

Running head: Nature relatedness

The Human-Nature Connection:
Increasing Nature Relatedness, Environmental Concern, and Well-Being Through Education

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August 2005

Master's Thesis submitted to the Faculty of Graduate Studies and Research in partial fulfilment
of the requirements for the degree Master of Arts



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Your file *Votre référence*

ISBN: 0-494-10064-8

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ISBN: 0-494-10064-8

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Abstract

Fragmented human-nature relationships may have a detrimental effect on psychological well-being as well as the environment. Increasing connectedness to nature has been suggested as a way to improve mental health and foster sustainable behaviour. We developed the Nature Relatedness Scale to assess individual differences in the affective, cognitive, and physical connection people have with nature. Nature relatedness has been linked to pro-environmental attitudes and a variety of psychological well-being indicators. This study examines the potential for increasing connectedness through environmental education. University students ($n = 175$) were tested on nature relatedness, environmental attitudes and psychological well-being before and after environmental and non-environmental courses. Regression analyses revealed that participants who received environmental education showed higher levels of sustainable attitudes and vitality, compared to a control group. Results are discussed in relation to how increases in nature relatedness achieved through environmental education may improve psychological well-being and motivate environmentally responsible behaviour.

Acknowledgements

I gratefully acknowledge Dr. John Zelenski for supervising this thesis and so enthusiastically supporting this line of research. His humour, patience, and insight were beyond measure. I also wish to thank Tania, Lisa, Matt and Sherri in the Happy Lab for their tremendous help with data entry. I would like to acknowledge the generous cooperation of the instructors and students who allowed me to visit their classes and conduct my research. Without them, this work would not have been possible. I am grateful to the Social Science and Humanities Research Council, the Ontario Graduate Scholarship program, as well as Carleton University for the funding that has made this study possible. The memory of my late brother, Christopher, continues to provide me with the inspiration to seek knowledge, live every day to the fullest, and look to nature for happiness. The invaluable encouragement and support of my family of friends, especially Magda, Chris, Robin, and Danielle, will be remembered forever. Many thanks are also due to Marion for sharing her experience, advice and guidance. Lastly, my canine companions deserve acknowledgement for accompanying me on all my outdoor adventures and keeping me connected to all things wild.

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Nature Relatedness, Environmental Concern, and Well-Being

We face increasing environmental problems such as smog warnings, floods and droughts, and increasing health problems related to toxins in the air, land, and water. In fact, Canadians report environmental pollution as the most important risk to their health (Enviroics, 1998). Our behaviour and lifestyles, however, contribute to global warming, habitat destruction, and depletion of the ozone layer (Winter, 2000). The world's leading scientists (Union of Concerned Scientists, 1993) tell us a drastic change in our treatment of the environment is necessary to prevent the earth from becoming uninhabitable for humans and all other species. Yet, despite the warnings and education efforts of governments, scientific experts, and activist groups, people continue to behave in ways that are damaging to human health and to the planet (Oskamp, 2000). While many people are aware of and care about environmental problems, this is not always reflected in behaviour (Dunlap, Van Liere, Mertig, & Jones, 2000; Kaplan, 2000; Kortenkamp & Moore, 2001; Pooley & O'Connor, 2000).

Psychologists have examined motivation, attitudes, values, and beliefs in order to understand this discrepancy and why some people engage in environmentally responsible behaviour (ERB) while others do not (Allen & Ferrand, 1999; Dunlap, & Mertig, 1995; Kaiser, Wölfing, & Fuhrer, 1999; Nordlund & Garvill, 2002; Pelletier, Dion, Tuson, & Green-Demers, 1999; Pelletier, Legault, & Tuson, 1996). People's personal relationship with nature may provide some insight into the way they treat the environment. That is, disconnection from the natural world may be contributing to our planet's destruction (Howard, 1997; Schultz, Shriver, Tabanico, & Khazian, 2004).

Conn (1998) and others (Bragg, 1996; Feral, 1998; Kahn, 1997; Kals & Maes, 2004; Kellert, 1997) argue that along with our physical health, our mental health is interwoven with the state of the planet, and a fragmented human-nature relationship affects our psychological well-being. In the study of ERB and how to inspire more concern for the environment, the cognitive and emotional connection we have with nature is worthy of more attention. We need to better understand *why* we treat the environment this way if we are to prevent continuing degradation and human suffering (Oskamp, 2004). Although the importance of people's connection to nature is often mentioned (e.g., Bragg, 1996; Conn, 1998; Roszak, 1992; Shultz, 2000; Thomashow, 1998), measuring this connection has been difficult. We developed the Nature Relatedness Scale in order to examine individual differences in connectedness. In this paper we investigate whether nature relatedness may be increased with environmental education, and if such an increase would influence pro-environmental attitudes and behaviour. We also test Conn's (1998) suggestion that a stronger connection to the natural world predicts psychological well-being.

The Environment And Behaviour

Global warming, pollution, species extinction, and other environmental problems do not just happen (Winter, 2000). Human beings release chemicals into the land, air and water. People throw recyclables into the garbage and drive two blocks to the store instead of walk. However, behaviour is often not indicative of attitude. In 1996, 45% of Canadians indicated that driving a vehicle was the individual behaviour that most contributed to environmental damage, yet few were willing to reduce the impact by using alternative forms of transportation (Environics, 1998).¹ However, the fact that people do not always behave environmentally does

not necessarily mean they are not concerned (Kaplan, 2000; Schultz, 2000). They may have limited choice, availability, or cultural and social support for alternatives.

In addition, people have trouble considering the interests of the environment when those interests are either unknown or not personally salient (Kortenkamp & Moore, 2001). The environmental consequences of behaviour are not always felt directly, as the scale of global environmental changes may make them intangible (Thomashow, 1998), and the deterioration process may be so slow that problems are undetectable by human senses (Bechtel & Churchman, 2002; Winter, 2000). Ozone depletion and climate change, for example, cannot be visually observed and so may seem abstract and irrelevant unless the consequences feel immediate and personal (e.g., those living in northern areas may notice insects appearing for the first time or ice receding earlier, as a consequence of global warming). People also may not behave environmentally if they feel overwhelmed by information and helpless to prevent the problem (Kaplan, 2000). Amotivation occurs if people believe environmental strategies are ineffective, if the situation seems hopeless, and if they feel low self-efficacy in executing the behaviour and integrating it into their lifestyle (Pelletier, Dion, Tuson, & Green-Demers, 1999).

Environmental behaviours may also be influenced by factors such as beliefs about the importance of the issue, socio-economic circumstances, geography, city infrastructure and geographical location, self-determination, and helplessness (McKenzie-Mohr, Nemiroff, Beers, & Desmarais, 1995). Indeed, using structural equation modeling, Kaiser, Wölfing, and Fuhrer (1999) found environmental attitudes were predictive of behaviour when constraints beyond one's control were included. Their measure of ecological behaviour considered non-

psychological factors such as financial, material, and social circumstances. In sum, there are many reasons for non-environmental behaviour, some psychological (e.g., lack of knowledge, hopelessness), and others structural (e.g., lack of local recycling programs, poverty). Research to disentangle these sources of inaction may help us understand what is causing the attitude-behaviour discrepancy as we work to solve environmental problems.

Environmental Solutions

One suggested approach to environmental problems is to focus on better efficiency in technologies, more efficient and productive resource use (Stern, 2000). Using the evidence of a weak link between values and behaviour, Stern argues that a change in lifestyle is not a valid or necessary path to protecting the environment. He asserts that individual choices to harm the environment are not freely made, as people lack environmental alternatives, and that more focus should be on the degradation of the environment by large organizations. Stern views a shift in values as unnecessary in achieving major policy changes. McKenzie-Mohr and Smith (1999) also take a problem-oriented approach, saying efforts should be focussed on developing new technologies to manage the problems. However, they have also developed a “community-based social marketing” framework to promote behaviour change at the local level. To encourage consumers to make more environmentally friendly choices they insist we must remove barriers and provide incentives. Their framework is based on social psychology principles such as framing, commitment, norms, and modeling.

While this approach is an important part of the solution in promoting ERB, it does not address the causes or individual differences in destructive behaviour. Caution must also be

exercised in turning to technology to solve all our problems. Technology often separates us from the natural world and contributes to our disconnection from the environment (Thomashow, 1998). Changes in lifestyle as well as the creative use of technology are likely required to move people toward ERB (Oskamp, 2000).

Research on what does inspire ERB has suggested a variety of motivators.

Dissatisfaction with the state of one's local environment seems to be a potential determinant of pro-environmental conduct (Pelletier, Legault, & Tuson, 1996). Recent research has found that long-term thinking, the consideration of future consequences, may be an important contributor to environmental choices (Joireman, Van Lange, & Van Vugt, 2004; Lindsay, & Strathman, 1997). For example, public transportation was more important to people with an orientation toward the future if they also believed cars were harmful to the environment (Joireman, Van Lange, & Van Vugt, 2004). This link between ERB and long-term thinking is not surprising, considering the slow and often imperceptible nature of global environmental changes. However, we still need to understand why some people are able to think long term or why some act upon their dissatisfaction with the environment while others do not, if we want to learn how to inspire more ERB.

A number of studies have examined altruism as a sign of environmental concern (Allen & Ferrand, 1999; Schultz, Shriver, Tabanico, & Khazian, 2004; Stern, Dietz, Kalof, & Guagnano, 1995). However, Kaplan (2000) argues against the sacrificial stereotype of ERB. According to Kaplan, the altruistic approach to environmentalism needlessly relies upon a model of self-sacrifice and only contributes to helplessness, denial and inaction. Kaplan points out that selfless

intentions do not guarantee positive outcomes. Altruism also implies that wanting to preserve nature for one's own enjoyment is at odds with ERB. In fact, pro-environmental attitudes may be related to both concern for the planet as a whole, as well as for humans (Kortenkamp and Moore, 2001). Indeed, the enjoyment attained from a personal relationship with nature may be an effective way to motivate ecological behaviour (Hartig, Kaiser, & Bowler, 2001; Pooley & O'Connor, 2000). We further investigate this possibility by examining links among nature relatedness, happiness, and environmental attitudes and behaviour.

The Human-Nature Connection

Based on evolutionary development, Wilson (1984) argues that humans possess an innate need to affiliate with other living things. The "biophilia hypothesis" (Kellert & Wilson, 1993) attempts to explain the human tendency to relate to the natural environment, along with an understanding of the importance of biodiversity. Evidence consistent with the biophilia hypothesis lies in the popularity of outdoor wilderness activities, zoos, gardening, in our relationship with animals, and our fondness for natural scenery (Wilson, 1993). Even unspectacular nature scenes are consistently preferred over urban images (Hartig, Bök, Garvill, Olsson, & Gärling, 1996; Kaplan, 1995; Ulrich, Simons, Losito, Fiorito, Miles, & Zelson, 1991). Further support for the hypothesis is the universal preference for a specific type of nature image, that of open grasslands or savannas, in which early humans flourished (Heerwagen & Orians, 1993). The continued preference in today's world for a landscape that offered survival advantages to our ancestors suggests biophilia has some genetic basis.

Similarly, there is evidence that fearful (or biophobic) responses to natural elements, such as snakes, for example, are partially innate (Ulrich, 1993; Ulrich, Simons, Losito, Fiorito, Miles, & Zelson, 1991). Humans began living in cities, separated from the natural world, relatively late in our evolutionary history, so, Wilson and Kellert (1993) point out, it is unlikely we have erased all the learning about nature's value embedded in our biology. Biophilia exists to provide us with an adaptive advantage, in order to value and maintain the environment upon which our survival depends (Wilson, 1993).

Our lives are also filled with words and images involving nature. The pervasive use of animal words and symbolism in language is an expression of what Lawrence (1993) terms "cognitive biophilia", or the place of nature in fostering human communication. We regularly use animal words to describe other humans, their personality, and behaviour, e.g., smart as a fox, chauvinist pig, blind as a bat, busy as a bee.

Despite the popularity of nature, there is considerable variability in the extent to which individuals are drawn to natural world. Some people enthusiastically seek out encounters with nature while others try to avoid all contact. Early experiences may help explain these differences. Perhaps there is a "critical phase" or some age by which we need to have positive nature experiences for biophilia to take hold (Orr, 1993). Kellert (1997) suggests that biophilia is inborn, but also shaped by experiences and culture. Individual differences in how attracted people are to the natural world may be a function of how supported or suppressed their biophilic tendencies are. This suggests that as species become extinct and biodiversity is lost, we may also be losing many of the 'environmental triggers' necessary to nurture biophilia (Thomashow,

1998). That is, a degraded environment may never extinguish our desire to connect with nature, but it can diminish our appreciation for the role of natural diversity in healthy human development (Kellert, 1997).

