

# The relationship between nature relatedness and anxiety

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## Abstract

This study investigated the relationship between anxiety and feelings of being connected to nature. Two standardised self-report scales, the Nature Relatedness Scale and the State Trait Inventory for Cognitive and Somatic Anxiety, were used in tandem with a qualitative question. Quantitative results indicated that connection to nature was significantly related to lower levels of overall, state cognitive and trait cognitive anxiety. Qualitative results revealed seven themes: relaxation, time out, enjoyment, connection, expanse, sensory engagement and a healthy perspective. Taken together, these results suggest that opportunities that enhance experiences of being connected to nature may reduce unhelpful anxiety.

## Keywords

anxiety, connection to nature, nature relatedness, well-being

## Introduction

Research from a wide range of disciplines indicates that nature-based experiences facilitate positive health and well-being outcomes (Brymer et al., 2010; Health Council of the Netherlands and Dutch Advisory Council for Research on Spatial Planning, Nature and the Environment, 2004; MIND, 2007; Orsega-Smith et al., 2004; Sugiyama and Thompson, 2008; Van den Berg, 2005). In particular, nature-based experiences boost mental health and psychological well-being (Bowler et al., 2010; Röderer and Cervinka, 2012) beyond benefits that physical activity alone would provide (Mitchell, 2013).

However, there is still uncertainty about the nature of this impact. This article investigates the relationship between anxiety and feelings of being connected to nature. The results suggest that creating opportunities for connection to nature may be an effective intervention for state

and trait anxiety. For this study, the term nature reflects the interpretations that underpin the Nature Relatedness Scale (NRS) where nature includes all non-human life including vegetation and animals (Nisbet et al., 2009).

Anxiety-related issues are often severely debilitating and are fast becoming one of the most prevalent mental health concerns in the world (World Health Organization, 2011). Anxiety is conceptualised as both a state and trait phenomenon. State anxiety is a passing condition triggered by particular responses to

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stress and once the event has passed anxiety levels decrease. Trait anxiety is characterised by a stable susceptibility to the experience of anxiety (Spielberger and Reheiser, 2009). While not all anxiety is troublesome, high-intensity anxiety is linked to clinical disorders such as phobias and generalised anxiety disorder.

Anxiety has been further conceptualised in terms of cognitive and somatic symptom characteristics. Cognitive symptoms are associated with intrusive thoughts, worry and low concentration, and somatic symptoms include heart rate increases, stiff muscles, sweating and hyperventilation (Ree et al., 2008). State and trait anxiety are linked such that increases in trait anxiety correlate with increases in state anxiety. This is reflected at both the cognitive and somatic levels (Ree et al., 2008; Spielberger and Reheiser, 2009). Accordingly, state and trait anxiety should be differentiated at the cognitive and somatic levels as they are aspects of anxiety which help explain overall increases in anxiety. For this study, participants reported on overall anxiety in conjunction with the cognitive and somatic aspects of both state and trait anxiety.

There is little research that focuses on the link between nature and anxiety; however, there are theoretical perspectives that suggest nature-based experiences might facilitate reduced anxiety (Cervinka et al., 2012). Most studies that have examined the nature–anxiety relationship have done so as a small part of a much larger study (Cervinka et al., 2012; Kuo, 2001; Ulrich et al., 1991;). Studies that have focused on anxiety have mostly undertaken experiments using physical activity in natural settings, such as parks. For example, Mackay and Neill (2010) measured the effect of different physical activities on anxiety levels using the state–trait anxiety inventory. They found that perceived naturalness of the environment was most important in reducing state anxiety. Exercise intensity and duration did not impact on state anxiety. Mackay and Neill (2010) postulated that outdoor ‘green’ environments are positively associated with mental restoration. However, the level of participant fitness and the

small sample size complicate the interpretation of the findings.

