# The Relationship between Connectedness to Nature, Environmental Values, and Pro-environmental Behaviours

Marybeth Pereira[1] and Peter M. Forster[2], Charles Darwin University, Northern Territory, Australia

*Abstract*

The aims of this study were to investigate (a) the relationship between connectedness to nature and pro-environmental behaviours; (b) the relationship between environmental values and behaviours; and (c) whether or not there is a mediating effect of values in the relationship between connectedness and behaviour. Seventy-six undergraduate students completed an online survey that measured connectedness to nature, egoistic values, altruistic values, biospheric values, pro-environmental behaviours, and social desirability. The results showed that connectedness to nature, altruistic values and biospheric values were positively related to pro-environmental behaviours; and that environmental values partially mediated the relationship between connectedness to nature and pro-environmental behaviour. These results lend support to Wilson's (1984) biophilia hypothesis, which suggests that all humans are innately and emotionally connected to nature, and the value-belief-norm model of Stern, Dietz, Abel, Guagnano and Kalof (1999), which suggests that values activate cognitions that create a positive environmental personal norm to engage in pro-environmental behaviours.

**Keywords:** Connectedness to nature, environmental values, pro-environmental behaviour, biospheric values, altruistic values

*Introduction*

Gas emissions from human activity have contributed to climate change (Crowley, 2000; Levitus *et al*., 2001; Stott *et al*., 2000). It has also been established that people could reduce the impacts of climate change through pro-environmental behaviours (Stern and Gardner, 1981a, 1981b; Stern, 2000). However, people have only moderate levels of knowledge about the causes, consequences and current state of climate change, and their level of confidence is only weakly related to the amount of knowledge they have of these topics (Sundblad, Biel and Gärling, 2009). Lack of knowledge causes people to act in less environmentally friendly ways (Lorenzoni, Nicholson-Cole and Whitmarsh, 2007; Stoll-Kleemann, O'Riordan and Jaeger, 2001). Other barriers include the costs to individuals overriding the benefits for others, the belief that one person is not solely responsible, the belief that technological advances will provide a solution in the future, the sunk costs in established habits and prior investments, and a lack of

trust in the government and other information sources (Burke, 2010). There is current interest in factors that lead people to engage in pro-environmental behaviours. One potential factor is to build on people's relationship with nature, which has been studied through nature's restorative effects, people's emotional connection with nature, and their preferences for and within natural environments (Bird, 2007). Another potential factor is people's concern for the environment, which is most often studied through their values (Bird, 2007).

### Human relationships with the natural environment

People's relationship with nature may be a determinant of engagement in pro-environmental behaviours. Two models that are frequently referred to when describing the relationship between humans and the natural environment are Wilson's (1984) biophilia model and Schultz's (2002) connectedness to nature model.

#### The biophilia model

Wilson (1984, 1993: 31–41) described biophilia as an emotional and innate connection people have with all living things. The model assumes that humans evolved in the savannahs of Africa; open and grassy landscapes scattered with short-trunked and wide canopied trees, various plants, animals, and bodies of water (Heerwagen and Orians, 1993: 138–72; Kahn, Jr., 1997; Wilson, 1984) and therefore have an affinity for such. Researchers have found that both children and adults preferred savannah-like landscapes to other biomes, including rainforests, coniferous forests, deciduous forests, and tundras (Falk and Balling, 2010; Kahn, Jr., 1997; Ulrich, 1993: 73–137).

The concept is not without its critics. For example, individuals in Taiwan, which predominantly features tropical and coniferous forests, ranked the tundra as the most preferred environment (Han, 2007). It may be that individuals prefer environments that are unfamiliar or dissimilar to the one in which they live rather than innately preferring the savannah. Regardless of the type of landscape, these studies have shown that individuals have an emotional connection to nature, which often translates into a preference for nature over urban environments and man-made constructs.