The individual relationship we have with nature is receiving increased attention in the study of ERB (Allen & Ferrand, 1999; Iwata, 2001; Pooley & O'Connor, 2000). Environmental concerns relate directly to the degree with which individuals see themselves as part of the natural world (Schultz, 2000). As Schultz, Howard (1997) and others have argued, if we value and feel concern for nature, we will then want to protect it. It is difficult to value something that is not part of one's experience, or to care about something one does not feel a part of.

Schultz (2002) categorizes environmental concerns in regard to whether individuals care about themselves, other people, or all living things (egoistic, social-altruistic, or biospheric concern). He argues that biospheric attitudes are indicative of a stronger connection to nature, while egoistic attitudes indicate a damaged relationship. Individuals who feel closer to nature, and who are concerned with all life report more ERB and pro-environmental attitudes (Schultz, 2000).

Schultz (2000) has been able to manipulate environmental concern from egoistic to biospheric by having participants take on the perspective of another creature. This temporarily increased participants' concern for the environment, perhaps due to a sense of inclusion with nature and increased feelings of interconnectedness. Schultz's findings suggest the individual human-nature connection may be malleable, and hint at the potential for interventions designed

to increase feelings of connectedness. By finding ways to increase people's sense of connectedness we may foster more ERB.

How nature influences human emotions and why some people feel strongly and positively about nature, while others are unmoved, are important questions in the study of ERB (Kals & Maes, 2004; Milton, 2002). Kals, Schumacher, and Montada (1999) have investigated the emotional aspects of environmental behaviour in their research on love of nature and interest in nature. Along with affinity, interest and indignation, positive past and present nature experiences were predictive of nature-protective behaviour. Another 'emotion-based' approach found that sympathy, as a measure of caring for the environment, was an important predictor of environmentally friendly behaviours (Allen & Ferrand, 1999). Pooley and O'Connor (2000) also found that including emotion made environmental education more successful in fostering behavioural changes. To understand what motivates ERB, we may need to integrate the affective component of individual relationships with nature with ecological understanding, i.e., knowledge of the relationships between human behaviour and the natural environment.

The Ecological Self

The understanding of our interconnectedness with the earth, and sense of our inclusion in nature is often referred to as an ecological identity or ecological self, a term coined by Arne Naess (1973). An ecological identity includes the self, the human and non-human community, and the planet's ecosystems (Conn, 1998). A sense of self that includes the whole earth means that damage to the planet is seen as damage to the self, so the development of an ecological identity should coincide with pro-environmental behaviour and lifestyle changes.

Naess (1973), and many others since (e.g. Bragg, 1996; Orr, 1993, Roszak, 1992; Tarnas as cited in Schultz, 2002), have insisted a more connected sense of self is necessary to change behaviour towards the environment. 'Ecopsychologists' promote environmental behaviour change by tapping into (assumed) innate biophilic tendencies and the experience of people's relationships with nature. The ecopsychology approach uses the human longing for a sustainable relationship with the natural world to inspire ERB, and suggests caring behaviour results from a sense of connection and concern for the well-being of the planet (Conn, 1998).

At a collective level, damaged person-nature relationships may be contributing to global environmentally unfriendly behaviour (Conn, 1998; Shultz, 2000). The fact that biophilic tendencies have not moved everyone toward environmentalism or conservation behaviours may be indicative of widespread disconnection from our natural environment, and suggests a need to further study individual differences in levels of connectedness and environmental concern.

Connection to nature, ecological identity, or the ecological self has been the subject of few empirical studies. Still, Schultz (2000, 2002) has evaluated aspects of the human-nature relationship. By adapting Aron, Aron, & Smollan's (1992) Inclusion of Other in the Self Scale, Schultz (2002) has created a measure of Inclusion of Nature in Self (INS). Using images with seven pairs of circles, each circle containing either the word "self" or "nature" inside, individuals indicate which image best represents their personal relationship with nature. Least connected are people who choose circles that touch but do not overlap. Most connected are those who choose entirely overlapping circles. Strong Inclusion of Nature in Self correlates with environmental concern and self-reported ERB (Schultz, 2002), consistent with ecopsychology theory. While

Schultz's method addresses some aspects of the human-nature connection, as a single-item scale it may not cover the broad range of emotions, thoughts and experience that comprise an individual's relationship with nature.

A measure of the human connection with nature should encompass both affective and cognitive elements, as well as the interest, fascination and desire to experience and be in nature. We describe such a measure, and the construct of nature relatedness below.

Nature Relatedness

Building on ecopsychology and the biophilia hypothesis, we propose a new construct, "nature relatedness" (NR), to describe individual levels of connectedness with the natural world. Nature relatedness is not unlike the deep ecology concept of an ecological self, the notion of a self-construal that includes the natural world. NR encompasses one's appreciation for and understanding of our interconnectedness with all other living things on the earth. It is not simply a love for nature, or enjoyment of only the superficially pleasing facets of nature, such as sunsets and snowflakes. It is an understanding of the importance of all aspects of nature, even those that are not aesthetically appealing to humans, such as spiders and snakes, for example. Kahn (1999) suggests that we need to build on and empirically test the biophilia hypothesis. Measuring individual differences in nature relatedness may promote this effort. From a biophilia perspective, NR is an indicator of the extent to which a person's innate need to connect with nature has been supported or suppressed, with individual differences in NR levels reflecting the strength of connectedness to nature. Thus, NR is one way to operationalize biophilia, but is also a useful measure of connectedness independent of ecopsychology theory and the biophilia

hypothesis. We conceive NR as 'trait-like' in that it is relatively stable over time and across situations, though not completely fixed.

The Nature Relatedness (NR) Scale (Nisbet & Zelenski, 2005) is a self-report measure we designed to assess the individual affective and cognitive relationship individuals have with the natural world. The scale measures overall nature relatedness but a three-factor structure may also be used to examine dimensions that contribute to one's connectedness to nature. The first dimension, NR-self, represents an internalized identification with nature, reflecting feelings and thoughts about one's personal connection to nature. The second dimension, NR-perspective, represents an external, nature-related world view about how humans interact with other living things and would be reflected in people's views about human treatment of animals and use of natural resources, for example. The third dimension, NR-experience, reflects a physical familiarity with the natural world, a level of comfort with, fascination, and desire to be in nature.

Past research using the NR Scale has shown that nature relatedness correlates with environmental attitudes, beliefs, and self-reported ERB, as well as vegetarianism, humanitarianism, love of animals, environmental activism, and long-term thinking (Nisbet & Zelenski, 2005). NR is distinct from environmentalism in that it is comprised of more than activism and, unlike most environmental measures, has been related to well-being or happiness indicators (Nisbet, Murphy, & Zelenski, 2005; Nisbet & Zelenski, 2005).

Nature and Well-Being

The ecopsychology approach suggests that a strong connection to nature promotes human health in addition to environmentally healthy behaviour. Consistent with this, research has

investigated nature as a corrective or remedial measure to counteract stress, anxiety, or to aid in the recovery from illness (Herzog, Black, Fountaine, & Knotts, 1997; Herzog, Maguire, & Nebel, 2003; Laumann, Gärling, & Stormark, 2003; Ulrich, 1993). Ulrich (1993) provides a thorough summary of this research. For example, systolic blood pressure in stressed pre-surgical patients was lower after a few minutes of looking at serene nature scenes, compared to more exciting outdoor scenes or no photographs, and dental patients reported feeling less stress and had lower heart rates on days when a nature mural was displayed than on days without it. Nature and natural settings seem to have relaxing, healing and restorative benefits for human beings, both physically and psychologically (see Frumkin, 2001 for a thorough review of the health benefits of nature).

According to Kaplan (2001), nature has positive effects even when viewed through a window. Nature views predict more effective functioning at work, feelings of peacefulness, and satisfaction with the neighbourhood. People who participate in outdoor activities such as walks through a park report feeling more positive, focused, effective and alert (Kaplan, 2001). Williams and Harvey (2001) have examined the characteristics of transcendent experiences people have in forest environments. Not only do these experiences involve fascination, relaxation and other indicators of well-being, but they are not limited to remote or wilderness environments.

The documented benefits of nature on human physical health, along with Kaplan's work, suggest that being more related to nature may make us happier. While research is plentiful on the factors that may contribute to happiness (Diener, Suh, Lucas, & Smith, 1999) there have been

few empirical studies on how the human relationship with nature influences well-being. Seligman (2002) has recently suggested three types of happiness: positive hedonic balance (i.e., more positive and less negative emotions), sense of satisfaction (i.e., a more cognitive evaluation that things are going well), and a sense of meaning (i.e., that one's life has an important purpose). As there is no single, definitive measure of well-being, a number of instruments are often used to provide overlapping and complementary measurement. We have assessed happiness at all three levels (Nisbet, Murphy, & Zelenski, 2005; Nisbet & Zelenski, 2005), and find that NR is modestly related to two of them. NR is related to feeling autonomous, achieving personal growth, and having a sense of purpose in life, all reflecting a sense of meaning. In addition, NR is related to vitality and positive affect, suggesting that a strong connection to nature could facilitate hedonic happiness as well. It is worth noting that we find NR is related to positive emotionality, but unrelated to negative emotionality. This builds on past work showing nature's efficacy in helping people recover from adverse experience (presumably associated with negative emotions). It may be that the mechanism of nature's restorative power is through positive emotions (c.f., Fredrickson & Levenson, 1998; Fredrickson, Mancuso, Branigan, & Tugade, 2000). The theory and research reviewed here clearly suggest that connection to the natural world will be associated with positive emotions and well-being more generally.

A corollary of this theory is the contention that a disconnection from nature may be leading not only to an unhealthy environment, but to unhealthy and unhappy humans as well (Conn, 1998). The loss of biodiversity, a bi-product of environmental destruction, has negative consequences for the human psyche (Kellert, 1997; Winter & Koger, 2004). People surrounded

by concrete in urban centres may feel unhappy when deprived of natural spaces (Feral, 1998) and may be unaware of the potential for personal happiness available through being more related to nature, even nearby urban nature.

There also may be some negative emotions associated with the awareness of environmental problems. For some highly nature related individuals, a strong connection to what they may see as a degrading environment may lead to negative affect. For example, Pelletier, Legault, and Tuson (1996) discovered that those less satisfied with the state of the environment and government policy experience more frustration and discouragement. Whether these influences extend beyond the domain of emotions specific to environmental concerns is not clear. The relationships found between NR, environmental concerns, and happiness (Nisbet & Zelenski, 2005), however, suggest that people can feel negative emotions concerning the state of the environment, but are also able to simultaneously feel positive about their own lives and their personal relationship with nature.

Environmental Education

Those concerned with the environment work to keep the air, soil and water clean, which everyone benefits from and depends on, regardless of connectedness levels (Orr, 1993). Environmental education can teach the next generation of decision-makers and consumers the skills required for living sustainably and maintaining a healthy environment. Biophilia and nature relatedness likely require nurturing to fully flourish. Education that nurtures NR likely must counter the pressures of consumption, materialism, and short-term thinking. Environmental education may accomplish this if thoughtfully undertaken.

Feral (1998) points out that people may spend more time watching life than living it. People often have no direct knowledge about the plants and animals that share their community. Modern lifestyles often separate us from meaningful interactions with the natural environment, where nature is deemed inadequate and relegated to home décor or television specials. As our separation from nature increases, so does our discomfort with the wilderness and things not human-made. As environmental damage continues, resulting in smog warnings, polluted waterways, ozone depletion, and overflowing landfills, it becomes less appealing and more dangerous to be outdoors in nature. Orr (1993) suggests biophobia, the opposite of biophilia, leads to a spiralling effect where damaging behaviour reduces the beauty and enjoyment of nature. An increased awareness of nature and basic knowledge of ecology could foster biophilic tendencies, increase NR, and promote concern for the environment. As people become aware of their neighbours in the same ecosystem, they will become more aware and concerned with the health of that ecosystem, feel part of it, and care about protecting it (Thomashow, 1998). Wilson (1984) alleges the more we learn about other organisms, the more we will value both these creatures and ourselves. In other words, ecological literacy and natural history education may promote more self worth and ERB.

Kaplan (2000) believes that tapping into the human desire to explore and learn is far more effective in inspiring concern for nature than dictating behaviour. This may explain why people often are unmotivated to comply with government initiatives, but may be more responsive when their own personal relationship with nature is involved. For example, a person may resent government pressure to carpool or take public transit, but actively work to protect a local

greenspace or park they enjoy visiting. Indeed research shows those who were interested in a freshwater marsh also engaged in more ERB (Hartig, Kaiser, & Bowler, 2001), and that invoking fascination is more likely to inspire ecological behaviour than the negative tone often used in messages about environmental problems. Fostering interest and fascination with nature is also likely to increase NR.

