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# The Nature Relatedness Scale

## Linking Individuals' Connection With Nature to Environmental Concern and Behavior

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Disconnection from the natural world may be contributing to our planet's destruction. The authors propose a new construct, Nature Relatedness (NR), and a scale that assesses the affective, cognitive, and experiential aspects of individuals' connection to nature. In Study 1, the authors explored the internal structure of the NR item responses in a sample of 831 participants using factor analysis. They tested the construct validity of NR with respect to an assortment of environmental and personality measures. In Study 2, they employed experience sampling methodology examining if NR people spend more time outdoors, in nature. Across studies, NR correlated with environmental scales, behavior, and frequency of time in nature, supporting the reliability and validity of NR, as well as the contribution of NR (over and above other measures) to environmental concern and behavior. The potential of NR as a useful method for investigating human-nature relationships and the processes underlying environmental concern and behaviors are discussed.

**Keywords:** *nature relatedness; environmental attitudes; conservation (ecological behavior); well-being*

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We face increasing environmental problems yet continue to behave in ways that are damaging to our own health and to the planet (Oskamp, 2000). 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. The fact that people do not always behave environmentally does not necessarily mean they are not concerned (Kaplan, 2000; Schultz, 2000). Although many people are aware of and care about environmental problems, this is not always reflected in behavior (Dunlap, Van Liere, Mertig, & Jones, 2000; Kaplan, 2000; Kortenkamp & Moore, 2001; Pooley & O'Connor, 2000). Psychologists have examined motivation, attitudes, values, and beliefs to understand this discrepancy and why some people engage in environmentally responsible behavior (ERB), whereas others do not (Allen & Ferrand, 1999; Dunlap, & Mertig, 1995; Kaiser, Wölfing, & Fuhrer, 1999; Nordlund & Garvill, 2002; Pelletier, Dion, Tuson, & Green-Demers, 1999). Hines, Hungerford, and Tomera's (1986-1987) meta-analysis of 128 empirical studies regarding the determinants of environmental behavior suggests that personality and attitudes, as well as knowledge and skills, predict proenvironmental behavior. We suggest that *nature relatedness* captures many of these individual differences and, thus, differences in ERB.

Personal relationships with nature may provide some insight into the way people 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). We need to better understand why we treat our 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. As a first step, we have developed the Nature Relatedness (NR) scale. In this article we outline the scale's potential usefulness and present evidence from two studies for its reliability and validity. In Study 1, we describe the development of items and structure of the NR scale. In Study 2, we employ experience sampling methodology to examine the reliability, construct validity, and correlates of NR.

## The Human-Nature Connection

Based on evolutionary history, 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 desire to relate to the natural environment. Humans began living in cities, separated from the natural world, relatively late in our evolutionary history, so as Kellert and Wilson point out, it is unlikely we have erased all the learning about nature's value embedded in our biology. Evidence of the biophilia hypothesis lies in the popularity of outdoor wilderness activities, zoos, gardening, our relationship with animals, and our fondness for natural scenery (Hartig, Bööck, Garvill, Olsson, & Gärling, 1996; Kaplan, 1995; Ulrich et al., 1991; Wilson, 1993). There are also well-documented health benefits associated with the natural environment (see Ulrich, 1993, for a thorough review of physiological health and environment studies, and Frumkin, 2001, for a review of the health benefits of nature).

Despite this evident attraction, there is considerable variability in the extent to which individuals are drawn to nature. How nature influences human emotions and why some people feel strongly and positively about nature, whereas others are unmoved, are important questions in the study of ERB (Kals & Maes, 2004; Milton, 2002; Vining, 1987). Kals, Schumacher, and Montada (1999) have investigated the emotional aspects of environmental behavior in their research on love of nature and interest in nature. Along with affinity, interest, and indignation, positive past and present nature experiences are predictive of nature-protective behavior. Another "emotion-based" approach found that sympathy, as a measure of caring for the environment, was an important predictor of environmentally friendly behaviors (Allen & Ferrand, 1999). Including emotion also makes environmental education more successful in fostering behavioral changes (Pooley & O'Connor, 2000). We need to develop a vocabulary, however, to express how people care about nature, as well as better measures to study human-nature relationships and conservation behavior (Saunders, 2003).

There is an increasing presence of human-nature relationships in the study of ERB (Allen & Ferrand, 1999; Clayton, 2003; Iwata, 2001; Mayer & Frantz, 2004; 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 (2000), Howard (1997), and others have argued, if we value and feel concern for nature, we will then want to protect it.

The understanding of our interconnectedness with the earth and sense of inclusion in nature is often referred to as our *ecological identity* or *ecological self*, a term coined by Arne Naess (1973). An ecological identity includes the self, the human and nonhuman community, and the planet's ecosystems (Conn, 1998), so that damage to the planet is seen as damage to the self. Clayton (2003) has investigated environmental self-concepts,

linking environmental self-definition with self-reports of environmental attitudes and behavior. How people identify with the natural environment is an important aspect of the person-nature relationship. Along with identity, however, we also need to investigate the role of emotions and experiences and how these factors interact to explain individual differences in the knowledge of interconnectedness with other life on the planet.