#### Connectedness to nature

Connectedness to nature is the extent to which people view themselves as a part of nature (Schultz, 2002) and may be measured through the Connectedness to Nature scale (CNS; Mayer and Frantz, 2004). Two types of connectedness are described in the literature: explicit, in which the individual acknowledges and is

able to express the connection; and implicit, which is a non-conscious connection inexpressible to others (Schultz and Tabanico, 2007).

### Concern for the natural environment

A factor that is related to people's connection with nature and is believed to be a determinant of pro-environmental behaviours is concern for the environment (Steg and Vlek, 2009). Uzzell (2000) found that considering the consequences of climate change at increasing levels (individual, town, country, continent, global) affected individuals' amount of concern; a result that was consistent across four countries (Australia, Ireland, England, Slovakia). However, the results show an opposite effect to that suggested by Wilson (1984). The amount of concern reported by the Australian, English, and Slovakian respondents showed a declining pattern with the most concern for global consequences and the least concern for individual consequences. The Irish respondents showed the most concern for global consequences and this concern progressively declined at the continental and country levels. However, instead of being more concerned for the town consequences than the consequences to themselves as the Australian, English, and Slovakian respondents were, the Irish respondents were more concerned about the consequences at the individual level and the least concerned for their town. Conversely, an increasing pattern in the attribution of responsibility for climate change consequences was found. The Australian, English, and Slovakian respondents felt the most responsible for the consequences to the town, followed by the country, continent, and world (Uzzell, 2000).

These findings showed that although the individuals viewed global consequences as the most concerning, they did not feel responsible for them. While this does not support Wilson's (1984) assertion that individuals will be more concerned about the consequences for themselves, the results are in line with the belief many people have that one person cannot significantly reduce the impact of climate change nor is one person solely responsible for the consequences; perceived barriers that can lead to an unwillingness to engage in pro-environmental behaviours (Lorenzoni *et al*., 2007; Stoll-Kleemann *et al*., 2001).

### The role of values

Environmental concern is sometimes described and measured by people's values. An individual may rely on moral obligations or certain personal values to evaluate their level of responsibility (Steg and Vlek, 2009). It is believed that values contribute to the connection to nature (Kellert, 1993: 42–72; Wilson, 1984). A number of models have been developed to investigate the role and impact of environmental values on pro-environmental behaviours. The New Environmental Paradigm (NEP) evaluates the degree to which an individual believes that human behaviours negatively affect nature (Dunlap and Van Liere,

2008; Stern *et al*., 1999). Schwartz (1994) developed a general model of values that contains 10 value types grouped into two bipolar motivational types: self-enhancement/self-transcendence and openness to change/conservation. Schwartz described self-enhancement as the concern for oneself and included the values power, achievement, and hedonism, while self-transcendence was described as concern for others and included the values benevolence and universalism (Schultz and Zelezny, 1998; Schwartz, 1994).

Stern *et al*. (1999) used elements from Schwartz's (1994) norm activation model and Dunlap and Van Liere's (2008) NEP, and developed a model depicted by a causal chain called the value-belief-norm (VBN) model. The first step proposes that values lead to the activation of the NEP belief; that human behaviours negatively impact the environment. This belief activates elements from Schwartz's norm activation model, specifically the awareness of the consequences of an individual's actions followed by the awareness that the individual has the ability to prevent or reduce the impact of these consequences. This awareness results in a positive environmental personal norm that, when activated, may lead to engagement in pro-environmental behaviours (Stern, 2000; Stern *et al*., 1999). The VBN model includes three value types: egoistic, altruistic, and biospheric (Stern and Dietz, 1994). The egoistic value type is similar to self-enhancement and is focused on impacts for the individual alone. Individuals with an egoistic value type may express concern for how climate change could affect their own life and what the costs may be to themselves. Egoistic values have been related to an independent self-construal, which involves a person separating him- or herself from other people (Arnocky *et al*., 2007), and negatively related to concern about the consequences of climate change (Stern and Dietz, 1994). The altruistic value type refers to individuals who are concerned about the impacts for other people, including family, friends, people in their neighbourhood or country, or all people (Stern and Dietz, 1994). Slimak and Dietz (2006) found that altruism was related to ecological concerns, such as loss of wildlife habitat, commercial fishing, and wetland loss. The biospheric value type is concerned with the impacts of climate change for all living creatures, including animals and plants (Stern and Dietz, 1994). A meta-personal self-construal, or feeling connected with all living creatures, is associated with biospheric values (Arnocky, Stroink and DeCicco, 2007). Biospheric values have been positively related to concern for the biosphere, humans, and to oneself (Stern and Dietz, 1994).