While individual differences in connectedness are likely to be relatively stable over time, environmental education or experiences in nature may increase NR. For instance, the research on outdoor adventure programs and nature therapy has demonstrated that a change in perspective and feelings about the human-nature relationship is possible (Kaplan, 1995, Kaplan & Kaplan, 1989; Kaplan & Talbot, 1983). Feral's research (1998) showed that nature had therapeutic benefits for children who were disconnected from nature, deprived of natural or green spaces. Not only did the children develop increased empathy for nature, but also their perceptual skills, self-esteem and self-efficacy increased, while aggression declined.

Bragg (1996) observed changes in ecological self-construal following intensive workshop experiences designed to expand people's self-concepts to include all life forms and ecosystems. Participants already had strong ecological self identities which drew them to the workshops, so similar research is need with less environmentally aware individuals to determine if a change can be effected. Our ability to measure changes in connectedness to nature with the NR Scale may help to address the paucity of empirical research in this area and test whether increasing connectedness influences well-being and ERB.

Kellert (1997) has expanded on the biophilia hypothesis, suggesting that our biophilic tendencies drawing us to natural diversity are important for optimal emotional and psychological development. In other words, embracing our connection to nature makes our lives richer and more meaningful. Becoming more nature related may make us happier. NR's positive relation to autonomy, personal growth, purpose in life, positive affect, and vitality (Nisbet, Murphy, & Zelenski, 2005; Nisbet & Zelenski, 2005) make these good candidates for change with environmental education. As individuals become more related to nature, they are likely to feel more positive emotions. This sense of well-being they experience could then inspire more pro-environmental behaviours. If increasing NR can improve psychological well-being, we may also dispel the myth that living environmentally requires a life of relentless deprivation. As Schultz (2000) suggests, if people feel good about their own natural environment, value and care about it, they will behave in ways that respect and protect it. As we strive to find the solutions to environmental problems, we may find that in healing the planet, we may also be able to restore or improve human mental health (Thomashow, 1998).

The Present Study

This study investigates the effects of education about ecology and the natural world on individual levels of nature relatedness, and how individual differences in connectedness relate to well-being, happiness and pro-environmental attitudes. Seven hypotheses are proposed.

Hypothesis 1: The first hypothesis is that students with high nature relatedness scores will have more pro-environmental and sustainable attitudes, and report more sustainable behaviour, relative to those with low NR scores.

Hypothesis 2: The second hypothesis is that those high in NR will have more biospheric, less social-altruistic, and little or no egoistic-based concern for the environment, relative to those low in NR. High NR people are expected to indicate more Inclusion of Nature in Self.

Hypothesis 3: Nature relatedness is expected to moderate the difference between self-reports of promised and actual environmental behaviour. Those with higher levels of NR are expected to show a smaller gap between verbal commitment and actual commitment regarding environmental issues.

Hypothesis 4: The fourth hypothesis is that those high in NR will also have higher well-being scores than those low in NR. Vitality, autonomy, personal growth, purpose in life, and positive affect are expected to be higher for nature related people.

Hypothesis 5: The fifth hypothesis is that levels of NR and Inclusion of Nature in Self among students will increase significantly as a result of receiving educational information about the natural environment. While students interested in and enrolled in ecological courses may start with higher NR scores than other students, we still expect to see an increase in connectedness resulting from the more recent environmental education.

Hypothesis 6: NR is expected to mediate the link between environmental education and environmental attitudes and concern. Increased levels of NR due to education are expected to increase pro-environmental attitudes and biospheric concern for the environment, as well as sustainable behaviour and attitudes.

Hypothesis 7: NR is expected to mediate the relationship between education and psychological well-being or happiness. An increase in NR due to education is expected to improve vitality, autonomy, personal growth, purpose in life, and positive affect.

Method

Participants

Carleton university undergraduates voluntarily completed surveys as part of a study on student views concerning the environment. Participants were recruited through in-class visits by the researcher to selected introductory psychology, geography, and biology classes, inviting students to participate in research, in exchange for their name being entered in a lottery for a cash prize. Two separate draws, following each of the surveys and each with the same prize value (\$200) took place to include all participants, whether they chose to participate at only Time 1 or also at Time 2. First year undergraduate psychology students who participated served as the control group for the study. The survey asked all students to indicate whether they were currently enrolled in any courses in biology, geography, natural history, or environmental studies and sciences, so we could classify them as experimental condition participants. Nine students from the control group were identified and recoded as experimental group participants.

Three hundred and fifty-four students completed the survey at the beginning of the fall term (Time 1). The mean age of the sample was 20.03 years, $SD = 4.36$. More women (59.9%, $n = 212$) than men ($n = 142$) participated. The majority (82.5%) were first year students, and represented a broad range of disciplines within the faculty of arts and social sciences.

A subsample of 176 students completed the survey again at the end of the term (Time 2). These participants had demographic characteristics very similar to the larger Time 1 sample. One respondent was excluded from the analysis due to the amount of missing data on her survey. Of the remaining cases, 109 were women (62.3%) and 66 were men, with a mean age of 19.97 years, $SD = 4.50$.

Of the 175 participants completing both surveys, 76 were not enrolled in any type of environmental courses at the time of the study and were designated as the control condition. The experimental group was comprised of 99 students. Ninety of these participants were enrolled in the biology, environmental studies, and geography classes visited by the researcher, with the remaining nine identified through their surveys as being enrolled in other biology, environmental studies, and earth sciences courses. The gender ratio was similar for the two groups, however the experimental group was slightly but significantly older ($M = 21.03$, $SD = 5.65$) than the control group ($M = 18.66$, $SD = 2.04$; $t = 3.49$, $p < .01$). We controlled for age in our subsequent analyses, which we discuss later.

Materials

Participants in the two conditions received the same questionnaire package. The same set of questionnaires was administered at both Time 1 and Time 2.

Demographics and Environmental Education History. A questionnaire (Appendix A) was used to gather basic demographic information, including age, gender, academic level, and major. In addition, students were asked if they were currently enrolled in or had completed any

past courses in geography, geology, biology, ecology, environmental sciences, environmental studies, or natural history.

Connectedness to Nature. The *Nature Relatedness (NR) Scale* (Nisbet & Zelenski, 2005; Appendix B) assesses individual connection to nature. The scale differentiates between known groups of nature enthusiasts and those not active in nature activities, between those who do and do not self-identify as environmentalists, and correlates with environmental attitudes and self-reported behaviour (Nisbet & Zelenski, 2005). Further evidence of validity was found using experience sampling methodology. Those higher in NR also reported spending more time outdoors and in nature (Nisbet, Murphy, & Zelenski, 2005). NR predicts aspects of well-being that other environmental measures do not, providing evidence of the NR scale's discriminant validity. Respondents rate 21 statements on how well each item describes them, using a five-point Likert scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*), such that higher scores are indicative of a stronger connection to nature. The items in the NR scale combine to provide a measure of overall nature relatedness ($\alpha = .90/.91$).² A three-factor structure provides an opportunity to examine specific dimensions of NR that contribute to one's connection to nature. The first dimension, NR-self, includes eight items ($\alpha = .88/.90$) such as "I feel very connected to all living things and the earth". The second dimension is NR-perspective and includes seven items ($\alpha = .64/.69$) such as "Humans have the right to use natural resources any way we want". The third dimension, NR-experience, includes six items ($\alpha = .81/.84$) such as "I enjoy being outdoors, even in unpleasant weather". Reverse items were recoded and

participants' scores were averaged to calculate an overall NR score as well as a score on each of the three dimensions.

For NR and all other outcome variables we also calculated change scores to capture variation from Time 1 to 2. Each variable at Time 2 was regressed on the corresponding Time 1 variable, with the standardized residuals becoming the new variable reflecting change over the course of the study.

The *Inclusion of Nature In Self Scale* (Schultz, 2002; Appendix C) assesses participants' feelings of closeness to the natural world. This measure is an adaptation of Aron, Aron and Smollan's work (1992) on closeness in interpersonal relationships. The scale predicts concern for all living things, as well as self-reported environmentally responsible behaviour (Schultz, 2001). Seven images are presented which represent varying levels of inclusion with nature. Each image consists of two circles, each circle containing either the word "self" or "nature". Participants are asked to select the image that best describes their relationship with nature. The least inclusive is represented by the self and nature circles side-by-side, while the most inclusive is an image of the two circles merged into one with both the words self and nature together inside.

Environmental Concern, Commitment, and Attitudes. Environmental Concern (Schultz, 2000; Appendix D) evaluates the structure of participants' concern for the environment. The scale differentiates between three types of motivation or concern: egoistic, which is based on how the environment affects one's own well-being; social-altruistic, which is concern based on the environmental conditions that affect other humans; and biospheric, concern for the impact of

environmental problems on all other living things. Confirmatory factor analysis, along with studies conducted in 10 Latin American countries, provide evidence of the validity regarding this classification of environmental concerns (Schultz, 2001). Using a 7-point Likert scale ranging from 1 (*not important*) to 7 (*supreme importance*), participants indicate their concern for the environment due to the consequences for: “animals”, “plants”, “marine life”, “birds” (these four items reflect biospheric concern, $\alpha = .92/.94$), “me”, “my future”, “my lifestyle”, “my health” (reflecting egoistic concern, $\alpha = .88/.86$), “all people”, “children”, “people in my community”, and “my children” (reflecting social-altruistic concern, $\alpha = .89/.85$). Items within each subscale were averaged to create biospheric, altruistic, and egoistic scores for each participant.

The *Ecology Scale, Short-Form* (Maloney, Ward, & Braucht, 1975; Appendix E) captures both feelings about ecological issues and willingness to commit to behaviour change in a “true” or “false” response format.³ The scale has differentiated between environmental activists and non-activists (Maloney, Ward, & Braucht, 1975; Amelang, Tepe, Vagt, & Wendt, 1977) and predicts involvement in environmental organizations (Shean & Shei, 1995). Three 10-item subscales measure *verbal commitment*, *actual commitment* and *affect* towards ecological issues concerning transportation, monetary donations, consumer purchases, pollution, political activism, and general awareness.⁴ The verbal commitment subscale ($\alpha = .72/.74$) measures what participants state they are willing to do in regards to environmental issues. Items include “I’d be willing to ride a bicycle or take the bus to school in order to reduce air pollution”. The actual commitment sub-scale ($\alpha = .74/.78$) measures what participants really do for the environment, or self-reported behaviour, and includes items such as “I have switched products for ecological

reasons". The affect sub-scale ($\alpha = .77/.83$) measures emotionality related to environmental issues and includes items such as "It frightens me to think that much of the food I eat is contaminated with pesticides". Reverse items were recoded and scores on the three subscales were calculated for each participant.

The Carleton Sustainable Campus Network is conducting an audit of sustainable practices at the university. To assist in this project and provide information about students' opinions and ERB, several questions were included which ask about attitudes concerning sustainability, as well as self-reported transportation, recycling, activism and purchasing patterns (*Sustainability Survey*; Appendix F). The number of activities reported by each participant was summed to create a sustainable behaviour score ($\alpha = .68/.73$). The sustainability attitude items ($\alpha = .71/.78$) were averaged to create a score for each participant.

Well-Being Indicators. Vitality was assessed with the *Vitality Scale* (Individual Difference Level Version, Ryan & Frederick, 1997; Appendix G). The scale is a measure of how much participants feel alive and energetic. Using structural equation modelling, Bostic, Rubio, and Hood (2000) have found evidence of the scale's validity. Items include "I feel alive and vital" and "I have energy and spirit". Respondents indicate how true each statement is for them, in general, using a Likert scale ranging from 1 (*not at all true*) to 7 (*very true*; $\alpha = .83/.88$). Items were averaged to compute an overall vitality score.

PANAS (Watson, Clark, & Tellegen, 1988; Appendix H) was used to measure positive ($\alpha = .83/.88$) and negative affect ($\alpha = .82/.85$) using a 20-word list of emotions. Discriminant and convergent validity have been established through correlates with other measures of affect and

lengthier mood measures, as well as experience sampling methodology (Watson, Clark, & Tellegen, 1988). In the Time 1 survey, participants were asked to indicate how much, *in general*, they felt each one, using a 5-point Likert scale ranging from 1 (*very slightly or not at all*) to 5 (*extremely*). The Time 2 survey asked participants to indicate how much, *over the past several weeks*, they felt each emotion. A positive affect score was calculated by averaging the positive emotion items, with negative affect calculated using the negative emotion words.