A study in the United Kingdom compared a walk in a country park with a walk in a shopping mall and found that 71 per cent of participants reported lower levels of tension after a walk in the park, whereas 50 per cent reported increased tension after walking in a mall. No participants reported an increase in tension after the walk in the park (MIND, 2007). Bowler et al. (2010) undertook a meta-analysis and established that nature-based activities are more likely linked to lower anxiety levels than in indoor activities. In summary, studies that have examined the relationship between anxiety and physical activity in nature have focused on state anxiety and determined that activities in nature are correlated with reduced state anxiety over and above the effects of exercise.

A variety of theoretical perspectives have been used to explain how nature might enhance positive mental health and potentially reduce anxiety. For example, attention restoration theory (ART) (Kaplan and Kaplan, 1989) and psycho-evolutionary theory (PET) (Ulrich, 1993) propose that nature is mentally restorative and prevents stress-related illnesses like anxiety (Hartig et al., 1991; Herzog et al., 1997; Karmanov and Hamel, 2008; Ulrich, 1984). Those espousing ART propose that urban environments deplete attentional capacity; however, interactions in nature promote effortless attention, which is restorative (Herzog et al., 1997). PET suggests that human beings have innate preferences for natural landscapes, which are associated with safety and as such are non-stress inducing (Kahn et al., 2009).

The biophilia hypothesis (Wilson, 1984) proposes that human beings are innately connected to nature and that experientially realising this connection is essential for physical, psychological and spiritual health (Frumkin, 2001; Heerwagen and Orians, 1993; Pretty, 2002). Connection to nature refers to the extent nature is part of a person’s identity or cognitive representation (Schultz, 2002; Scott, 2010). Awareness of this ecological identity and feelings of connectedness are associated with positive mental health.

Roszak (1992) popularised the term ecopsychology to examine the relationship between psychological health and connection to nature. Proponents of ecopsychology argue that activities that enhance engagement with the natural world increase feelings of connection to nature. From this perspective, the natural world is not separate from humanity; but it is at the very core of humanity, even if we live in a material and cultural world which may attempt to deny recognition of this fact. Feelings of connection, unity or being a part of the natural world, according to this perspective, are a causal step to psychological health (Feral, 1998). Thus, feelings of connection to nature would be expected to correlate with reduced anxiety (Besthorn and Canada, 2002; Mayer and Frantz, 2004; White, 2011). As anxiety is a mental health problem with increasing prevalence, creating further understanding of the anxiety–nature relationship would be beneficial. While previous research has focused on state anxiety, the aim of this study was to extend this research by including assessment of both state and trait aspects of anxiety, as well as cognitive and somatic aspects of anxiety, in relation to connection to nature.

## Method

### Participants

Participants were recruited through student networks at an Australian university and the Australian Psychological Society (APS), participants ( $n=305$ ) ranged in age from 18 to 79 years ( $M=33.53$  years, standard deviation ( $SD$ )= $15.71$  years). Females represented 78.7 per cent of the sample.

### Materials

Participants completed a survey consisting of quantitative questions, one qualitative question and a request for demographic information. The aim of collecting qualitative data was to identify categorical themes from the statement ‘In your own words please tell us what being in

nature means to you’ (Castro and Coe, 2007). The qualitative question was worded in a broad, open fashion in order to minimise the chances of leading responses and allow for a range of responses including the possibility that being in nature may have no relationship to anxiety or the reduction in anxiety.

Two quantitative scales were utilised, the NRS which measured an individual’s relatedness to nature and the State Trait Inventory for Cognitive and Somatic Anxiety (STICSA) which measured overall anxiety as well as somatic and cognitive aspects of state and trait anxiety. The NRS is a 21-item scale that measures the ‘affective, cognitive, and physical relationship individuals’ have with the natural world’ (Nisbet et al., 2009: 719). The NRS consists of three subscales including an eight-item subscale ‘self’ which measures personal connection to nature, a seven-item subscale ‘perspective’ which measures external worldviews of nature and a six-item subscale ‘experience’ which measures physical familiarity with nature. Each subscale uses a 5-point Likert scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*). Scores are summed to range from 21 to 105 whereby higher scores indicate a stronger connection with nature.