### Pro-environmental behaviours and their determinants

Four types of pro-environmental behaviours that have been measured are environmental activism, non-activist public-sphere behaviours, private-sphere behaviours, and behaviours within organisations (Corbett, 2006). Environmental activism involves actively joining and participating in environmental organisations, while non-activist public-sphere behaviours include supporting the aims of environmental organisations by attending meetings or writing letters to politicians.

Private-sphere behaviours include those in which an individual engages at home or on a personal level, including recycling and decreasing energy use. People may then bring these private-sphere behaviours to their workplace or any other organisation to which they belong (Corbett, 2006).

### Connectedness to nature and pro-environmental behaviours

In his biophilia hypothesis, Wilson (1984) suggested that people's emotional relationship with nature may motivate them to act in environmentally protective ways. Therefore, people's emotional relationship with nature has been studied as a determinant of engagement in pro-environmental behaviours through the construct of connectedness to nature. Davis *et al*. (2009) found connectedness to nature, as measured by the INS, moderately and positively related to pro-environmental behaviours. The authors found that individuals who answered questions that activated thoughts of dependence on nature (high-commitment condition) had higher behaviour scores than those who answered questions that activated thoughts of independence from nature (low-commitment condition). Mayer and Frantz (2004) found a moderate positive relationship between connectedness to nature and pro-environmental behaviours with 19.36% of the variance in behaviours explained by connectedness.

A possible explanation for finding a moderate rather than strong relationship may be the modernisation of society. Kellert (1996) suggested that individuals who live in urban environments are less connected with nature. He further suggested that some individuals may believe they do not need a relationship with nature to increase their satisfaction with life.

### Environmental values, concern and behaviours

Cross-cultural similarities have been found in studies regarding environmental values or concern as a determinant of pro-environmental behaviours. Schultz and Zelezny (1998) found that the NEP positively related to such behaviours as recycling, the use of public transportation, purchasing environmentally friendly products, and conserving energy and water in Mexico, Spain, and the United States. The authors also found that an environmental subtype of Schwartz's (1994) self-transcendent motivational type was consistently positively associated with these behaviours while self-enhancement was negatively associated with them in the United States, Mexico, Spain, Peru, and Nicaragua. In a Swedish study, Nordlund and Garvill (2002) found that self-enhancement and anthropocentrism were negatively associated with pro-environmental behaviours and awareness of climate change issues, while self-transcendence and ecocentrism showed a positive association.

The VBN model predicts willingness to engage in, and actual engagement in, various types of pro-environmental behaviours. Some studies only find

associations between biospheric values and pro-environmental behaviours (Arnocky *et al*., 2007; Schultz, 2001; Steg *et al*., 2005). For example, Arnocky and colleagues and Schultz both found biospheric values were the only one of the three value types that predicted engagement in pro-environmental behaviours.

Other researchers have found significant results with egoistic and altruistic values (Clark, Kotchen and Moore, 2003; Schultz *et al*., 2004; Schultz *et al*., 2005). Egoistic values were found to be negatively associated with pro-environmental behaviours in New Zealand, Germany, the United States, and India, although these associations were weak as only 6.25% to 6.76% of the variance in behaviours was explained by egoistic values (Schultz *et al*., 2004; Schultz *et al*., 2005). Stern and Dietz (1994) also found a weak but negative relationship between egoistic values and intention to take political action. Regarding the altruistic value type, Clark and associates found that individuals with higher altruism scores were more likely to participate in a green electricity programme in which individuals paid an additional fee to their electricity bill for the use of a solar electricity service.