The *Psychological Well-Being Inventory* (Ryff, 1989; Appendix I) assesses six dimensions of psychological well-being derived from the literature on life span development, mental health and personal growth. Reliability and validity have been established with correlates of similar measures, relevant life events, and spousal reports (Ryff & Essex, 1992; Ryff & Singer, 1996). We measured three of the six dimensions of well-being previously linked with NR: autonomy, purpose in life, and personal growth. Participants are asked to respond to statements pertaining to various aspects of their lives, using a Likert scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Each dimension contains nine items. The autonomy sub-scale ($\alpha = .78/.80$) measures ability to think independently and resist social pressures, and includes items such as “Being happy with myself is more important to me than having others approve of me”. Personal growth ($\alpha = .74/.82$) assesses openness to new experiences and feelings of continued development. Items include “For me, life is a continuous process of learning, changing, and growth”. Purpose in life ($\alpha = .79/.80$) measures one’s goals in life and a sense of directedness and meaning. Items include “I enjoy making plans for the future and

working to make them a reality”. Appropriate items were reverse scored and average scores for each dimension were calculated.

Procedure

Students were invited to participate in a study about their thoughts on the environment. The researcher visited classes, pre-arranged with instructors, during the first two weeks of the fall term (see Appendix J, Notice for Recruitment). During the class visits, students who volunteered for the study were informed of the experimental procedure and asked to provide written informed consent (Appendix K).

The study comprised two parts: a measure of students’ nature relatedness, well-being, and environmental attitudes, taken twice during the fall term. The first measurement (Time 1) occurred during the first two weeks of classes, before students received any substantial information about the environment. The second measurement (Time 2) using the same set of questionnaires was taken near the end of the term, prior to exams.

The questionnaire package included relevant demographics. Students’ nature-relatedness, affect, vitality, well-being, and environmental attitudes and concern were assessed with self-report measures. Participants were also asked if they were currently enrolled in, or had previously completed any geography, geology, biology, ecology, environmental sciences, environmental studies, or natural history courses. This allowed us to identify any students in the control group who should be considered part of the experimental condition, or who need to be examined separately in our analyses due to any past course experience. Participants completed the questionnaires individually, during or immediately following class time, as pre-arranged with

each instructor. The time required to complete the study was approximately 40 minutes (20 minutes on two occasions). Participants were debriefed after completing the survey, on both occasions, to ensure students who only participated at Time 1 were given the necessary information. In order not to influence students' responses at Time 2, however, the Time 1 debriefing was a less detailed one (see Appendixes L and M). Students were entered in a draw to win a prize each time they completed the survey. The two draws were held and prizes awarded to winning participants.

The researcher also visited the control group and some of the environmental classes after the study was completed to thank the students for their participation and give a short presentation about the research process and some early results of the study.

Results

Missing Data and Outliers

There was no indication that missing data were not random. Six missing values (less than 1%) were imputed from a regression on all other variables. The data were examined for outliers. Several were detected, however adjusting all outliers to within three standard deviations of recalculated means did not alter any of the findings, so we report analyses on unadjusted data.

Control and Experimental Group Characteristics

There were differences in the groups concerning past education. Contrary to our expectations, the control group had significantly more past environmental education than the experimental group, $\chi^2(1, n = 175) = 4.29, p < .05$. Eighty one percent of the control group students and 67.7% of the experimental participants reported having taken at least one course in

geography, geology, biology, ecology, environmental sciences, environmental studies, or natural history previously, either in high school or university. Seven control group and 10 experimental group students reported no previous environmental courses.

Experimental group students enrolled in the environmental courses had significantly higher levels of NR at Time 1, $t(173) = 6.24, p < .01, d = .96$, compared to the control group. Experimental group students also had higher initial levels of all the environmental variables, as well as personal growth. Time 1 means, standard deviations, and effect sizes for all dependent variables are presented in Table 1, below.

Nature Relatedness and Environmental Measures

The first two hypotheses, that students higher in NR will have more pro-environmental attitudes and more biospheric concern and inclusion with nature, were confirmed. NR correlated with the environmental measures as expected for the Time 1 survey ($n = 354$). Table 2 contains the correlations between NR and the environmental scales. All correlations were moderate to large (.50 to .70), consistent with past research (Nisbet & Zelenski, 2005) linking the NR scale to environmental measures.⁵

NR correlated with all three subscales of the Ecology scale, and with the Inclusion of Nature in Self measure. As expected, NR correlated strongly with biospheric orientation, but only weakly with altruistic concern, and not at all with egoistic concern. NR also correlated strongly with the questionnaires on sustainability, both self reported sustainable behaviours and the attitude measure.

Table 1

Time 1 Means, Standard Deviations, and Effect Sizes For Environmental and Well-Being Variables by Group

	Control (<i>n</i> = 76)		Experiment (<i>n</i> = 99)		<i>t</i>	<i>d</i>
	M	SD	M	SD		
Nature Relatedness	3.35	.58	3.93	.62	6.24**	.96
Inclusion of Nature In Self	3.21	1.24	4.44	1.34	6.24**	.95
Ecology scale - Verbal Commitment	1.54	.22	1.75	.20	6.67**	1.01
Ecology scale - Actual Commitment	1.26	.21	1.48	.25	6.08**	.94
Ecology scale - Affect	1.56	.29	1.74	.20	4.92**	.73
Biospheric Concern	5.48	1.24	6.12	.92	3.80**	.59
Altruistic Concern	6.23	1.08	6.41	.87	1.20	.19
Egoistic Concern	5.91	1.22	5.91	1.14	.03	.00
Sustainable Behaviour	5.60	2.58	7.38	2.61	4.48**	.69
Sustainable Attitude	3.33	.50	3.77	.46	6.03**	.91
Vitality	4.46	1.15	4.78	1.05	1.92	.29
Positive Affect	3.50	.55	3.64	.59	1.65	.25
Negative Affect	2.03	.55	2.01	.61	.20	.03
Autonomy	4.43	.74	4.36	.72	.61	.09
Personal Growth	4.70	.72	5.05	.57	3.57**	.54
Purpose in Life	4.55	.78	4.77	.74	1.96	.30

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

Table 2

Time 1 Correlations Between NR, NR Dimensions, and Environmental Measures (n = 354)

	NR	NR-self	NR-perspective	NR-experience
Inclusion of Nature In Self	.69**	.68**	.45**	.58**
Ecology scale - Verbal Commitment	.70**	.69**	.58**	.48**
Ecology scale - Actual Commitment	.57**	.57**	.36**	.46**
Ecology Scale - Affect	.63**	.61**	.58**	.38**
Biospheric Concern	.50**	.44**	.49**	.33**
Altruistic Concern	.11*	.11*	.13*	.04
Egoistic Concern	.00	.01	.04	-.05
Sustainable Behaviour	.59**	.57**	.40**	.48**
Sustainable Attitude	.63**	.59**	.59**	.41**

* $p < .05$, ** $p < .01$.*Nature Relatedness as Moderator*

Our third hypothesis was that NR would moderate the gap between verbal and actual commitment to environmental issues. Verbal commitment and NR were both centered before computing the interaction term (Preacher, Curran, & Bauer, 2003). A multiple regression analysis was conducted with verbal commitment entered on step 1, NR added on step 2, then the verbal commitment-NR interaction term entered on step 3 (Table 3). The interaction was significant, $\beta = .165$, $p < .01$, and is illustrated in Figure 1. While the effect is not a large one,

NR does predict the difference between what people say and what they do for the environment, such that the relationship between promised and actual behaviour is stronger for more nature related people.

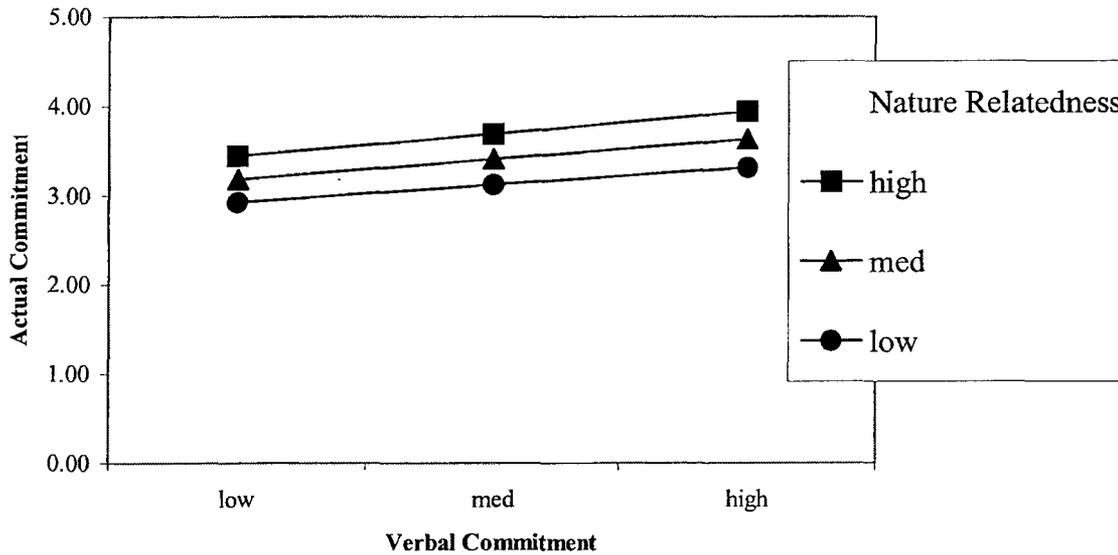
Table 3

Time 1 Regression Analysis Assessing NR's Moderating Effect on Verbal Commitment and Actual Commitment to Environmental Issues

	B	SE B	β	R ²
Step 1				.39
Verbal Commitment	.68	.07	.62**	
Step 2				.45
Verbal Commitment	.44	.08	.41**	
NR	.13	.03	.33**	
Step 3				.47
Verbal Commitment	.51	.08	.47**	
NR	.13	.03	.34**	
Verbal Commitment-NR	.23	.08	.16**	

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

Figure 1. Time 1 Verbal and Actual Environmental Commitment Moderated by Nature Relatedness



Nature Relatedness and Well-Being Measures

Our fourth hypothesis was that those higher in NR would also report higher levels of subjective well-being. Indeed, NR was correlated with a number of the well-being measures (Table 4). The strongest correlation was .36, between NR and personal growth. Vitality, positive affect, and autonomy all correlated .25 with NR. Purpose in life correlated .19 with NR. There was no significant correlation between NR and negative affect.⁶

Table 4

Time 1 Correlations Between NR, NR Dimensions, and Well-Being Measures (n = 354)

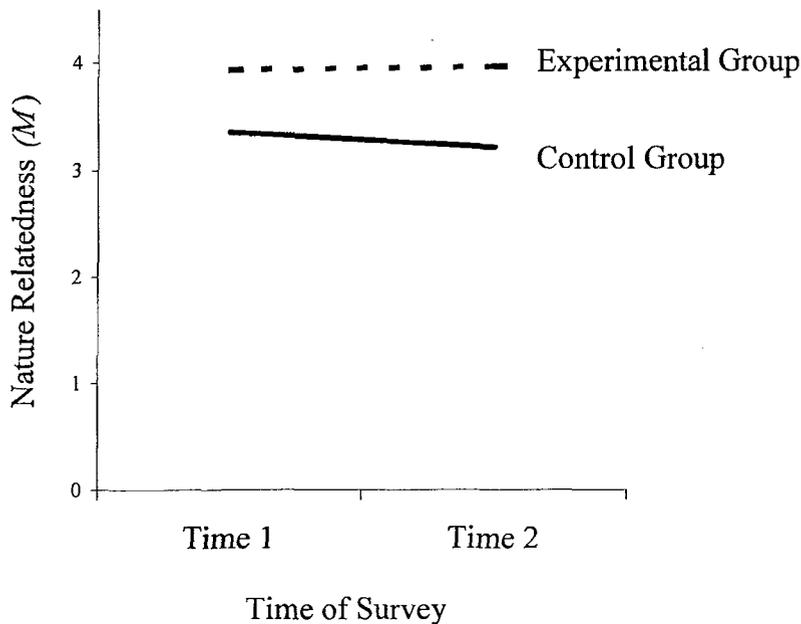
	NR	NR-self	NR-perspective	NR-experience
Vitality	.25**	.24**	.17**	.20**
Positive Affect	.25**	.22**	.14**	.25**
Negative Affect	-.08	-.06	-.00	-.12*
Autonomy	.25**	.24**	.14*	.25**
Personal Growth	.35**	.31**	.28**	.29**
Purpose in Life	.19**	.16**	.19**	.13*

* $p < .05$, ** $p < .01$.*Effects of Environmental Education*

The fifth hypothesis was that students receiving environmental education would show an increase in NR and Inclusion of Nature in Self from Time 1 to Time 2. A repeated measures ANOVA showed the main effect of NR from Time 1 to 2 was significant, $F(1,173) = 4.68, p < .05$. There was a significant change, overall, in NR levels during the school term. However, as predicted, this main effect was qualified by an interaction between NR over time and the experimental condition, $F(1, 173) = 10.50, p < .01$. The control and experimental groups differed in the way their levels of NR changed over time, and this effect is illustrated in Figure 2. Post hoc tests were conducted to investigate these differences. When we examined the experimental group alone on NR levels over time, we found a trend in the expected direction. The mean NR level of the environmental education group increased slightly over the course of

the study (Time 1 $M=3.93$, Time 2 $M=3.96$), but this increase was not statistically significant, $t(98) = .74$, n.s. The control group, however, had a significant decrease in their NR levels from Time 1 ($M=3.35$) to Time 2 ($M=3.21$), $t(75) = 4.27$, $p < .01$, $d = .25$.