Naess, and many others since (e.g., Bragg, 1996; Roszak, 1992) have insisted a more connected sense of self is necessary to change behavior toward the environment. This *ecopsychology* approach taps into (assumed) innate biophilic tendencies and the experience of people's relationships with nature to promote ERB. Although this is an attractive idea, empirical research is lacking. One impediment to such research has been the lack of a tool to assess individual differences in people's connection to nature. We developed the nature relatedness scale to assess individual differences in these processes.

## Nature Relatedness

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. The concept of NR encompasses one's appreciation for and understanding of our interconnectedness with all other living things on the earth. It is distinct from environmentalism in that it includes much more than activism. It is not simply a love of nature or enjoyment of only the superficially pleasing facets of nature, such as sunsets and snowflakes. It is also an understanding of the importance of all aspects of nature, even those that are not aesthetically appealing to humans (e.g., spiders and snakes). Finally, we conceive of NR as "trait-like" in that it is relatively stable over time and across situations, though not completely fixed.

Examining measures of environmentalism and ecological worldview, we were unable to find an existing scale that captured all the elements we consider key to the person-nature relationship. The New Ecological Paradigm scale (NEP; Dunlap et al., 2000), for example, captures views about how humans interact with nature but lacks an emotional or personal aspect and does not explore how people feel about actually being in nature. The New Ecological Consciousness scale (NEC; Ellis & Thompson, 1997) assesses general feelings about environmental degradation, limits to economic

growth, and potential crises in overpopulation, but does not explore the individual's feelings about their own relationship with nature.

Mayer and Frantz (2004) published a Connection to Nature scale (CNS), a proposed affective measure of community with nature. The CNS attempts to measure a sense of inclusion or closeness with nature on both an emotional and cognitive level, however it misses the physical aspect of human-nature relationships, a key element of individual sense of connectedness (Chawla, 1998, 1999, 2003; Kahn & Kellert, 2002). Similarly, Clayton's (2003) Environmental Identity scale (EIS) may be useful for evaluating self-identification, but does not capture experiences and emotions related to nature.

Some instruments evaluate motives and values for environmental attitude or concern. Thompson and Barton's (1994) scales mainly differentiate ecocentric (intrinsic) versus anthropocentric (extrinsic) value motives for proenvironmental behavior, and so are unlikely to capture the diversity of all possible human-nature relationships, particularly those that may be damaged. Schultz (2000) has created a self-report scale to assess the value structure underlying environmental concerns (whether individuals care about themselves, other people, or all living things), but this scale does not assess connectedness. Schultz (2002) has also created a measure of Inclusion of Nature in Self (INS) by adapting Aron, Aron, and Smollan's (1992) Inclusion of Other in the Self scale (used to study interpersonal relationships). Using images of 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. Although the INS scale addresses some aspects of the human-nature relationship, and is conceptually similar to NR, the single-item format limits the construct's breadth.

To help fill this gap, we developed the NR questionnaire, a self-report measure designed to assess the affective, cognitive, and physical relationship individuals have with the natural world. Drawing on aspects of the environmental measures available, the literature, and our concept of nature relatedness, we compiled a set of candidate items designed to measure individuals' feelings of connection to nature. Following an initial survey, each statement was reexamined for content and clarity, resulting in a pool of 30 potential items for the NR scale, which we planned to further reduce. We selected items we felt were most indicative of the affective, cognitive, and experiential aspects of NR. However, in creating our pool of items, there were instances in which these elements were best captured with statements

concerning an environmental belief or attitude (e.g., “Humans have the right to use natural resources any way we want”). Because the influence of the human-nature relationship in shaping environmental attitudes and beliefs is not completely understood, we felt it was unreasonable to attempt to exclude all overlap between NR and other aspects of concern for and behaviors toward the environment. Therefore, NR is likely to be correlated with environmental measures containing similar theoretical origins, yet not so strongly related as to be impossible to differentiate between them. The principles of ecopsychology would suggest that NR is linked to ERB, and that the stronger the connection to nature, the more environmentally we will behave. Our goal was to explore these ideas by (a) developing a valid measure of NR and (b) examining the relationship between NR, environmental attitudes and behavior, and personality.

We present two studies. In the first, we conducted a two-phase study to explore the construct of nature relatedness, individual differences, and NR’s relation to ERB. In the first phase of Study 1, we examined the structure of the set of candidate NR items for potential dimensionality using a principal axis factor analysis. In phase two, we tested a subsample of participants on their environmental attitudes and personality, using a variety of measures differing in structure and response style. The NR scale was also included in a larger study using experience sampling methodology (Study 2). We collected baseline measures of NR and personality, as well as biweekly reports of time spent in the outdoors and in nature. This allowed us to further investigate reliability, construct validity, and correlates of NR.