### The link between connectedness to nature, values and behaviour

Values may be a determinant of environmental preferences as past researchers have found a relationship between connectedness to nature and environmental values. Dutcher *et al*. (2007) showed that 17% of the variance in environmental values was explained by connectedness to nature. Mayer and Frantz (2004) found that scores on the CNS positively related to scores on the NEP. Frantz and associates (2005) manipulated participants' level of objective self-awareness (OSA), described as detachment from individuals' surroundings, to determine the effect of OSA on connectedness to nature and environmental attitudes. The results of two studies showed that participants in a low OSA condition showed higher levels of connectedness than those in a high OSA condition. In terms of environmental attitudes, participants who had more positive environmental attitudes were equally as connected to nature regardless of the OSA condition. However, those with less positive environmental attitudes were more connected to nature if they were in the low OSA group (Frantz *et al*., 2005). Connectedness to nature has been moderately and positively related to biospheric values and negatively but weakly related to egoistic values (Mayer and Frantz, 2004).

Researchers have proposed that environmental values play a mediating role in the relationship between connectedness to nature and pro-environmental behaviours (Arnocky *et al*., 2007; Gosling and Williams, 2010). This is in line with the biophilia hypothesis and the suggestion that higher value for nature leads to a stronger relationship with nature and a higher chance of engagement in pro-environmental behaviours (Kellert, 1993: 42–72; Wilson, 1984). Arnocky and colleagues found that biospheric values partially mediated the relationship between pro-environmental behaviours and having a meta-personal self-

construal; a construct similar to connectedness to nature that is described as feeling connected to all living things. Gosling and Williams (2010) used a modified values scale specific to living on a farm that consisted of a subscale for biospheric values (environmental concern) and a subscale that combined egoistic and altruistic values (concern for human welfare). The authors found that environmental concern fully mediated the relationship between connectedness to nature and environmentally protective behaviours among a sample of Australian farmers.

An important feature of the present study is the location of the participants in the Northern Territory of Australia. This environment includes extensive deserts in the south of the Territory, extensive monsoon rains in the north, a higher proportion of Aboriginal and Torres Strait Islanders, renowned for their long-standing and deep connection to the land, than other parts of Australia and greater extremes of environmental factors such as temperature and humidity, all of which may be expected to contribute to heightened awareness of the importance of the environment among these participants. It is worth exploring whether environmental values and behaviours are different for those living under such extreme conditions.

The current study investigates the following hypotheses:

1. Connectedness to nature will have a significant positive relationship with pro-environmental behaviours when social desirability is controlled for.
2. Egoistic, altruistic, and biospheric values will have a significant positive relationship with pro-environmental behaviours when controlling for social desirability.
3. Environmental values will act as a mediator between connectedness to nature and pro-environmental behaviours.

*Method*

### Participants

The participants in the study were 76 undergraduate psychology students between the ages of 18 and 60 years (*M* ¬= 33) from Charles Darwin University, 57 of whom were female and 19 male. The ages of three participants were not provided and these were replaced by the mean. The participants were recruited through the university's online learning environment by posting a link to the survey on a psychology class's site. Participants were free to complete the survey in their own time and in the location of their choice. Participation was voluntary and students were not given any incentives to participate. Only responses from students over the age of 18 were included.

## Materials

The survey was constructed using Qualtrics survey software. Participants were asked two demographic questions regarding age ('How old are you?') and gender ('What is your gender?'). The remainder of the survey consisted of four scales: connectedness to nature, environmental values, pro-environmental behaviours and social desirability.

### Connectedness to nature

Mayer and Frantz's (2004) 14-item CNS was used to measure connectedness to nature. Participants rated each statement on a five-point Likert-type scale from 1 (*strongly disagree*) to 5 (*strongly agree*) based on how they 'generally feel' (Mayer and Frantz, 2004). A mean score between 1 and 5 was calculated from these 14 items, with higher scores indicating higher connectedness. Examples of items included 'I often feel a sense of oneness with the natural world around me', and 'My personal welfare is independent of the welfare of the natural world' (reverse scored). Factor analyses have consistently produced one factor solutions that explain 29% to 38% of the variance, while reliability analyses revealed high reliability with alpha levels of 0.79 to 0.84 (Mayer and Frantz, 2004).