Figure 2. Time 1 and Time 2 Nature Relatedness Means of Experimental and Control Groups



Contrary to our expectations, there were no significant changes in Inclusion of Nature in Self (INS) levels over the course of the study, for either the control or experimental groups, or for the entire group of participants as a whole. NR change was modestly correlated with INS change ($r = .29$, $p < .01$), however, so overall, those whose levels of NR increased during the study, also increased in INS.

We also conducted repeated measures ANOVAs to examine whether changes in all the dependent variables (environmental concern and well-being) differed between the groups over time. Table 5 contains difference scores from Time 1 to 2 by group, as well as the multivariate

test values for the interaction between time and experimental condition for each dependent variable. The tests were significant for some, but not all of the environmental and well-being variables. The control group decreased in biospheric concern over time and, unexpectedly, both groups had a significant decline in sustainable behaviour over the course of the study.

Interactions between time and experimental condition were significant for affect (Ecology subscale) and sustainable attitudes.

The interaction between experimental condition and time was significant for vitality, $F(1,173) = 5.14, p < .05$, but not for the other well-being indicators we measured. In fact, both groups had significantly lower levels of positive affect and purpose in life at the end of the study, compared to the start.

Table 5

Change in Environmental and Well-Being Variables by Group

	Control (<i>n</i> = 76)		Experiment (<i>n</i> = 99)		Time X Group
	Difference	<i>t</i>	Difference	<i>t</i>	<i>F</i>
Nature Relatedness	-.14	-4.27**	.03	.74	10.50**
Inclusion of Nature In Self	.07	.52	-.03	-.31	.38
Ecology scale - Verbal Commitment	-.01	-.84	-.00	-.35	.19
Ecology scale - Actual Commitment	-.03	-1.72	-.00	-.05	1.26
Ecology scale - Affect	-.04	-1.95	.02	.99	4.77*
Biospheric Concern	-.36	-2.20*	-.11	-1.13	.16
Altruistic Concern	-.27	-1.97	-.16	-1.38	.40
Egoistic Concern	-.07	-.48	-.04	-.37	.02
Sustainable Behaviour	-.73	-4.26**	-.38	-2.04*	1.71
Sustainable Attitude	-.04	-.99	.10	2.95**	7.48**
Vitality	-.16	-1.57	.13	1.60	5.14*
Positive Affect	-.23	-3.26**	-.17	-2.97**	.46
Negative Affect	.11	1.81	.14	2.02*	.10
Autonomy	-.11	-1.98	-.07	-1.31	.26
Personal Growth	-.15	-2.64	-.06	-1.15	1.23
Purpose in Life	-.16	-3.07**	-.15	-2.52*	.05

Note. Difference = Time 1 score - Time 2 score. * $p < .05$, ** $p < .01$.

Nature Relatedness as Mediator - Environmental Attitudes and Concern. In hypothesis six we speculated that changes in NR would mediate the relationship between environmental education and increased environmental attitudes, behaviour and concern. All Time 2 environmental change measures of interest were significantly correlated with NR change, with the exception of biospheric concern (Table 6). To test the hypothesis that change in nature relatedness mediates the relationship between education and change in environmental attitude or behaviour, the following three-step analyses (Baron & Kenny, 1986) were conducted. First, environmental education was used to predict NR change scores. Second, education was used to predict the change in verbal commitment, actual commitment, affect about the environment, biospheric concern, and sustainable behaviour and attitude. The regressions were significant for the change in affect concerning environmental issues, biospheric concern, and sustainable attitude and behaviour. The non-significant variables (verbal and actual commitment to the environment) were not examined in the next steps of the analyses. NR change and environmental education were then entered together to predict each environmental change variable.

The relationship between education and change in both sustainable attitudes and behaviours was mediated by NR change. The effect of education on changes in self-reported sustainable behaviours became insignificant with NR change added to the model. For sustainable attitude change, the effect of education became less powerful when NR change was included in the model. This indicates that change in NR is serving as a path for the effects of education on sustainable attitudes and activities. The Sobel test statistics (Preacher &

Leonardelli, 2001) supported these findings. The significant paths of the mediation models appear in Figures 3 and 4. Unstandardized and standardized regression coefficients, as well as standard error and coefficients of partial determination are presented in Tables 7 and 8.

Table 6

*Correlations Between Nature Relatedness Change and Environmental Change Measures**(n = 175)*

	Nature Relatedness Change
Verbal Commitment Change	.30**
Actual Commitment Change	.24**
Affect-Ecology Scale Change	.15*
Biospheric Concern Change	.06
Altruistic Concern Change	.06
Egoistic Concern Change	.02
Sustainable Behaviour Change	.29**
Sustainable Attitude Change	.23**

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

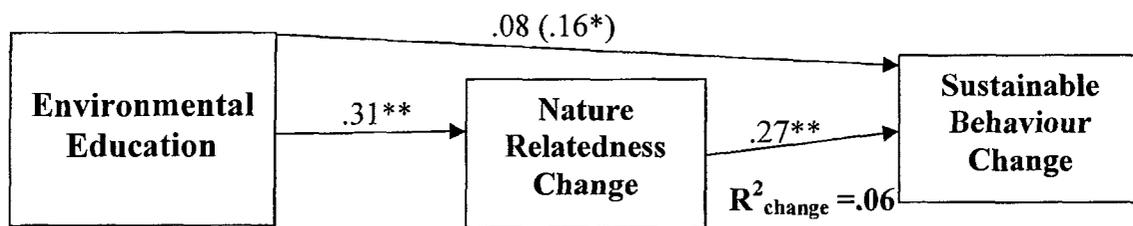
Table 7

Regression Analysis for Variables Predicting Sustainable Behaviour Change

Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	R^2
Step 1					
Experimental condition	.33	.15	.16*	2.18	.03
Step 2					
Experimental condition	.16	.15	.08	1.06	
Nature Relatedness Change	.26	.08	.27**	3.44	.09

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

Figure 3. Mediation Model for Education, Nature Relatedness Change, and Sustainable Behaviour Change.



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

Sobel test: $z = 2.69$, $p < .01$.

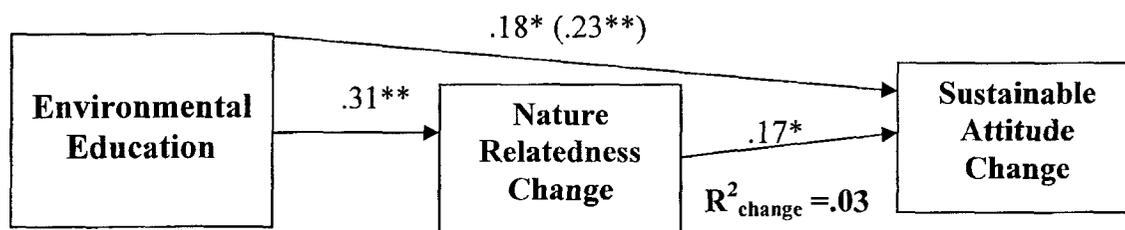
Table 8

Regression Analysis for Variables Predicting Sustainable Attitude Change

Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	R^2
Step 1					
Experimental condition	.46	.15	.23**	3.08	.05
Step 2					
Experimental condition	.35	.16	.18*	2.28	
Nature Relatedness Change	.17	.08	.17*	2.21	.08

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

Figure 4. Mediation Model for Education, Nature Relatedness Change and Sustainable Attitude Change.



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

Sobel test: $z = 1.96, p < .05$.

Contrary to our hypothesis, change in NR did not mediate the relationships between education and any of the change in Ecology scale variables (affect, actual or verbal commitment), nor was NR change a mediator of the education-biospheric concern change relationship.

Nature Relatedness as Mediator - Well-Being. To test the seventh hypothesis, that nature relatedness mediates the education - well-being change relationship, the same three-step mediation analyses (Baron & Kenny, 1986) were conducted, this time using the change in vitality, positive and negative affect, autonomy, personal growth, and purpose in life as the dependent variables. The correlations between NR change and the well-being change indicators are presented in Table 9.

Table 9

*Correlations Between Nature Relatedness Change and Well-Being Change Measures**(n = 175)*

	Nature Relatedness Change
Vitality Change	.29**
Positive Affect Change	.15*
Negative Affect Change	-.07
Autonomy Change	.04
Personal Growth Change	.33**
Purpose in Life Change	.27**

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

Change in vitality, positive affect, personal growth, and purpose in life were significantly correlated with NR change. Change in autonomy and negative affect were not, so were not included in the next steps of the analysis. First, environmental education was used to predict NR change scores. Second, education was used to predict the change in vitality, personal growth,

and purpose in life. Only the significant regressions, for vitality change and personal growth change, were then used in the next step. Third, NR change and environmental education were entered together to predict change in vitality and personal growth. Our hypothesis was confirmed in that the effect of education on both vitality change and personal growth change became insignificant with NR change added to the model. This indicates that NR is serving as a path for the effects of education on these aspects of well-being. The Sobel test statistics (Preacher & Leonardelli, 2001) supported these findings. The significant paths of the mediation models appear in Figures 5 and 6. Unstandardized and standardized regression coefficients, as well as standard error and coefficients of partial determination are presented in Tables 10 and 11. The relationships between education and change in autonomy, purpose in life, positive and negative affect were not mediated by NR change, contrary to our expectations.

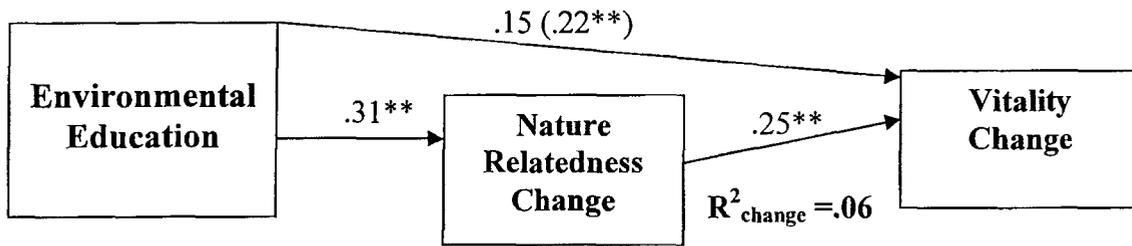
Table 10

Regression Analysis for Variables Predicting Vitality Change

Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	R^2
Step 1					
Experimental condition	.45	.15	.22**	3.01	.05
Step 2					
Experimental condition	.30	.15	.15	1.93	
Nature Relatedness Change	.25	.08	.25**	3.25	.11

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

Figure 5. Mediation Model for Education, Nature Relatedness Change, and Vitality Change.



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

Sobel test: $z = 2.59, p < .01$.

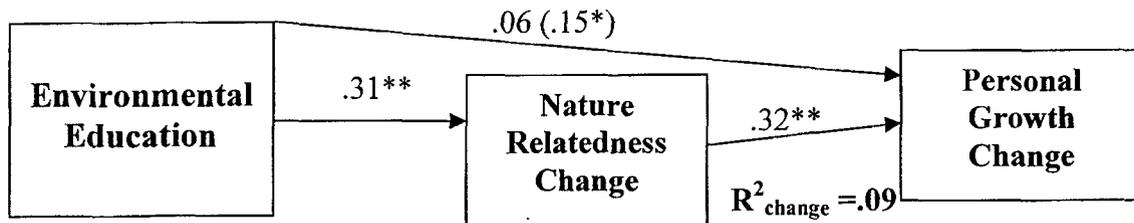
Table 11

Regression Analysis for Variables Predicting Personal Growth Change

Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	R^2
Step 1					
Experimental condition	.31	.15	.15*	2.04	.02
Step 2					
Experimental condition	.11	.15	.06	.73	
Nature Relatedness Change	.32	.08	.32**	4.20	.11

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

Figure 6. Mediation Model for Education, Nature Relatedness Change, and Personal Growth Change.



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

Sobel test: $z = 3.00, p < .01$.

Due to fact that the experimental group was older than our control group, we reran all mediation analyses controlling for age. First, we examined correlations between age and all of the change variables. Age correlated only with change in personal growth ($r = .17, p < .05$), and E-scale affect ($r = .20, p < .01$). We revised our analysis of NR change as a mediator of the education-personal growth relationship to include age. With age included in the model, the effects of education become insignificant, but NR change remained a predictor of change in personal growth ($\beta = .33, p < .01$).