We hypothesized that those high in NR would be likely to engage in more contemplation about the future in their desire to maintain or preserve the environment they feel connected to (c.f., Lindsay & Strathman, 1997). The desire to affiliate with other living things, stemming from the biophilia hypothesis, suggests that highly nature related individuals will be drawn to animals (Bekoff, 2003; Birjulin, Myers, & Saunders, 2004; Vining, 2003) and other people. Indeed, the research examining altruism as a motivation for proenvironmental behavior (Allen & Ferrand, 1999; Schultz, 2000; Schultz et al., 2004; Stern & Dietz, 1994; Stern, Dietz, & Kalof, 1993) suggests that humanitarianism will also be positively correlated with NR. We also administered a broad personality inventory to investigate NR’s position in the Five-Factor Model, an approach to personality that purports to comprehensively capture major individual differences with five dimensions (see John & Srivastava, 1999). Finally, we investigated whether those most related to nature would demonstrate this in concrete behaviors such as spending more time outdoors in the natural environment.

## Study 1

### Method

*Participants.* In phase one, 831 Canadian undergraduate psychology students participated as part of a mass-testing questionnaire package in exchange for credit in an introductory psychology course. In phase two, a random selection of the first group of participants were contacted and invited to participate in a follow-up session ( $N = 184$ ). Most participants (67.4%) were female ( $n = 124$ ;  $n = 60$  males). The mean age was 19.48 years,  $SD = 2.83$ , and 82.1% were in their first year of university.

*Procedure.* Participants in phase one of the study responded to the set of NR items, included as part of a large questionnaire package administered to first-year psychology students. Students in phase two were run in small group sessions. Participants provided information on various behaviors, attitudes, and beliefs concerning the environment and nature. We asked participants about vegetarianism, pet ownership, the purchase of organic and fair trade goods, participation in environmental organizations, self-definition as an environmentalist, and the frequency and type of outdoor, nature-related activities. The questionnaire package included scales assessing a variety of environmental attitudes, values, and beliefs, and various personality measures (described below), along with the set of 30 candidate NR items.

### Materials

For our proposed measure of NR, participants rated the 30 candidate NR statements on how well each item described them, using a 5-point Likert scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*), such that higher scores were indicative of a stronger connection to nature ( $\alpha = .88$ ).

The Ecology Scale, Short-Form (Maloney, Ward, & Braucht, 1975) captures both feelings about ecological issues and willingness to commit to behavior change in a *true* or *false* response format. We used three of the four 10-item subscales to measure verbal commitment ( $\alpha = .73$ ), actual commitment ( $\alpha = .72$ ) and affect ( $\alpha = .79$ ) toward ecological issues concerning transportation, monetary donations, consumer purchases, pollution, political activism, and general awareness.<sup>1</sup>

The New Ecological Paradigm scale (Dunlap et al., 2000) contains 15 statements and uses a 5-point Likert scale ranging from 1 (*strongly agree*)

to 5 (*strongly disagree*) to assess ecological worldview. We used the scale's unidimensional scoring in our analyses ( $\alpha = .75$ ) as a measure of environmental views.

We used a version of the NEC (Ellis & Thompson, 1997) often administered to environmental activists. This 10-item version of the scale is strongly worded to assess feelings about environmental degradation, limits to economic growth, and potential crises in overpopulation using a 7-point Likert scale ranging from 1 (*strongly agree*) to 7 (*strongly disagree*). Items such as "What human beings are currently doing to nature can be fairly characterized as an 'ecoholocaust'" tap into concerns of potential environmental catastrophes, as well as beliefs about human responsibility for such conditions. We included this scale specifically for the intensity of the wording to help clearly differentiate between responses that might reflect some measure of social desirability or a mainstream level of concern for the environment ( $\alpha = .83$ ).

The Consideration of Future Consequences scale (CFC; Strathman, Gleicher, Boninger, & Edwards, 1994) assesses how people differ in their contemplation of how potential current behavior may affect future events. Although it does not assess environmentalism per se, the scale has been used in several studies concerning recycling and waste reduction, funding of public transit, social norms and environmentalism (Ebreo & Vining, 2001; Joireman, Lasane, Bennett, Richards, & Solaimani, 2001; Lindsay & Strathman, 1997). Participants are asked to rate 12 statements for how characteristic each one is of them, using a 5-point Likert scale ranging from 1 (*extremely uncharacteristic*) to 5 (*extremely characteristic*;  $\alpha = .81$ ).

To explore how NR is an extension of the biophilia hypothesis, we measured the level of affiliation with nonhuman animals using a modified version of the Love of Animals and Love of People scale (Ray, 1982). We included items pertaining solely to the love of animals and removed references to animals not indigenous to Canada. Participants responded to 20 statements concerning domestic and wild animals with a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*;  $\alpha = .82$ ).

We included a brief comprehensive measure of personality, the Big Five Inventory (BFI; John & Srivastava, 1999) to measure extraversion, agreeableness, conscientiousness, neuroticism, and openness. Participants were asked to indicate how descriptive each of 44 statements was of them, using a 5-point Likert scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*). Each subscale demonstrated acceptable reliability (coefficient alpha between .77 and .84).

The American National Election Studies Humanitarianism scale (Steenbergen, 1995) is a 6-item scale measuring variations in beliefs about,



concern for, and willingness to help others (e.g., “A person should always be concerned about the well-being of others”). Measurement of each item uses a 5-point Likert scale ranging from 1 (*agree strongly*) to 5 (*disagree strongly*;  $\alpha = .75$ ).