### Environmental values

Environmental values were assessed using the Schultz (2001) Environmental Concerns Scale. This consists of 12 items, four of which have egoistic orientation (i.e., concern about the environment for one's own self). The second set of four items has altruistic orientation (i.e., concern about environmental problems for the sake of others), and the third set of four items has a biospheric orientation (i.e., concern about environmental problems for the sake of the living world or biosphere). Participants were asked to rate each item from 1 (*not important*) to 7 (*supreme importance*). A mean score for each subscale was calculated and the range of each subscale's score was 1 to 7. Factor analyses revealed three factors with eigenvalues larger than 1.0 and explained 74% of the variance (Schultz, 2000). The egoistic, altruistic, and biospheric subscales have each been found to show moderate to high reliability as Schultz (2001) obtained alpha levels of 0.71, 0.64, and 0.86, respectively, while Snelgar (2006) found alpha levels of 0.88 and 0.91 for the egoistic subscale, 0.86 and 0.90 for the altruistic subscale, and 0.90 and 0.91 for the biospheric subscale in two separate studies.

### Pro-environmental behaviours

The Environmental Behaviour scale was developed by Schultz *et al*. (2005). Participants were asked to rate how frequently they engaged in 10 pro-environmental behaviours from 1 (*never*) to 5 (*very often*). An additional response of 'not applicable' with a score of 0 was provided for participants who felt they had no opportunity to engage in the behaviour. Sample items included 'Bring shopping bags with you to the grocery store', and 'Buy local food'. A mean score of between 0 and 5 was calculated for the 10 items with higher scores indicating more frequent reported engagement in pro-environmental behaviours. All 10 items were found to load on one factor, and Cronbach alphas (found in parentheses) showed moderate reliability across countries including Russia (0.60), the Czech Republic (0.65), Germany (0.66), India (0.71), New Zealand (0.74), and Brazil (0.75; Schultz *et al*., 2005).

### Social desirability

The tendency of participants to present a favourable impression was assessed using a social desirability scale. As the present survey already consisted of three scales with a total of 36 items, a briefer 10-item version of the 33-item Marlowe-Crowne Social Desirability Scale (Crowne and Marlowe, 1960) developed by Strahan and Gerbasi (1972) was used to minimise completion time and the risk of participant fatigue. Five statements were socially desirable if answered as true ('I'm always willing to admit it when I make a mistake', for example) and five were socially desirable if answered as false ('There have been occasions when I felt like smashing things', for example). The scale assigns one point for every socially desirable response and the total score ranges from 0 to 10, with high scores indicating a tendency to respond in more social desirable ways. This scale has shown moderate reliability as Strahan and Gerbasi (1972) obtained Kuder-Richardson coefficients ranging from 0.49 to 0.87 and other researchers have obtained alpha values between 0.50 and 0.88 (Barger, 2002; Loo and Thorpe, 2000; Reynolds, 1982).

### Procedure

Ethical approval was obtained from Charles Darwin University's Human Research Ethics Committee. The study used a within-subjects design. Each section of the survey was presented in the same sequence for every participant. The sequence of the survey was as follows: the plain language statement, the demographic questions, the CNS, the Environmental Concern scale, the Environmental Behaviour scale, and the shortened MC-SDS. All items of each scale were presented on one page in the same order as written by their respective authors with the exception of the Environmental Concern scale's items, which were presented in a randomised order to avoid order effect.

Participants could not go back to previous sections of the survey or proceed to the next section without completing each question. Upon completion of the survey, participants were informed that their responses had been successfully submitted and were thanked for their time.

