242.70$, $p < 0.001$.

4. Discussion

International data have demonstrated that human behaviour is the leading contributor to rising temperatures around the globe [80]. As such, it is crucial that psychologists investigate how to motivate individuals of all ages to curtail environmentally unsustainable behaviours, and adopt ecologically sustainable behaviours. The proposed study contributed to this body of knowledge by offering an insight into the age dependency of ECN, and investigating the role that fixed factors, such as living context and gender, play in its developmental course.

A large amount of the past literature on ECN has focused on the role that contact with nature might play in its development. However, this study's findings seem to suggest that the amount of actual contact needed to forge this emotional connection might, in fact, be quite minimal. Past research also seems to indicate that future efforts ought to focus on having young people engage with nature, rather than just exposing them to a surplus of it [26].

This study's initial results conflicted with the past literature, revealing no adolescent dip in levels of ECN. In response to this finding, the age groups were recoded, and the analysis was conducted at a more fine-grained level. This second analysis revealed a decline in levels of ECN in early to mid adolescence, which had been obscured by the original age-group partitioning. More importantly, all three analyses of age revealed an increase in both ECN and PEB moving toward adulthood.

In line with the original hypothesis, which predicted higher levels of ECN and PEB in females, analyses revealed that females scored higher in both of these categories. However, the effect sizes of these differences were larger for ECN ($\eta^2 = 0.032$) than they were for PEB ($\eta^2 = 0.007$). Future research ought to investigate the role of gender on individuals' environmental attitudes and PEB. In particular, research ought to explore whether these gender differences persist across other cultures. Research might also look to clarify whether particular pro-environmental behaviours and attitudes are more susceptible to gender differences than others, which might be attributed to how certain behaviours are framed or culturally understood. Lastly, future research should be used to determine if ECN differences fully explain the gender gap in PEB, or whether other moderating factors explain these differences.

The direction of living context differences was in the opposite direction to the project's original hypotheses. Moreover, while urban participants differed significantly from rural participants in their levels of PEB, there were no significant differences in their levels of ECN. Rural participants reported significantly lower levels of PEB compared to urban participants. This may suggest that other factors, such as the level of available infrastructure in an area, might be more important than the population-based measure of rurality used in this study. Moreover, factors such as the primary occupation or trade in an area (e.g., agriculture and logging) might impact these findings, and should be investigated in future research [38,45].

Rural living may entail less contact with nature in the modern era. Research has demonstrated that young people living in industrialized nations are spending less time outdoors than the young people of previous generations [81]. Thus, perhaps access to nature is ultimately irrelevant because individuals are not taking advantage of the outdoor opportunities available to them. Future research might attempt to test this question quasi-experimentally by exposing a randomized group to nature and comparing their ECN levels to a control group [26]. Alternatively, future correlational studies could include measures that require participants to report the amount of time they typically spend in nature in order to determine if this factor has a significant impact.

Another possible explanation for the direction of these living context differences is political partisanship. Past research on American populations has demonstrated that rural individuals tend to espouse more conservative viewpoints in comparison to their urban counterparts [82]. In light of the fact that environmental conservation has become a

partisan issue in American politics, one ought to consider the possibility that living context differences may be indicative of these partisan trends [83].

One unexpected finding was that urban participants reported engaging in significantly more PEB than rural participants. This was the case, despite the fact that no significant differences were found in the two groups' levels of ECN. This finding indicates that factors other than ECN are responsible for the pro-environmental differences identified between these groups.

This unexpected finding might be explained by other relevant factors associated with living context, such as the level of available infrastructure in an area. Although industrialization has been found to be negatively correlated with PEB in past research [43], the infrastructure that accompanies it may be important in providing individuals with opportunities to perform pro-environmental behaviours. Many students who report low levels of pro-environmental action cite the lack of opportunities and resources they have to make a meaningful difference in their communities [84]. Likewise, previous research has demonstrated that PEB is more likely to occur when individuals believe that they can actually make a difference, and play a meaningful part in combatting environmental degradation [85]. Both of these findings highlight the fact that PEB is influenced by how salient and readily available pro-environmental opportunities are, and by the extent to which individuals are convinced there is a meaningful connection between their PEB and environmental improvement or preservation. Many urban settings are arguably better equipped to provide these opportunities than rural settings.

In line with the past literature, the fine-grained age analysis revealed an adolescent decline in ECN, although ECN levels were found to later recover in adulthood. Neither gender nor living context moderated the relationship between age and ECN. Thus, relatively immutable factors, such as gender and living context, did not influence the trajectory of individuals' ECN and PEB over the course of adolescent development. Though it is clear that this adolescent dip presents an environmental challenge, research has revealed factors that could bolster ECN prior to this decline, such as familial values [3], educational initiatives [26] and cultural norms [86]. If policy makers and administrators want to address unsustainable behaviour in teenagers, bolstering ECN in young people might be a promising frontier as well. However, this study's findings (lack of effects of living context) suggest that simply exposing young people to nature is not effective for cultivating ECN. Instead, it is the combination of exposure to nature whilst engaging young people in authentic educational experiences that might positively influence emotional connectedness to nature during this age period [26].

There is also contemporary evidence to suggest that adolescents are more concerned about the environment now than they have ever been historically. For instance, the Fridays for Future movement, which involves elementary, middle and secondary school walk-outs around the globe to protest local government responses to environmental problems, highlights children and adolescents' awareness of, and concern for, environmental issues. Perhaps the waning ECN characteristic of adolescence is not the only factor researchers ought to consider, as it appears that other existential and social motivations have begun to rise in salience in the present geopolitical context.

5. Limitations

The limitations present in this study should not be overlooked. One major limitation of this research was its cross-sectional design, which risks confounding cohort differences with the developmental effects of age. With the amount of growing attention paid to environmental issues in politics, school curricula and the media, it is difficult to determine how these various forces shape generational perspectives on the environment across lifespans. Future longitudinal research could help address this limitation and would provide insight into the deeper developmental trends at play.

Another limitation was this study's correlational design. This study was unable to establish any causal claims about the relationships identified. As such, there are a number

of alternative explanations for the study's findings that cannot be directly attributed to the factors in question. Such explanations might include the possibility of a reverse relationship between ECN and PEB. This might be explained by individuals attempting to minimize cognitive dissonance by adjusting their attitudes to match their behaviours. There is also the possibility that a third factor explains the predictive relationship between ECN and PEB. Resolving these lingering questions would require the use of experimental designs heretofore not explored in the literature (for a meta-analysis and future suggestions see Whitburn, Linklater and Abrahamse, 2019) [87].

This study's questionnaire failed to measure a number of important variables. Most notably, the amount of time spent in nature by participants was not measured. Likewise, individuals' occupations, the levels of infrastructure in their cities and the levels of industrialization near their homes were not measured by the questionnaire. Future research ought to use more localized data, such as postal codes, in order to help provide a more detailed understanding of the differences that exist across various Canadian living contexts. This is particularly relevant because technology and infrastructure are not homogenous across all of the Canadian provinces or within the provinces themselves.

6. Conclusions

In light of the findings linking ECN to PEB, many have sought out ways to bolster ECN. This has led to efforts such as nature retreats, green classrooms and the romantization of rural living. The present study has demonstrated that future efforts ought to instead focus on environmental engagement and not simply exposing individuals to the outdoors, as the relationship between contact with nature and the development of ECN appears to be socially moderated and contingent upon a host of other factors.

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