## Results

### Phase 1: Factor Analysis

Frequency distributions and inter-item correlations were used to select items that were most representative of the construct of NR and that best differentiated between people. Several items did not discriminate between people low or high in NR (i.e., all respondents answered similarly) or were not satisfactorily correlated with the rest of the scale. Based on these conceptual and statistical reasons we dropped nine items, leaving the NR item pool with 21 statements determined to be indicative NR. We reverse scored appropriate items before proceeding with further analyses. We conducted an exploratory factor analysis ( $n = 831$ ) with the maximum likelihood method to examine the structure of the NR items. As we expected the factors to correlate, an oblique Promax rotation was selected ( $\kappa = 4$ ), although we also explored less satisfactory orthogonal rotations. Three factors were extracted (first four eigenvalues were 5.90, 1.72, 1.42, and 1.07), accounting for 34.18% of the total variance. Catell’s scree plot method also suggested a three-factor model, which was the most interpretable solution.<sup>2</sup> Six communality values were low ( $< .25$ ), and several of these items are not easily forced onto only one factor. However, reliability analysis and inter-item correlations suggested all 21 items contributed to one or more of three potential subscales.<sup>3</sup>

Table 1 presents the 21 variables ordered and grouped by loading size to facilitate interpretation. Descriptive labels suggested for the three factors are NR-Self, NR-Perspective, and NR-Experience. The first factor, NR-Self, represents an internalized identification with nature, reflecting feelings and thoughts about one’s personal connection to nature, such as “My relationship to nature is an important part of who I am.” The second factor, NR-Perspective, reflects an external, nature-related worldview, a sense of agency concerning individual human actions and their impact on all living things, for example “Conservation is unnecessary because nature is strong enough to recover from any human impact” (reversed). The item, “I think a lot about the suffering of animals,” loaded more heavily on NR-Self than on

**Table 1**  
**Rotated Factor Loadings for Maximum Likelihood Extraction and Promax Rotation on Nature Relatedness (NR) Items**

Item	Factor 1	Factor 2	Factor 3
<b>NR-Self</b>			
My connection to nature and the environment is a part of my spirituality	<b>.87</b>	-.2	
My relationship to nature is an important part of who I am	<b>.86</b>	-.16	.12
I feel very connected to all living things and the earth	<b>.77</b>		
I am not separate from nature, but a part of nature	<b>.46</b>		
I always think about how my actions affect the environment	<b>.46</b>	.19	
I am very aware of environmental issues	<b>.45</b>	.16	
I think a lot about the suffering of animals	<b>.43</b>	.26	-.18
Even in the middle of the city, I notice nature around me	<b>.41</b>		.26
My feelings about nature do not affect how I live my life	<b>.39</b>		.21
<b>NR-Perspective</b>			
Humans have the right to use natural resources any way we want		<b>.52</b>	
Conservation is unnecessary because nature is strong enough to recover from any human impact	-.15	<b>.51</b>	
Animals, birds and plants have fewer rights than humans		<b>.42</b>	
Some species are just meant to die out or become extinct		<b>.28</b>	
Nothing I do will change problems in other places on the planet	.17	<b>.26</b>	
The state of nonhuman species is an indicator of the future for humans	.17	<b>.17</b>	
<b>NR-Experience</b>			
The thought of being deep in the woods, away from civilization, is frightening	-.22		<b>.81</b>
My ideal vacation spot would be a remote, wilderness area			<b>.63</b>
I enjoy being outdoors, even in unpleasant weather			<b>.62</b>
I don't often go out in nature			<b>.59</b>
I enjoy digging in the earth and getting dirt on my hands	.11		<b>.44</b>
I take notice of wildlife wherever I am	.27		<b>.38</b>

Note: Boldface type indicates the factor under which the item loads most strongly in cases with multiple factor loadings.

NR-Perspective (.43 and .26 respectively). This item is conceptually similar to other items on NR-Perspective, and, thus, is scored this way for phase two analyses.<sup>4</sup> “The state of non-human species is an indicator of the future for humans” loaded equally on NR-Self and on NR-Perspective (.17). As the item is intended to capture perspective and attitude, it is scored as part of NR-Perspective.

The third factor, NR-Experience, reflects a physical familiarity with the natural world, the level of comfort with and desire to be out in nature, and includes items such as “I enjoy being outdoors, even in unpleasant weather.” This aspect of nature relatedness is evident in those who seek out nature, are drawn to the wilderness, and who are aware of and fascinated with nature all around them.

The oblique rotation allows factors to correlate and, as anticipated, the dimensions of NR were. The first factor, NR-Self, which represents an internal perspective or ecological identity, was moderately correlated with the other two (.47 with NR-Perspective, .58 with NR-Experience). The weaker correlation (.34) between NR-perspective and NR-experience is consistent with some of the research indicating interest or participation in outdoor recreation has not been found to consistently predict environmentally responsible behavior (Teisl & O’Brien, 2003). Some people may enjoy being outdoors for thrill seeking, adventure or challenge, but not because they identify with nature or because of concern or appreciation for nature’s intrinsic qualities.