*Results*

Data analyses were conducted using PASW Statistics 18 software by SPSS and IBM. Preliminary analyses were conducted to ensure that there were no violations of the assumptions of the analyses. Reliability analyses were conducted and Cronbach alphas (in parentheses) revealed moderate to high reliability for the CNS (0.87), the egoistic subscale (0.87), the altruistic subscale (0.84), the biospheric subscale (0.95) of the Environmental Concern scale, the Environmental Behaviour scale (0.79), and the shortened MC-SDS (0.61). Table 1 outlines the mean scores and standard deviations of each variable for males, females, and all participants.

| Variable | Males Mean (*SD*) | Females Mean(*SD*) | All Mean (*SD*) |
|---|---|---|---|
| Connectedness to nature | 3.30 (0.75) | 3.52 (0.60) | 3.47 (0.64) |
| Egoistic values | 5.58 (1.45) | 5.69 (0.88) | 5.66 (1.04) |
| Altruistic values | 5.58 (1.33) | 6.19 (0.77) | 6.04 (0.97) |
| Biospheric values | 5.82 (1.34) | 6.03 (0.77) | 5.97 (0.94) |
| Pro-environmental behaviours | 2.85 (0.80) | 3.12 (0.82) | 3.05 (0.82) |
| Social desirability | 5.84 (1.77) | 5.04 (2.24) | 5.24 (2.15) |

**Table 1:** Mean scores of all variables for males, females, and all participants

## Connectedness to nature and pro-environmental behaviours

Connectedness to nature was positively correlated with pro-environmental behaviours, $r(74) = .36$, $p < .01$. As predicted in the first hypothesis, this relationship remained positive and significant when controlling for social desirability, $r(73) = .32$, $p < .01$, and showed that connectedness to nature explained 10% of the variance in pro-environmental behaviours.

### Environmental values and pro-environmental behaviour

To test the second hypothesis, three separate partial correlations were conducted to determine the effect of each of the three environmental value types on pro-environmental behaviours. Egoistic values were not related to pro-environmental behaviours when controlling for social desirability, $r(73) = .10$, $p = .39$. However, social desirability did not influence this relationship as it remained non-significant when social desirability was not controlled for, $r(74) = .12$, $p = .32$. Altruistic values were positively related to pro-environmental behaviours, $r(74) = .33$, $p < .01$, as were biospheric values, $r(74) = .37$, $p < .01$. As predicted in the second hypothesis, social desirability did not have an effect on the relationship between altruistic values and pro-environmental behaviours, $r(73) = .33$, $p < .01$, and it was found that 11% of variance in behaviour was explained by altruistic values. Additionally, social desirability did not affect the relationship between biospheric values and pro-environmental behaviours, $r(73) = .35$, $p < .01$, which revealed that 12% of the variance in behaviour was explained by biospheric values.

### Mediation analyses

Baron and Kenny's (1986) approach to mediation analysis has been used successfully in past research (Arnocky *et al*., 2007; Gosling and Williams, 2010; Mayer *et al*., 2009). Therefore, this method was used to test the third hypothesis that environmental values act as a mediator between connectedness to nature and pro-environmental behaviours (Figure 1). The authors stated that three regression equations must be conducted and three conditions met to determine mediation. The first equation requires the mediator to be regressed on the independent variable (IV); the second equation requires the dependent variable (DV) to be regressed on the IV; and, the third equation requires the DV to be regressed on both the IV and the mediator. The first and second of the three conditions require the IV to have an effect on the mediator and the DV (paths *a* and *c*, respectively, in Figure 1), and the third condition requires the mediator to have an effect on the DV (path *b* in Figure 1). For complete mediation, path *c* must become non-significant. If path *c* remained significant, partial mediation would be determined.