We also retested our mediation model with vitality change as the dependent variable and found that age had no influence on the earlier results. Age also had no influence on the education-sustainable attitude change relationship, as mediated by NR change. Including age in the model reduced the effect of education on sustainable behaviour change, as mediated by NR change. Controlling for age, however, NR change still predicted change in sustainable behaviour ($\beta = .27, p < .01$).

Discussion

The results of this study provide empirical evidence for the benefits of being connected to nature, both for human psychological health and for the state of the environment. Based on previous research and ecopsychology theory, we predicted that nature related people would be happier and care more about the environment. Our results showed that nature related people do report more pro-environmental attitudes and behaviours, and that their concern is for all life, not just humans. The findings in this study are consistent with ecopsychology theory, which suggests being connected to the natural world gives meaning and fulfilment to our lives (Conn, 1998; Kellert, 1997). People who are more related to nature report experiencing more positive emotions, vitality, autonomy, personal growth, and have a greater sense of purpose in life.

Given the benefits of being related to nature, we wondered if environmental education would enhance connectedness, and whether environmental concern and well-being would change as a result. The present research shows that education has a positive effect on both sustainable attitudes and feelings of vitality, and these effects are mediated by changes in NR. These results provide evidence for the importance of nature relatedness in understanding how individual relationships with the natural environment benefit human mental health as well as motivate ERB.

Nature Relatedness and Environmental Concern

Our previous research with the Nature Relatedness Scale (Nisbet & Zelenski, 2005) found that people connected to nature are also likely to hold more pro-environmental values and beliefs. This study replicated the relationship between nature relatedness and environmental attitudes. NR correlated modestly to strongly with a variety of different measures of

environmental attitude and concern (e.g., verbal and actual commitment to ecological issues, affect about environmental problems, biospheric concern). We also looked at sustainable attitudes and practices for the first time, and found that NR people support sustainability and report more pro-environmental behaviour. Our findings support previous research linking environmental concern to connectedness with nature (Schultz, 2000, 2002). As with Schultz's (2000) research on inclusiveness with nature, we found people with higher NR levels are concerned about the environment not simply for their own benefit, but for ecosystems and all other living creatures.

The construct of nature relatedness allows for humans to be considered a part of nature and included in the need for affiliation with all life. This may explain the small but significant correlation we found between NR and altruistic environmental concern. We do not expect those most concerned for the environment to exclude humans in their considerations, but rather to have an awareness of how the health of humans and the maintenance of biodiversity are dependent upon our behaviour. NR can therefore be thought of as consistent with a biospheric concern, including, but not assuming the preeminence of, human beings.

We also examined whether NR moderates the relationship between promised and actual commitment to environmental issues. While the effect is small, we did find a significant interaction between nature relatedness and verbal commitment to the environment that predicted levels of actual commitment. Our test was not ideal, given that NR was correlated with both verbal and actual environmental commitment. The moderator should be uncorrelated with the predictor and dependent variable(s) for the clearest interpretation of the interaction term (Baron

& Kenny, 1986). In addition, our measure of actual commitment to ecology issues was a self-report scale, which may not be as accurate as observable behaviour. We know that attitudes are not always predictive of environmental behaviour (Kaiser, Wölfing, & Fuhrer, 1999). Therefore, the correlation we found between promised and actual (self-reported) behaviour (.54) is at odds with most findings concerning attitude behaviour discrepancies. For example, people say driving is the individual behaviour most damaging to the environment, but do not curtail their own vehicle use (EnviroNics, 1998). The correlation between NR and environmental attitudes and concern does suggest that nature related people are more likely to act on their environmental intentions. Ideally, research testing NR's potential for regulating attitude-behaviour discrepancies should involve observed rather than self-reported behaviour.

In the initial stages of our analyses we also examined the NR dimensions, however none of these findings were noteworthy or inconsistent with the full NR scale results. Although subscales sometimes showed different relationships with criterion variables, these differences were not overwhelming, and never went in opposite directions.

Environmental Education and Connectedness

One of the suggested curriculum goals for environmental education is a foundation of ecological knowledge that includes interdependence (Hungerford & Volk, 1990), i.e., an understanding of interconnectedness. One of the objectives of this study was to explore how environmental education might increase NR. We expected a stronger connection to nature would follow from the environmental information, as theorized by Thomashow (1998), Wilson (1993) and others. However, we did not find a significant increase in NR (or the environmental

variables, except for environmental affect and sustainable attitude). Moreover, even the statistically significant *relative* change in NR (i.e., compared to the control group's decrease) was small. The environmental education students were already highly connected to nature at the start of the study, so there may have been a ceiling effect with our experimental group for NR and all the environmental variables.

Contrary to our expectations, all students reported a decrease in sustainable behaviours over the course of the study. While we expected the education would make students more aware of the importance of environmentally friendly behaviour, there may have been barriers that discouraged more pro-environmental action. The majority of our sample were first year university students, so many of them may recently have moved, either to a new city, into campus housing, or their first apartment. Adjusting to student life and financial constraints may have had an impact on some of the behaviours we asked about. Students likely have more money at the beginning of the term and so would have been more able to afford to buy organic foods, fair trade and environmentally friendly products, and make other environmental choices that cost more. At the end of the term, students may not have been able to afford these things, or could have been preoccupied with exams and less mindful of practicing sustainable behaviours.

Although NR change did not mediate the education-ERB relationship (when controlling for age), changes in NR still predicted change in sustainable behaviours. In addition, education and change in nature relatedness contributed to the change in people's sustainable attitudes over the course of the study. These findings are consistent with the theory proposed by ecopsychologists (Bragg, 1996; Conn, 1998; Orr, 1993, Roszak, 1992) and add to the earlier

research (Schultz, 2002) linking a sense of connectedness to the natural world with increased environmental concern. The current findings extend our earlier research linking NR to environmental attitudes (Nisbet & Zelenski, 2005). That is, we confirmed our hypotheses linking NR to environmental concern, but also went beyond the correlational data to demonstrate how changing nature relatedness may promote changes in attitudes and support for sustainability.

Nature Relatedness and Well-Being

Consistent with our previous findings (Nisbet, Murphy, & Zelenski, 2005; Nisbet & Zelenski, 2005) nature related people reported higher levels of well-being on a variety of indicators. Students scoring higher on the NR Scale reported experiencing more positive emotions and feeling more alive and vital, as well as higher levels of autonomy, personal growth, and purpose in life. We have had evidence for the fact that nature related people are happier, but the current study allowed us to go beyond the correlational data and examine whether changes in nature relatedness would be related to changes in happiness. To our knowledge, past research has not attempted to manipulate well-being or ERB by enhancing connectedness. Our results indicate that the relationship between education and changes in vitality is mediated by nature relatedness. We did not find this relationship with the other well-being variables we examined, suggesting there is something different about vitality that links it to NR. Perhaps learning about plants, animals, and complex ecosystems provokes reflection about how all life is interconnected. Wilson (1984) believes this type of learning makes us value all life more. It may be that contemplating and re-evaluating our place in nature makes us feel more alive and vital.

Although the findings linking education, NR, and vitality were encouraging, NR failed to mediate between education and many of the well-being indicators we measured. These null results may be due to a number of factors. First, the change in NR for the experimental group may have been too small to influence all aspects of students' well-being. Another explanation for the well-being levels may be the timing of the surveys. The Time 1 survey took place at the beginning of the fall term. The weather outside is temperate and the outdoors is often considered very pleasant at this time of year. Time 2 surveys were completed at the end of November and early December, a time of year with fewer hours of daylight, less visible greenery, falling temperatures, and impending harsh winter weather. Even for outdoor enthusiasts, this time of year may be less enjoyable for activities as it is often cold and rainy and snow sports are not yet possible.

It may be more difficult to feel connected to the natural world in poor weather. In fact, we assess this aspect of NR in our scale by asking about enjoyment of nature despite unpleasant weather. While the most nature related people are expected to maintain their connectedness year round, there may be seasonal variations that coincide with the abundance of good weather, opportunities for wildlife observation, and conditions for outdoor activities. Since we evaluated the effects of the environmental education at the end of the fall term, there may have been some seasonal influence on both feelings of connectedness to nature, as well as well-being. Given the research demonstrating the health benefits of nature scenery and time spent in nature (Kaplan, 2001), it may be that some nature related people feel somewhat deprived of the opportunity to connect with nature at certain times of the year and suffer as a result. The fact that the control

group significantly declined in NR over the course of the study, combined with their lower levels of NR at the start, suggests that even those low in NR may be susceptible to seasonal effects.

Some of the decline we see in positive emotions may be due to the timing of our second survey, so close to the exam period. Perhaps an assessment at a less stressful time of the academic year would yield different results with neither group declining in positive affect, or the environmental education group experiencing increased positive emotions.

Despite these issues, our findings do provide some support for Conn's (1998) theory that increased connectedness will increase well-being. NR's association with happiness is proving to be complex, however. While we continue to find correlations between NR and positive emotions (Nisbet, Murphy, & Zelenski, 2005; Nisbet & Zelenski, 2005), vitality was the only well-being indicator to change as a result of education and changes in NR in this study. It may be that specific types of NR manipulations influence different aspects of happiness. For example, experiences outdoors in nature may be the best way to increase state level emotions (Kaplan, 2001, Kaplan & Kaplan, 1989; Kaplan, & Talbot, 1983; van den Berg, Koole, Van Den Berg, Koole, & Van Der Wulp, 2003), whereas educational information may have the greatest impact on internal, cognitive evaluations of well-being through an increased sense of connectedness and belonging to the natural world (Bragg, 1996; Conn, 1998; Kellert, 1997).

Despite the seasonal influence of poor weather and pressure of looming exams, students in the environmental education courses reported increased vitality (mediated by NR-change) at the end of the study. If education can produce such an effect, it is likely worthwhile to consider including NR content when developing educational programs. That being said, more research is

needed to confirm NR's relation to well-being on a long-term basis, to determine how lasting the effects of education are on both NR and happiness levels.

Limitations

Students may not be representative of the general population, however, given that our study investigated environmental education, a university setting with student participants provides good ecological validity. The type of environmental information provided in university courses is likely quite different from the public service messages used by government and non-profit groups, so we cannot conclude that all educational information about the environment will necessarily improve environmental attitudes, nature relatedness, or vitality for everyone.

Logistical and ethical constraints, along with the voluntary nature of research participation, required that our survey disrupt classes as little as possible. This meant administering the questionnaire during a break or at the end of class. Having students complete the questionnaire immediately following a lecture may partially account for the initially high levels of NR and the environmental variables in our experimental group. Although we did expect a self-selection bias for the environmental education students, their NR levels may have been increased further (perhaps temporarily) by the first class. Ideally, an initial evaluation of participants should be conducted further in advance, without this type of influence. Evaluating students at the end of the courses meant that impending exams might have had a negative influence on well-being.

It may be that the effects of environmental education on NR are not felt immediately and our study of three-month courses was not long enough to capture a significant change in NR.

People may need time to integrate new information into their daily lives and a chance to put the new knowledge into practice. For example, they may need opportunities to explore and observe the natural environment in all seasons, to observe in the “wild” things they have studied in a classroom, and to trigger changes in NR.

We could not randomly assign participants to environmental classes in this study, but we controlled for differences by using change scores in our analyses. In other words, initial differences between the control and experiment group were accounted for by examining the change in NR, environmental concern and behaviour, and well-being over time. The fact that the experimental group began the study with higher levels of NR and environmental attitudes, however, means that we cannot generalize our findings about how education affected these students to the general population. We do not know if environmental education and changes in nature relatedness would have the same effects on vitality and environmental attitudes for those low in NR. It could be that those least connected to nature may benefit the most from this type of education.

Although the experimental group had a variety of instructors with a broad range of topics related to the environment, we cannot dismiss the possibility that teaching style or some other variable is responsible for changes in participants’ environmental attitudes or well-being. Teaching styles, content, and classroom conditions no doubt contribute to the way the information is received and integrated into the student’s life (Biggs, 2003; McKeachie, 2002; Perry & Smart, 1997). Some component of this education, however, is having a beneficial effect on NR as mediator for both sustainable attitudes and vitality.

While we selected classes for study that had information expected to be relevant to NR, course content was already set in advance, and was not designed specifically to increase nature relatedness. To accurately assess the unique effects of increasing NR through education would require designing an educational program under controlled conditions, specifically with that aim in mind. While this study lacked the control of a laboratory experiment, it provided a good opportunity to study how education influences NR in the “real world”. We were able to find effects with a broad range of courses taught by different instructors, with no pre-planned NR content. If improvements to well-being and environmental attitudes can be achieved under these conditions, it suggests that NR manipulations could be even more successful if courses were specifically designed with increasing NR in mind.