The 21 items combine to provide a measure of overall nature relatedness, however our results suggest a possible 3-factor structure within the scale. Further analysis into how specific dimensions of NR relate to other measures is required to confirm the exact nature of the scale’s structure (e.g., do the subscales have similar or dissimilar relationships with criterion variables?).

## Phase 2: Reliability and Construct Validity

All 21 items were averaged to create a single NR scale and the three subscales (identified in Table 1) were also computed. Chronbach’s alpha for the full NR scale was .87, and .84 for NR-Self, .66 for NR-Perspective, and .80 for NR-Experience, demonstrating good internal consistency. Test-retest correlations over a 6-to-8-week period were .85 for NR, .81 for NR-Self, .65 for NR-Perspective, and .85 for NR-Experience. These results confirm the temporal stability of the NR measure.

### *Relationship With Other Measures*

Table 2 illustrates NR differences related to pet ownership, vegetarianism, fair trade and organic purchasing habits, participation in environmental organizations, activities in nature, and self-identification as an environmentalist. Differences in NR (or on at least two NR dimensions) were significant for every variable. In sum, these results support the validity

of NR. Those with higher NR scores demonstrated an affiliation with animals (through pet ownership and vegetarianism<sup>5</sup>), concern for the environment by belonging to organizations and self-declaration as an environmental activist, as well as spending time engaged in nature-related activities. In addition, those related to nature report more environmental behavior, such as purchasing organic and fair-trade goods. These results provide initial construct validity for the NR scale.

*NR and environmental scales.* Correlations between NR, the three dimensions of NR, and the environmental attitude measures are presented in Table 3. As we anticipated, verbal commitment and actual commitment to environmental actions were strongly correlated with NR. The affect subscale was also positively correlated with NR. The NEP correlated strongly with NR. This is consistent with our expectations as NR shares some conceptual basis with the NEP. Nature relatedness was positively correlated with NEC, and results were stronger than we had expected, given the extreme wording of some of the items. To summarize, NR was moderately to strongly related to measures of environmentalism.

*NR and personality measures.* As predicted, NR was related to several measures of personality. Correlations between overall NR, the three dimensions of NR, and personality variables are presented in Table 4. Extraversion correlated with NR, as did agreeableness, conscientiousness, and openness. We found only a weak negative correlation between neuroticism and NR-Experience. Our hypothesis concerning the CFC and NR was supported with a strong positive correlation. Humanitarianism was related moderately to NR. Consistent with our predictions, love of animals was also related to NR.

*Distinguishing NR from environmental attitude measures.* We predicted that the NR scale would be correlated with measures of environmentalism, attitude, and beliefs (e.g., E-scale, NEC, etc.). However the magnitude of many of these correlations ( $> .50$  for the full NR scale) leads to the question of whether the NR items measure anything besides environmental attitudes. Ultimately, the NR scale will be useful to the extent that it can predict ERB that other scales cannot. Therefore, we investigated NR's ability to predict the specific environmental behaviors included in this investigation (e.g., purchase of organics, membership in environmental organizations, etc.) even when controlling for other measures of environmentalism. More

**Table 2**  
**Mean (*M*), Standard Deviations (*SD*), and Effect Sizes (*d*) of Nature Relatedness (NR) Dimensions by Environmental Behaviors**

	Pet Ownership					
	No ( <i>n</i> = 72)		Yes ( <i>n</i> = 111)		<i>t</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
NR	3.15	.63	3.37	.58	-2.35*	.36
NR-Self	2.91	.79	3.12	.77	-1.79	.27
NR-Perspective	3.40	.68	3.59	.61	-2.03*	.29
NR-Experience	3.19	.88	3.42	.83	-1.81	.27
	Vegetarianism					
	No ( <i>n</i> = 169)		Yes ( <i>n</i> = 14)		<i>t</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
NR	3.26	.58	3.54	.85	-1.67	.38
NR-Self	3.01	.75	3.46	1.06	-2.13*	.49
NR-Perspective	3.47	.62	4.02	.68	-3.13**	.85
NR-Experience	3.35	.82	3.08	1.23	1.13	-.26
	Organic Purchases					
	No ( <i>n</i> = 96)		Yes ( <i>n</i> = 85)		<i>t</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
NR	3.16	.61	3.42	.58	-2.88**	.44
NR-Self	2.82	.76	3.30	.74	-4.29**	.64
NR-Perspective	3.50	.68	3.54	.60	-.41	.06
NR-Experience	3.23	.88	3.44	.83	-1.64	.25
	Fair Trade Purchases					
	No ( <i>n</i> = 121)		Yes ( <i>n</i> = 52)		<i>t</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
NR	3.20	.58	3.42	.65	-2.20*	.36
NR-Self	2.95	.76	3.18	.82	-1.83	.29
NR-Perspective	3.47	.62	3.62	.69	-1.44	.23
NR-Experience	3.22	.87	3.50	.84	-1.92	.33

(continued)