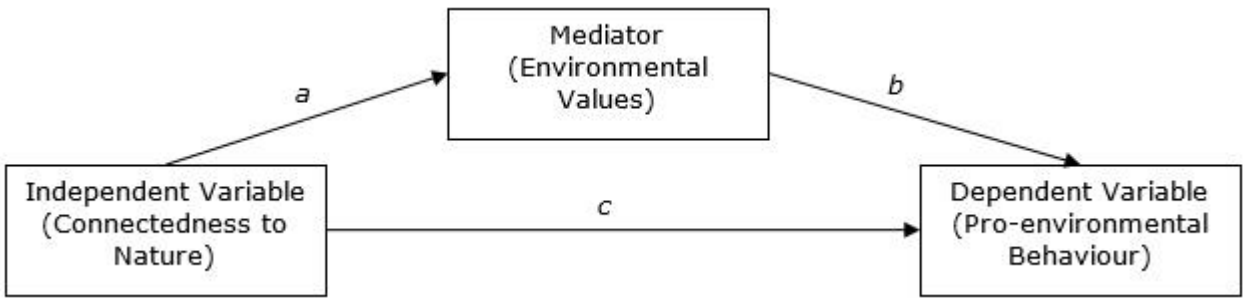

**Figure 1:** The mediating role of environmental values between connectedness and behaviour.

For the purpose of this mediation analysis, a mean combined environmental values score was computed. The first requirement for mediation was met as connectedness to nature had an effect on environmental values, $B = .42$, *S. E.* = .11, $p < .01$. The second regression showed that connectedness to nature affected pro-environmental behaviours, $B = .46$, *S. E.* = .14, $p < .01$, which met the second requirement of mediation. Finally, the third requirement was met as the relationship between environmental values and pro-environmental behaviours was significant, $B = .38$, *S. E.* = .14, $p < .01$. However, environmental values only partially mediated the relationship between connectedness to nature and pro-environmental behaviours as this relationship remained significant when environmental values was added to the equation, $B = .30$, *S. E.* = .15, $p < .05$. Sobel's test was performed using Preacher and Hayes's (2004) SPSS procedure to determine whether the size of the relationship between connectedness to nature and pro-environmental behaviours was significantly different when environmental values were and were not controlled for. Results showed that this difference was significant, $z = 2.15$, $p < .05$.

*Discussion*

A positive relationship was found between connectedness to nature and pro-environmental behaviour with no impact of social desirability; a finding that confirms the first hypothesis. The second hypothesis was partially supported as altruistic and biospheric values, but not egoistic values, were positively related to pro-environmental behaviours. The results of the mediation analysis support the third hypothesis as it was revealed that environmental values partially mediated the relationship between connectedness to nature and pro-environmental behaviour.

The positive relationship between connectedness to nature and pro-environmental behaviours is consistent with previous research, which found positive relationships of a similar strength (Davis *et al*., 2009; Dutcher *et al*., 2007; Gosling and Williams, 2010; Mayer and Frantz, 2004). This is supportive of Wilson's (1984) biophilia hypothesis and his suggestion that emotions play a role in people's motivation to protect the natural environment. It is also supportive of the concept of connectedness to nature as described by Schultz (2002: 61–78), who suggested that a cognitive representation of the self in nature will determine an individual's willingness to protect nature.

Past research has shown a weak but negative relationship between egoistic values and pro-environmental behaviours (Schultz *et al*., 2004; Schultz *et al*., 2005; Stern and Dietz, 1994). However, the present study is not consistent with these studies as no relationship was found between these two constructs. However, the positive relationships between altruistic and biospheric values, and

pro-environmental behaviours are consistent with the results of previous research (Arnocky *et al*., 2007; Clark *et al*., 2003; Schultz, 2001). According to the VBN model, egoistic, altruistic and biospheric values are expected to lead to the awareness of the consequences for and the willingness to protect oneself, all humans, or all living things, respectively. The results of the present study showed that only altruistic and biospheric values supported this theory.

Arnocky *et al*. (2007) found that biospheric values partially mediated the relationship between having a meta-personal self-construal, a construct similar to connectedness to nature, and engagement in pro-environmental behaviours. Gosling and Williams (2010) determined that their measure of environmental concern, which was similar to the biospheric subscale of Schultz's (2000, 2001) Environmental Concern scale, fully mediated the relationship between connectedness to nature and environmentally protective behaviours. These researchers' results are consistent with those of the present study and together suggest that the more concerned one is for the environment, the more connected to nature one will feel, and the more pro-environmental behaviours one will engage in; a finding that is supportive of the VBN model. However, a comparison of the strength between these researchers' results and those of the present study should be made with caution as the different measures used in each study may assess differing levels of values and behaviours. Additionally, both Arnocky and colleagues and Gosling and Williams investigated the mediating effect of only biospheric values rather than a combined score of each value type.