Implications and Future Directions

The results of this study have several theoretical implications. Our findings are encouraging in that they suggest a potential mechanism for improving environmental concern and behaviour through education and nature relatedness. This may be worth remembering when creating environmental messages aimed at changing behaviour, since we know that information alone is often not successful in achieving a change (Hines, Hungerford, & Tomera, 1986-1987). This study adds to the research (Kals & Maes, 2004; Kals, Schumacher, & Montada, 1999; Pooley & O’Connor, 2000; Schultz, 2000, 2002) indicating that emotions and connectedness to nature may influence how people perceive environmental conditions and what actions they are motivated to take. From this and other studies involving the NR scale (Nisbet & Zelenski, 2005), it appears that connectedness is strongly related to pro-environmental attitudes, but also,

more importantly, to behaviour (at least self-reported behaviour). While information about environmental problems on its own may not motivate people to act (Pelletier, Dion, Tuson, & Green-Demers, 1999), combining it with NR may inspire action. Given all the barriers that may exist to ERB, nature relatedness may be worth considering and including in the effort to change behaviour. Once developed, nature relatedness may be more resistant to pressures that prevent people from behaving responsibly, particularly as NR individuals are more likely to be autonomous and have a sense of purpose in life. In fact, more autonomous individuals report more stable and more pervasive environmentally responsible behaviour (Villacorta, Koestner, & Lekes, 2003). Highly autonomous NR people may be able to withstand social and other pressures that condone damaging environmental actions.

Although our results are not as strong as predicted, the variety of well-being indicators linked to NR indicates that nature related people are indeed happier, and that this relationship is worthy of consideration when studying individual differences in happiness and what factors may contribute to well-being. Building on mental illness research and the healing aspects of nature imagery (Fredrickson, 2000; Ulrich, 1993), increasing NR may help to cultivate more positive emotions and moderate the symptoms of various mood or affective disorders. NR has potential for future research into stress, anxiety and depression, and how reconnecting with nature may lessen these conditions. Of course, this suggestion remains speculative given our limited data, but if future research continues to confirm the benefits of NR, health care professionals may wish to integrate more nature therapy into their treatments of mood and affective disorders. If

increasing NR can improve mental health, employers may be interested in promoting nature relatedness in the workplace.

To better understand how to cultivate more connectedness to nature, we need to investigate the antecedents of NR. Under what circumstances does NR thrive? What are the conditions that nurture NR? What kinds of places and experiences foster connectedness and biophilia? If snuffed out, can it be restored? What are the teaching conditions that promote nature relatedness? There are likely cultural and societal differences in NR worth examining. Perhaps the current study will inspire researchers to investigate these questions. By testing how environmental education increases nature relatedness, this study adds to the work on environmentally responsible behaviour and the benefits of ecological knowledge. By demonstrating the potential benefits of increasing connectedness, both to humans and the environment, we hope to have encouraged researchers and educators to find ways to help nature relatedness flourish.

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Appendix A

General Information

Sex: Female/ Male (please circle one)

Age: _____

What is your current year of study at Carleton University?

_____ 1st year (undergraduate) _____ 2nd year (undergraduate)
 _____ 3rd year (undergraduate) _____ 4th year (undergraduate)
 _____ master's _____ doctoral

What is your major: _____

Are you currently enrolled in any courses in the following areas: geography, geology, biology, ecology, environmental sciences, environmental studies, natural history?

Yes/ No

If yes, please specify which courses _____

Have you ever taken any courses in geography, geology, biology, ecology, environmental sciences, environmental studies, natural history, in the past?

Yes/ No

If yes, please specify which courses _____

How long ago did you complete these courses? _____

Where did you spend the most time while growing up? (please choose only one response from the options below)

___ city ___ small town ___ rural or farm
 ___ other (please specify: _____)

Where do you live now?

___ campus residence ___ small town
 ___ city ___ rural or farm
 ___ other (please specify: _____)

Appendix B

Nature Relatedness Scale

Instructions: For each of the following, please rate the extent to which you agree with each statement, using the scale from 1 to 5 as shown below. Please respond as you really feel, rather than how you think “most people” feel.

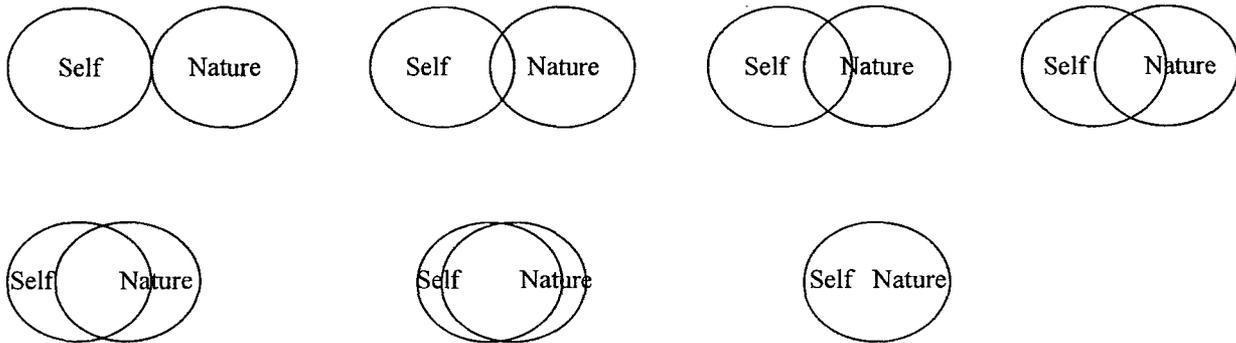
1 Disagree strongly	2 Disagree a little	3 Neither Agree or disagree	4 Agree a little	5 Agree strongly
---------------------------	------------------------	-----------------------------------	---------------------	------------------------

- | | |
|--|---|
| <p>1. I enjoy being outdoors, even in unpleasant weather. _____</p> <p>2. Some species are just meant to die out or become extinct. _____</p> <p>3. Humans have the right to use natural resources any way we want. _____</p> <p>4. My ideal vacation spot would be a remote, wilderness area. _____</p> <p>5. I always think about how my actions affect the environment. _____</p> <p>6. I enjoy digging in the earth and getting dirt on my hands. _____</p> <p>7. My connection to nature and the environment is a part of my spirituality. _____</p> <p>8. I am very aware of environmental issues. _____</p> <p>9. I take notice of wildlife wherever I am. _____</p> <p>10. I don't often go out in nature. _____</p> <p>11. Nothing I do will change problems in other places on the planet. _____</p> | <p>12. I am not separate from nature, but a part of nature. _____</p> <p>13. The thought of being deep in the woods, away from civilization, is frightening. _____</p> <p>14. My feelings about nature do not affect how I live my life. _____</p> <p>15. Animals, birds and plants should have fewer rights than humans. _____</p> <p>16. Even in the middle of the city, I notice nature around me. _____</p> <p>17. My relationship to nature is an important part of who I am. _____</p> <p>18. Conservation is unnecessary because nature is strong enough to recover from any human impact. _____</p> <p>19. The state of non-human species is an indicator of the future for humans. _____</p> <p>20. I think a lot about the suffering of animals. _____</p> <p>21. I feel very connected to all living things and the earth. _____</p> |
|--|---|

Appendix C

Inclusion With Nature In Self

Please circle the picture below that best describes your relationship with the natural environment.
How interconnected are you with nature?



Appendix D

Environmental Concern

People around the world are generally concerned about environmental problems because of their consequences that result from harming nature. However, people differ in the consequences that concern them the most. Please rate each of the following items from 1 (not important) to 7 (supreme importance) in response to the question:

I am concerned about environmental problems because of the consequences for _____

1. _____ Animals
2. _____ Plants
3. _____ Marine Life
4. _____ Birds
5. _____ Me
6. _____ My future
7. _____ My lifestyle
8. _____ My health
9. _____ All people
10. _____ Children
11. _____ People in my community
12. _____ My children

Appendix E

Ecology Scale

Please read the following statements carefully, and indicate either True or False by circling the appropriate letter the right of the item. **TRUE FALSE**

- | | | |
|---|---|---|
| 1. I'd be willing to ride a bicycle or take the bus to school in order to reduce air pollution. | T | F |
| 2. I would probably never join a group or club which is concerned solely with ecological issues. | T | F |
| 3. I would be willing to use a rapid transit system to reduce air pollution. | T | F |
| 4. I'm not willing to give up driving on a weekend due to a smog alert. | T | F |
| 5. I'm really not willing to go out of my way to do much about the environment since that's the government's job. | T | F |
| 6. I would donate a day's pay to a foundation to help improve the environment. | T | F |
| 7. I would be willing to stop buying products from companies guilty of polluting the environment, even though it might be inconvenient. | T | F |
| 8. I'd be willing to write my member of parliament concerning ecological problems. | T | F |
| 9. I probably wouldn't go house to house to distribute literature on the environment. | T | F |
| 10. I would not be willing to pay a pollution tax even if it would considerably decrease the pollution problem. | T | F |
| 11. I guess I've never actually bought a product because it had a lower polluting effect. | T | F |
| 12. I keep track of my politicians' voting records on environmental issues. | T | F |
| 13. I have never written a politician concerning the environment. | T | F |
| 14. I have contacted a community agency to find out what I can do about pollution. | T | F |
| 15. I don't make a special effort to buy products in recyclable/reusable containers. | T | F |
| 16. I have attended a meeting of an organization specifically concerned with bettering the environment. | T | F |
| 17. I have switched products for environmental reasons. | T | F |

- | | | |
|---|---|---|
| 18. I have never joined a cleanup drive. | T | F |
| 19. I have never attended a meeting related to the environment. | T | F |
| 20. I subscribe to environmental publications/newsgroups/listservs. | T | F |
| 21. I feel people worry too much about pesticides on food products. | T | F |
| 22. It genuinely infuriates me to think that the government doesn't do more to help control pollution of the environment. | T | F |
| 23. I feel fairly indifferent to the statement: "The world will be dead in 40 years if we don't remake the environment." | T | F |
| 24. It frightens me to think that much of the food I eat is contaminated with pesticides. | T | F |
| 25. I become incensed when I think about the harm done to plant and animal life by pollution. | T | F |
| 26. I'm usually not bothered by so-called "noise pollution". | T | F |
| 27. I get depressed about the state of the environment. | T | F |
| 28. When I think of the ways industries are polluting, I get frustrated and angry. | T | F |
| 29. The whole pollution issue has never upset me too much since I feel it's somewhat overrated. | T | F |
| 30. I rarely ever worry about the effects of pollution on myself and family. | T | F |

Appendix F

Sustainability Survey

1. Which (if any) of the following do you do on a regular basis? (circle all that apply)
 - a. separate recyclables from trash
 - b. carry a reusable cup
 - c. buy organic foods
 - d. use public transportation
 - e. refuse to buy certain products based on environmental criteria
 - f. compost organic waste at home
 - g. donate money to aid agencies for the developing world
 - h. consider the environmental impacts of actions
 - i. buy fair trade goods
 - j. volunteer time to non-profit organizations
 - k. plant a garden in the spring
 - l. purchase local produce when it is in season
 - m. participate in community events
 - n. make a vehicle purchase based on emissions and consumption

2. How do you usually commute to Carleton? (choose the one you use the most)
 - a. Car (personal)
 - b. Bus/O-Train
 - c. Walk
 - d. Carpool
 - e. Bike/ rollerblade/ skateboard
 - f. Ottawa U. shuttle bus

3. Please indicate your level of agreement with the following statements by circling the appropriate number.

	Strongly disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Strongly agree
a. I resent having to pay a deposit on bottles and other containers.	1	2	3	4	5
b. The Kyoto accord should be fully implemented.	1	2	3	4	5
c. Carleton should use only paper with high post-consumer content (recycled).	1	2	3	4	5
d. My actions as an individual are unlikely to affect the bigger picture.	1	2	3	4	5
e. Responsibility for maintaining sustainability standards should rest primarily with the government.	1	2	3	4	5
f. People should be charged for plastic bags at the grocery store.	1	2	3	4	5
g. Jobs are more important than air pollution issues.	1	2	3	4	5
h. Technology will provide solutions for problems of sustainability.	1	2	3	4	5
i. Educational institutions need to do more to promote sustainability issues within the curriculum.	1	2	3	4	5
j. The concentration of global wealth in Western nations is a sustainability issue.	1	2	3	4	5
k. Corporations are entitled to the same rights as individuals.	1	2	3	4	5

4. Please assign a level of importance to each of the following possible improvements to the sustainability of Carleton

(1 = very important, 2 = somewhat important, 3 = of little importance, 4 = not important).