**Table 2 (continued)**

	Member of Environmental Organization				<i>t</i>	<i>d</i>
	No ( <i>n</i> = 157)		Yes ( <i>n</i> = 26)			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
NR	3.22	.60	3.68	.71	-3.77**	.70
NR-Self	2.96	.73	3.53	.92	-3.58**	.69
NR-Perspective	3.47	.62	3.79	.70	-2.34*	.48
NR-Experience	3.26	.81	3.76	1.00	-2.78**	.55

  

	Participate in Nature Activities				<i>t</i>	<i>d</i>
	No ( <i>n</i> = 49)		Yes ( <i>n</i> = 134)			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
NR	3.06	.57	3.37	.60	-3.13**	.53
NR-Self	2.81	.80	3.12	.76	-2.41*	.40
NR-Perspective	3.54	.63	3.51	.65	.27	-.05
NR-Experience	2.82	.77	3.52	.81	-5.23**	.89

  

	Consider Myself an Environmentalist				<i>t</i>	<i>d</i>
	No ( <i>n</i> = 135)		Yes ( <i>n</i> = 47)			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
NR	3.14	.55	3.70	.56	-5.93**	1.01
NR-Self	2.83	.69	3.63	.75	-6.60**	1.11
NR-Perspective	3.41	.64	3.84	.56	-4.12**	.72
NR-Experience	3.23	.83	3.63	.86	-2.80**	.47

\* $p < .05$ . \*\* $p < .01$ .

specifically, we conducted a series of stepwise logistical regression analyses, with the measures of environmental attitude (the NEP, the NEC, the affect dimension of the Ecology scale) and NR as predictors. Other environmental measures were largely unrelated to outcomes (see Table 5).<sup>6</sup> This pattern of findings suggests that NR is indeed unique; that is, it is measuring something different that other environmental scales such as the NEP, NEC, or Ecology scale do not, and it is a better predictor of (self-reported) environmental behaviors. In other words, this pattern of results establishes NR's discriminant validity.

**Table 3**  
**Correlations of Nature Relatedness (NR) With**  
**Environmental Measures**

	NR	NR-Self	NR- Perspective	NR- Experience
Ecology scale				
Verbal commitment	.65**	.61**	.55**	.37**
Actual commitment	.53**	.57**	.31**	.35**
Affect	.57**	.56**	.51**	.28**
New Ecological Paradigm	.54**	.42**	.67**	.24**
New Ecological Consciousness	.60**	.52**	.57**	.37**

\* $p < .05$ . \*\* $p < .01$ .

**Table 4**  
**Study 1 Correlations Between Nature Relatedness (NR) Dimensions**  
**and Personality**

	NR	NR-Self	NR- Perspective	NR- Experience
Extraversion	.15*	.07	.13	.18*
Agreeableness	.24**	.23**	.12	.21**
Conscientiousness	.15*	.15*	.14	.06
Neuroticism	-.04	-.02	.08	-.15*
Openness	.38**	.39**	.16*	.33**
Consideration of Future Consequences	.40**	.40**	.39**	.15*
Humanitarianism	.25**	.23**	.32**	.07
Love of Animals	.34**	.18*	.45**	.22**

\* $p < .05$ . \*\* $p < .01$ .

## Study 2

### Method

*Participants and procedure.* Participants were 145 executives from the federal government and private sector located throughout Canada. All surveys were completed anonymously online, with biweekly reminders sent from organizations. At the beginning of the study, participants completed a baseline survey that included the NR scale and personality measures. In the

**Table 5**  
**Study 1 Results of Logistic Regression Analyses Entering Nature Relatedness (NR) as Predictor of Environmental Behaviors, Controlling for Environmental Attitude<sup>a</sup> (*N* = 176)**

	$\beta$	$R^2$ change	OR <sup>b</sup>	95% CI <sup>b</sup>
Belong to environmental organization	1.26*	.06	3.52	1.29–9.63
Self-identification as environmentalist	1.24**	.06	3.45	1.43–8.32
Buy organic	.80*	.04	2.23	1.11–4.50
Buy fair trade	1.00*	.05	2.72	1.22–6.08
Participate in nature-related activities	1.49**	.10	4.41	1.89–10.29

\* $p < .05$ . \*\* $p < .01$ .

a. New Ecological Paradigm, New Environmental Consciousness, and environmental affect were included in the equation, but are not reported here. Details of the analyses are available from the authors.

b. OR = odds ratio; CI = confidence interval.

Experience Sampling Method (ESM) portion, respondents reported twice a week (on Mondays and Thursdays) for a period of 8 weeks. The ESM surveys asked questions regarding the frequency of time spent outdoors and in nature on the previous three days. One hundred and forty five individuals completed the baseline survey and 854 ESM surveys were collected over the 8-week period. Average age of the participants was 42.37 years,  $SD = 8.80$ , and 61% were male ( $n = 87$ ,  $n = 56$  females; 2 participants did not indicate gender).

## Materials

*Baseline survey.* The 21-item NR scale developed in Study 1 was used to assess individuals' connection to nature ( $\alpha = .87$ ). The BFI (John & Srivastava, 1999) described in Study 1 was also administered at the beginning of this study.