### Methodological limitations

One limitation of the present study is its use of a sample of convenience. This limits the generalisability of the results to the greater population. The use of the Schultz *et al*. (2005) Environmental Behaviour scale may be another limitation. The scale consists of only 10 behaviours, six of which are related to recycling or reusing items. This limited number of behaviours may have contributed to the low score as participants may have engaged in behaviours not included in the scale. As the scale measures engagement in past behaviours, it is possible that participants could not adequately recall how frequently they engaged in the behaviours, if at all.

Finally, the relatively small effect sizes are worth noting. While the relationships were significant, little variance in pro-environmental behaviours was explained by connectedness and environmental values. Connectedness explained only 10%, altruistic values explained 11%, and biospheric values explained 12% of the variance. These results show that, in the relationship between connectedness and behaviours, 90% of the variance is explained by other factors. In the relationship between environmental values and behaviours, only 23% of the variance in behaviours is explained, leaving 77% of the variance to be explained by other factors.

## Directions for future research

To better understand the relationship between these three constructs, a number of steps could be taken by future researchers. First, the sample should be more representative of the general population than an undergraduate sample. Second, the location of the study and the amount of time spent within that location should be controlled for as it has been found to influence results (Bruni *et al*., 2008; Schultz and Tabanico, 2007) and an Australian sample may differ from other countries and cultures. Third, a more defining role of connectedness and values on behaviours may come from measuring intentions to engage in pro-environmental behaviours rather than past engagement. A more detailed alternative is to observe participants' actual engagement in pro-environmental behaviours as interpreting the results of an observational study would be more reliable than interpreting self-reported data.

The VBN model consists of a step in which individuals become aware of the consequences of their actions and that they are able to reduce the impact of these consequences. Past research has shown that individuals' amount of knowledge varies regarding climate change as well as their confidence in their knowledge (Sunbald *et al*., 2009). An investigation of participants' knowledge about climate change may be beneficial as greater knowledge may lead to greater connectedness and value for nature resulting in a greater willingness to engage in pro-environmental behaviours.

*Conclusion*

The aim of the present study was to investigate the relationships between connectedness to nature, environmental values and pro-environmental behaviours. It was found that connectedness positively related to environmental behaviours, lending support to Wilson's (1984) biophilia hypothesis. Both altruistic and biospheric values were positively related to pro-environmental behaviours while egoistic values were not, which lends partial support to the VBN model (Stern *et al*., 1999). The relationship between connectedness and behaviours was partially mediated by environmental values, indicating that as an individual's connectedness increases due to their environmental values, the number of pro-environmental behaviours they engage in increases.

Overall, the results of the present study indicated that both connectedness to nature and environmental values are determinants of engagement in pro-environmental behaviours.

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*List of illustrations*

Figure 1: The mediating role of environmental values between connectedness and behaviour.

*List of tables*

Table 1: Mean scores of all variables for males, females, and all participants.

*Notes*

[1] Marybeth Pereira is a psychologist and practice manager at Wisemind Psychology, located in Darwin, Australia. Marybeth's focus is on interventions with children, adolescents and adults, with a special interest in anxiety disorders.

[2] Peter Forster is a senior Lecturer in Psychology at the University of Worcester in the United Kingdom and a Malvern Hills Conservator.

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To cite this paper please use the following details:

Pereira, M. and Forster, P (2015), 'The Relationship between Connectedness to Nature, Environmental Values, and Pro-environmental Behaviours', *Reinvention: an International Journal of Undergraduate Research*, Volume 8, Issue 2, http://www.warwick.ac.uk/reinventionjournal/issues/volume8issue2/pereira Date accessed [insert date]. If you cite this article or use it in any teaching or other related activities please let us know by e-mailing us at Reinventionjournal@warwick.ac.uk.