- ___ Ensure that organizations and corporations with which Carleton has relationships are environmentally and socially responsible.
- ___ Ensure that all paper used by Carleton is unbleached and recycled.
- ___ Improve bicycle access and facilities.
- ___ Ensure that water consumption at Carleton is monitored and, if possible, reduced
- ___ Develop an external conflict resolution service for addressing tension between various groups within the university (students, administration, clubs, etc.)
- ___ Expand and improve recycling services at the university.
- ___ Offer more bursaries to low-income students.
- ___ Ensure that campus operations are energy-efficient.
- ___ Make composting programs available at all cafeterias and food outlets on campus.
- ___ Provide more organic and vegetarian choices at food outlets on campus.

5. Do you consider yourself an activist? Yes No Not sure

6. Do you support a project designed to improve the sustainability of Carleton?

Yes/No/Not sure

Appendix G

Vitality Scale

Please respond to each of the following statements by indicating the degree to which the statement is true for you in general in your life. Use the following scale:

	1	2	3	4	5	6	7
	not at all true			somewhat true			very true
1.	I feel alive and vital.			_____			
2.	Sometimes I feel so alive I just want to burst.			_____			
3.	I have energy and spirit.			_____			
4.	I look forward to each new day.			_____			
5.	I nearly always feel alert and awake.			_____			
6.	I feel energized.			_____			

Appendix H

PANAS

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way **in general**, that is, on average. Use the following scale to record your answers.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely
_____	interested		_____	irritable
_____	distressed		_____	alert
_____	excited		_____	ashamed
_____	upset		_____	inspired
_____	strong		_____	nervous
_____	guilty		_____	determined
_____	scared		_____	attentive
_____	hostile		_____	jittery
_____	enthusiastic		_____	active
_____	proud		_____	afraid

NOTE: For Time 2 only, instructions were slightly different, asking participants to indicate to what extent they “have felt this way over the past several weeks”.

Appendix I

Psychological Well-Being Inventory

The following set of questions deals with how you feel about yourself and your life. Please remember that there are no right or wrong answers.

Circle the number that best describes your present agreement or disagreement with each statement.	Strongly Disagree	Disagree Somewhat	Disagree Slightly	Agree Slightly	Agree Somewhat	Strongly Agree
1. I am not afraid to voice my opinions, even when they are in opposition to the opinions of most people.	1	2	3	4	5	6
2. I am not interested in activities that will expand my horizons.	1	2	3	4	5	6
3. I live life one day at a time and don't really think about the future.	1	2	3	4	5	6
4. My decisions are not usually influenced by what everyone else is doing.	1	2	3	4	5	6
5. I don't want to try new ways of doing things--my life is fine the way it is.	1	2	3	4	5	6
6. I tend to focus on the present, because the future nearly always brings me problems.	1	2	3	4	5	6
7. I tend to worry about what other people think of me.	1	2	3	4	5	6
8. I think it is important to have new experiences that challenge how you think about yourself and the world.	1	2	3	4	5	6
9. My daily activities often seem trivial and unimportant to me.	1	2	3	4	5	6

Circle the number that best describes your present agreement or disagreement with each statement.	Strongly Disagree	Disagree Somewhat	Disagree Slightly	Agree Slightly	Agree Somewhat	Strongly Agree
10. Being happy with myself is more important to me than having others approve of me.	1	2	3	4	5	6
11. When I think about it, I haven't really improved much as a person over the years.	1	2	3	4	5	6
12. I don't have a good sense of what it is I'm trying to accomplish in life.	1	2	3	4	5	6
13. I tend to be influenced by people with strong opinions.	1	2	3	4	5	6
14. I have the sense that I have developed a lot as a person over time.	1	2	3	4	5	6
15. I used to set goals for myself, but that now seems like a waste of time.	1	2	3	4	5	6
16. I have confidence in my opinions, even if they are contrary to the general consensus.	1	2	3	4	5	6
17. I do not enjoy being in new situations that require me to change my old familiar ways of doing things.	1	2	3	4	5	6
18. I enjoy making plans for the future and working to make them a reality.	1	2	3	4	5	6
19. It's difficult for me to voice my own opinions on controversial matters.	1	2	3	4	5	6
20. For me, life has been a continuous process of learning, changing, and growth.	1	2	3	4	5	6

Circle the number that best describes your present agreement or disagreement with each statement.	Strongly Disagree	Disagree Somewhat	Disagree Slightly	Agree Slightly	Agree Somewhat	Strongly Agree
21. I am an active person in carrying out the plans I set for myself.	1	2	3	4	5	6
22. I often change my mind about decisions if my friends or family disagree.	1	2	3	4	5	6
23. I gave up trying to make big improvements or changes in my life a long time ago.	1	2	3	4	5	6
24. Some people wander aimlessly through life, but I am not one of them.	1	2	3	4	5	6
25. I judge myself by what I think is important, not by the values of what others think is important.	1	2	3	4	5	6
26. There is truth to the saying you can't teach an old dog new tricks.	1	2	3	4	5	6
27. I sometimes feel as if I've done all there is to do in life.	1	2	3	4	5	6

Appendix J

Notice For Recruitment

Delivered verbally (in person), to students in selected Geology, Geography, Environmental Studies, Biology, and Psychology courses, as pre-arranged with instructors.

My name is Lisa Nisbet and I am a researcher from the university's Psychology Department. I am conducting a study about students' views on the environment. Participation in this study is entirely voluntary, however any students who are interested in completing this survey will be extremely helpful in my research and most appreciated.

The study involves completing a short questionnaire which will ask you about your attitudes, beliefs and opinions about the environment, your general well-being, personality characteristics, and some background information. All responses and personal information will be kept strictly confidential. This study is not part of your course and your instructor will not know whether or not you participated. The questionnaire package takes about 20 minutes to complete and students who wish to participate will be entered in a draw for a \$200 cash prize.

Any students who are interested in participating can stay here to complete the study. If you aren't interested, then please feel free to leave and thank you for your time.

At Time 2, only, the researcher also said:

Everyone is welcome to participate. If you completed a similar survey in September, we still would very much appreciate your participation in today's survey. Even if some questions seem similar it is important that you please answer them all.

Appendix K

Informed Consent

The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent has to provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Study Title: Views On The Environment

Study Personnel: Elizabeth (Lisa) Nisbet (Principal Investigator, 520-2600 ext 1293)
 Dr. John M. Zelenski (Faculty Investigator, 520-2600 ext 1609)

Should you have any ethical or other concerns about this study then please contact Dr. Chris Davis, (Chair, Carleton University Ethics Committee for Psychological Research, 520-2600, ext. 2251) or Dr. Mary Gick (Acting Chair, Dept. of Psychology, 520-2600, ext. 2648).

Purpose and Task Requirements: The general purpose of this study is to students' views about the environment relationship with nature. We will be asking you to complete a series of questionnaires regarding your opinions about the environment, nature, your quality of life and personality. The approximate time to complete the study will be 20 minutes.

Potential Risk and Discomfort: There are no particular risks in this study.

Confidentiality: The data collected in this study will be kept confidential. Only the researchers will see your responses. Your informed consent form will be separated from your questionnaire so that your name is not kept with the survey.

Right to Withdraw: Your participation in this study is entirely voluntary. At any point during the study you have the right to not complete certain questions or to withdraw with no penalty whatsoever.

Draw for Cash Prize: The draw for the cash prize will take place on September 30, 2004/December 8, 2004. Chances of winning are approximately one in 300.

I have read the above description of the study concerning views on the environment. The data collected will be used in research publications and/or for teaching purposes. My endorsement indicates that I agree to participate in the study, and this in no way constitutes a waiver of my rights. I am at least 16 years of age.

ACKNOWLEDGEMENT

I ACKNOWLEDGE THAT I HAVE READ AND UNDERSTOOD THIS AGREEMENT, that I have executed this agreement voluntarily.

SIGNED THIS _____ day of _____, 2004, at Ottawa Ontario.

Signature of Participant

 Signature of Witness (Researcher)

Elizabeth K. L. Nisbet
 Printed Name of Witness

Printed Name of Participant

Carleton University, Psychology Dept., B552 Loeb Bldg.
1125 Col. By Dr., Ottawa, K1S 5B6, 613-520-2600 x 1293
 Witness Address & Phone No.

Appendix L

Debriefing - Time 1

Thank you for agreeing to participate in this study. The goal of this research is to examine individual differences in views about the environment.

This study seeks to examine how differences in environmental opinions and beliefs are related to concern, caring and behaviour. We are interested in how environmental concern is related to personal well-being, world views and environmental attitudes. Studying individual differences is helping us to identify personality traits and behaviour to better understand human psychological health and environmental actions.

Some researchers are finding that those with broad, biospherically-oriented concerns for the environment are more likely and motivated to engage in activities with a more broad, global focus (as opposed to those with ecocentric motivation for taking environmental action on strictly a local/personal level). It is also suggested that if one develops an understanding and appreciation for ecology it will be reflected in behaviour. With this in mind, we feel individuals' feelings and attitudes could lead to changes in personal choices and behaviour.

Please be assured that your responses will be treated confidentially. In any public presentation of our data, either in print or in speech, we will not present any information that could identify a participant.

Once again, thanks!

Contacts

The following people are involved in this research project and may be contacted at any time if you have any further questions about the project, what it means, or concerns about how it was conducted:

Dr. John M. Zelenski, Department of Psychology, Carleton University, 520-2600 ext 1609

Elizabeth (Lisa) Nisbet, Department of Psychology, Carleton University, 520-2600 ext 1293

Should you have any ethical or other concerns about this study then please contact Dr. Chris Davis, (Chair, Carleton University Ethics Committee for Psychological Research, 520-2600, ext. 2251) or Dr. Mary Gick (Chair, Dept. of Psychology, 520-2600, ext. 2648).

Appendix M

Debriefing - Time 2

Thank you for agreeing to participate in this study. The goal of this research is to examine individual differences in views about the environment and connectedness to nature.

This study seeks to examine how individual relationships with nature influence environmental behaviour and psychological well-being. We are interested in the human-nature relationship and how this influences our treatment of the environment. It is possible that environmental destruction is related to a damaged person-planet connection, as our lives often separate us from nature and many people may be unaware of how their behaviour affects the ecological systems in which they live. We feel that increasing environmental education and nature relatedness could lead to a heightened awareness and understanding of the fragility and importance of the environment. This feeling of connection to nature should then motivate protection and preservation behaviours. Some researchers are finding that those with broad, biospherically-oriented concerns for the environment are more likely and motivated to engage in activities with a more broad, global focus (as opposed to those with ecocentric motivation for taking environmental action on strictly a local/personal level). It is also suggested that if one develops an understanding and appreciation for ecology it will be reflected in a stronger sense of connection to the natural world. With this in mind, we feel increasing individuals' nature relatedness could lead to more concern and care for nature and more environmentally responsible behaviour.

Through these feelings of connectedness, it may also be possible for people to experience more positive emotions and higher levels of well-being (happiness). Examining levels of connectedness is helping us to identify personality traits associated with nature-relatedness in an effort to better understand this dimension of human psychological health. The potential benefits of nature relatedness for human psychological health include stress and anxiety reduction, as well as more positive emotions and general feelings of well-being. This research is helping us to better understand how personal connections to nature are linked happiness and mental health.

Please be assured that your responses will be treated confidentially. In any public presentation of our data, either in print or in speech, we will not present any information that could identify a participant. Once again, thanks!

Contacts

The following people are involved in this research project and may be contacted at any time if you have any further questions about the project, what it means, or concerns about how it was conducted:

Dr. John M. Zelenski, Department of Psychology, Carleton University, 520-2600 ext 1609
Elizabeth (Lisa) Nisbet, Department of Psychology, Carleton University, 520-2600 ext 1293

Should you have any ethical or other concerns about this study then please contact Dr. Chris Davis, (Chair, Carleton University Ethics Committee for Psychological Research, 520-2600, ext. 2251) or Dr. Mary Gick (Chair, Dept. of Psychology, 520-2600, ext. 2648).

If you wish to obtain information about the environment and the human relationship with nature, the following may be of interest:

Carleton Sustainable Campus Network - cscn@carleton.ca, www.carleton.ca/cscn/
Eco Footprint calculator - <http://www.mec.ca/Apps/ecoCalc/ecoCalc.jsp>
International Union for the Protection of Nature - www.iucn.org/
Redefining Progress - www.redefiningprogress.org/
Ecopsychology Institute at Harvard - www.johnemackinstitute.org

Footnotes

¹ Of note, the Ottawa-Hull region led the country in 2001 with 35% of commuters using alternative transportation methods such as the bus, cycling, or walking to get to work (Statistics Canada, 2003)

² Alphas provided here and for subsequent measures indicate Time 1/Time 2.

³ Minor adjustments to the scale's original wording were made to remove place-specific and dated terminology.

⁴ We omitted the fourth *knowledge* subscale as it was somewhat dated and many of the items required excessive technical knowledge.

⁵ The same pattern of correlations was also found in the Time 2 data.

⁶ We refer here to the Time 1 results, however the pattern of correlations was very similar in the Time 2 data.