*Experience sampling measures.* To capture people's ongoing experiences in nature, both in urban and wilderness settings, participants reported how often they spent time "outdoors" and "in nature (e.g., the bush)." Respondents reported twice a week on the frequency of these activities during the previous 3-day period, using a 5-point Likert scale ranging from 0 (*not at all*) to 4 (*7 or more times*). Experience Sampling Method has the advantage of minimizing retrospective (memory) biases. Frequent, repeated assessments diminish the need for mental aggregation over time, and this



**Table 6**  
**Study 2 Correlations Between Nature Relatedness (NR) Dimensions**  
**and Frequency of Time Outdoors, in Nature**

	NR	NR-Self	NR- Perspective	NR- Experience
Frequency outdoors	.25**	.23*	.16	.19*
Frequency in nature	.30**	.30**	.20*	.22**

\* $p < .05$ . \*\* $p < .01$ .

makes self-reports more indicative of actual experience or behavior (see Scollon, Kim-Prieto, & Diener 2003).

## Results

Responses to the 21 NR items were averaged. Overall NR scores were normally distributed and ranged from 2.14 to 4.90, with a median of 3.71. As predicted, NR correlated positively with the frequency of time spent in nature and outdoors (see Table 6). Thus, our hypothesis that nature-related people spent more time outside, in the natural environment was supported.

Correlations between NR and the personality measures are presented in Table 7, and NR was again related to several Big Five scales. Nature relatedness was positively correlated with agreeableness and openness. Conscientiousness verged on significance with NR ( $r = .16, p = .06$ ). These correlations are similar to those found in the student sample (Study 1), replicating NR's link with personality in a somewhat more diverse adult sample.

## General Discussion

The studies' primary goal was to develop and evaluate the NR scale as a reliable and valid tool to assess individuals' connections with nature. Results suggest that this goal was met. Nature relatedness was internally consistent, temporally stable, and correlated with time spent outdoors, in nature, and with measures of environmental attitudes and behaviors, confirming the NR scale's validity. This pattern of relationships supports the links between individuals' sense of connection to nature and ERB. A secondary goal was

**Table 7**  
**Study 2 Correlations Between Nature**  
**Relatedness (NR) and Personality**

	NR	NR-Self	NR-Perspective	NR-Experience
Extraversion	.10	.08	.10	.11
Agreeableness	.26**	.26**	.20*	.11
Conscientiousness	.16	.15	.13	.08
Neuroticism	-.02	-.04	.05	-.06
Openness	.27**	.24**	.09	.32**

\* $p < .05$ . \*\* $p < .01$ .

to further investigate the nature-related personality. Roughly consistent with our expectations, nature-related people tend to be open to experience, agreeable, and conscientious.

### Structure of the Nature Relatedness Questionnaire

Our exploratory factor analysis revealed dimensions within the NR scale. The 3-factor solution we obtained explained 34% of the variance, which is consistent with scales with similar theoretical background (i.e., Mayer & Frantz's, 2004, 1-factor solution for the CNS explains between 32% and 38% of the variance). We view NR as representing the thoughts, feelings, and experiences people have with nature, but expect these characteristics of human-nature relationships may overlap across three NR factors: self, perspective, and experience. The NR-Self factor might be thought of as the ecological self, or how strongly people identify with the natural environment. The NR-Perspective factor is an indication of how one's personal relationship with the environment is manifested through attitude and behavior. The NR-Experience factor reflects the physical familiarity and attraction people have to nature.

Several items loaded on multiple factors, and subscales based on the factors correlated fairly strongly. Although subscales sometimes showed different relationships with criterion variables, these differences were not overwhelming and never went in opposite directions. For example, NR-Self and Perspective were, in general, more related to the environmental measures than NR-Experience. All together, these findings suggest that the factor structure requires further investigation. Items may ultimately require rewording or removal to achieve an optimal multi-factorial solution. Results of the

exploratory factor analysis suggest some multidimensionality exists. Nonetheless, as a single, 21-item scale, the NR construct looks promising.

## **Nature Relatedness and Environmental Behavior**

Our results provide evidence for the construct validity of the NR scale. Nature-related people reported spending more time outdoors and in the natural environment. Those higher in NR reported more environmental concern and endorsement of proenvironmental attitudes as well as more self-reported environmental behavior. Higher levels of NR were predictive of ecological perspective, as well as strong views about the seriousness of ecological problems and human treatment of the environment.

Kaplan (2000) believes that tapping into the human desire to explore and learn is far more effective in inspiring concern for nature than dictating behavior. 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 green space or park they enjoy visiting. The emotional aspect of human-nature relationships may partly explain some of these individual differences. Nature relatedness correlated not only with self-reported behavior, but also with affect concerning ecological issues. The NR scale may be an alternative to measures that only inquire into belief and neglect the emotional component of environmental behavior. Unlike the Ecology Affect subscale, though, which emphasizes the negative emotions associated with fears and concerns around environmental threats, NR attempts to take into account both the positive and negative feelings that are part of our relationship with nature.

The NR scale is related to environmental measures as predicted, but not so strongly as to be impossible to differentiate between them. NR shares 4% to 42% of the variance with environmental measures (i.e., Ecology scales, NEP, etc.), justifying further investigation of how the person-nature relationship is different from other environmental measures and how it may influence ERB. Measures of environmental attitudes, beliefs, and actions alone are not sufficient to explain people's relationships with nature and the motivation behind environmental behaviors. Since we began our research, human-nature relationships have received increased attention and other scales (e.g., Connectedness to Nature) have been published. Future work may investigate how other measures are related to NR and whether each of these instruments captures different aspects of connection to nature.

There is a gap between many people's feelings and attitudes about environmental problems and their own actions. Psychology needs to find ways to shrink this gap and transform concern for the environment into environmentally responsible behavior (Winter, 2000). Increasing nature relatedness may be one way to accomplish this. Given the inconsistencies that often exist between attitudes and behavior, it is interesting to see NR predicting both. Our results indicate that NR is better able to predict certain types of environmental activism, behavior, and identity as an environmentalist better than many of the existing environmental scales. Although speculative, increasing people's NR may narrow the gap between their attitudes and behaviors. Experimental research would be required to confirm this suggestion.

### **Nature Relatedness and Personality**

Our hypothesis that NR would be positively correlated with select personality variables was supported. The relation of NR to specific characteristics or traits provides some insight into the nature related personality. Nature relatedness was related to agreeableness and openness in both samples, suggesting that high NR people may be more adventurous and easy going. We had no expectations of high NR individuals to be outgoing, however the correlation between extraversion and NR (mostly due to the NR-Experience dimension) suggests that those who actively experience nature may also possess this quality. However, both outdoor experiences and high extraversion scores might be the result of sensation seeking, rather than sociability. Although weak, the correlation between NR and conscientiousness suggests that those who are most connected to nature may also engage in responsible environmental behaviors, or that a general sense of responsibility manifests itself in the environmental domain as in others.

The strong relationship between NR and CFC provides support for the idea that NR is related to long-term thinking about the environment (and more generally). Expanding on Strathman et al.'s theory (1994), it may be the case that those highly related to nature are more able to contemplate possible future outcomes, even if those outcomes are ambiguous.

### **Strengths and Limitations**

Although these data are mainly self-reports and the analyses mostly correlational, we were able to establish a link between NR and environmental attitudes and behavior, as well as personality, with a large number of subjects, using both cross-sectional and experience-sampling methods. These results were consistent across students and business people, indicating that the

construct of NR and its potential influence is not necessarily limited by age or occupation.

A potential benefit of NR research is an understanding of the root causes of environmentally destructive behavior. We are encouraged by NR's ability to predict proenvironmental attitudes and practices, however a further exploration of the direct effects of NR on individual actions is needed to confirm this relationship. Investigating the effects of manipulating NR on behavior seems a logical next step in confirming NR's ability to motivate ERB.

## Future Directions

Although we expect individual differences in NR to be relatively stable over time, environmental education or experiences in nature may increase NR. 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 (Feral, 1998; Kaplan, 1995, Kaplan & Talbot, 1983). Because much of the research on the benefits of nature experiences comes from the marketers of structured wilderness trips (Frumkin, 2001), it would be useful to have unbiased, empirical information about people's everyday nature experiences and the sustained benefits of being nature related.

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. As individuals become more related to nature, they may feel more positive emotions. This sense of well-being they experience could then result in more proenvironmental behaviors. If people feel good about their natural environment, value and care about it, they might behave in ways that respect and protect it (Schultz, 2000). If people fully understand their connection to nature they may develop more empathy for all living creatures and the planet (Feral, 1998). 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).

## Conclusion

The results reported in this article support the validity of a new instrument to measure the affective, cognitive, and experiential aspects of individual connection with the natural world. Our goals were (a) to develop a

valid Nature Relatedness scale and (b) to examine the relationship between NR, environmental attitudes and behavior, and personality. Our scale correlated as expected with environmental measures, and NR was a better predictor of involvement in environmental groups, sustainable consumption, and identification as an environmentalist.

We know that knowledge and concern for environmental issues does not necessarily predict pro-environmental behavior. We suggest that alongside the current interest in studying how to increase and motivate these behaviors, there be a more thorough investigation of the underlying contributors to environmental concern and caring. The results of our study support our hypothesis that NR—emotions, values, attitudes and a self-concept that includes the natural world, a biospheric orientation—may provide a motivational force toward nature protection and preservation.

## Notes

1. We omitted the fourth knowledge subscale as we felt many of the items required such technical expertise as might only be found amongst individuals with a background in science.

2. We also randomly split the data, reran the factor analysis, and found a similar factor solution on the split samples.

3. Inter-item correlation data is available from the authors on request.

4. This item's loading on Factor 1 may be a result of wording, rather than a true reflection of where the item fits best. The item was intended to capture an external perspective by tapping into beliefs about how humans treat nonhuman animals, however first-person wording may be one explanation for why it loads on the NR-Self factor. In addition, removing this item from Factor 2 reduces that dimension's reliability and does not increase that of dimension 1.

5. Vegetarianism may also be practiced for environmental reasons.

6. Environmental affect predicted environmentalist identification; NEC was negatively associated with NR activity. Nature relatedness remained a significant predictor in both cases.

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