The STICSA comprises two scales with 21 items each rated on a 4-point Likert scale ranging from 1 (*not at all*) to 4 (*very much so*). The STICSA produces a score from 42 to 168 whereby higher scores indicate higher anxiety (Ree et al., 2008). The first scale assesses how people feel at the time of taking the survey (state anxiety) even if it is not how people usually feel, and the second scale predicts situations in which individuals will have elevated anxiety (trait anxiety). Within each scale, anxiety is separated into two subscales comprising 10 cognitive items and 11 somatic items. The STICSA reliably differentiates between state and trait anxiety with Cronbach’s alpha coefficients reported of greater than .86 for each scale. The STICSA was also shown to be a reliable and valid scale in confirmatory factor analyses with clinical and college samples (Gros et al., 2007, 2010). The STICSA has been

validated as a good measure of anxiety with excellent clinical and non-clinical psychometric properties (Van Dam et al., 2013)

### Design and procedure

The survey was administered online. As recommended in a concurrent nested mixed method design, quantitative data were prioritised over qualitative data (Hanson et al., 2005). Quantitative data were analysed followed by thematic analysis of qualitative data.

Bivariate correlations were used to investigate quantitative data. Data were analysed using the Statistical Package for the Social Sciences (SPSS, version 17.0). The qualitative comments were analysed using the thematic analysis process (Creswell, 2009). Initially, comments were read to gather a general sense of what was being said. Descriptive categories were chosen based on the aim of the study which was to explore the relationship between nature and anxiety (Shaughnessy et al., 2009). The results were cross checked by two coders in order to increase reliability as multiple category responses were collapsed into fewer themes with multiple levels. Finally, quantitative and qualitative data were integrated to assist overall interpretation of results (Creswell, 2009).

## Results

This study examined the relationship between connection to nature and anxiety. In this study, the observed internal consistency for the STICSA was satisfactory, with Cronbach's alpha ranging from .68 to .93. In the following sections, the quantitative and qualitative results will be discussed and implications for different aspects of anxiety and overall anxiety will be outlined.

### Quantitative results

Table 1 presents the descriptive statistics of the NRS and STICSA subscales used for the analyses. Normality was investigated visually via histograms and statistically via Kolmogorov–Smirnov

**Table 1.** Means and SDs for NRS and STICSA subscales ( $n = 305$ ).

Subscales	M	SD	95% BCa CI
NRS Self	3.74	.80	[3.65, 3.83]
NRS Perspective	3.98	.59	[3.91, 4.06]
NRS Experience	3.70	.81	[3.61, 3.79]
STICSA state cognitive	1.70	.60	[1.64, 1.76]
STICSA state somatic	1.27	.35	[1.23, 1.31]
STICSA trait cognitive	1.75	.63	[1.69, 1.82]
STICSA trait somatic	1.31	.39	[1.26, 1.35]

SD: standard deviation; NRS: Nature Relatedness Scale; STICSA: State Trait Inventory for Cognitive and Somatic Anxiety; CI: confidence interval; BCa: bias-corrected and accelerated.

Bootstrapped bias-corrected 95% CI based on 1000 bootstrapped samples.

statistics and follow-up skew and kurtosis statistical assessments. Both the state and trait somatic subscales of the STICSA showed notable positive skew and leptokurtosis. Bootstrapping was used to calculate confidence intervals for descriptive statistics to provide more stable estimates given this deviation from normality.

Bivariate correlations between variables were examined via both Pearson's and Spearman's correlation analysis for comparative purposes given the normality breaches for the two somatic anxiety subscales of the STICSA (Allen and Bennett, 2010). No notable differences were found in the direction and relative strength of these relationships.

The results displayed in Table 2 show statistically significant strong positive inter-correlations between the STICSA subscales as would be expected as well as moderate to strong inter-correlations between the NRS subscales. Slightly stronger correlations were noted between the self and experience subscales of the NRS and the STICSA subscales compared to those with the perspective subscale of the NRS.

In order to more fully explore the relationship between the NRS subscales and the STICSA subscales, four standard multiple regressions were conducted with the three NRS subscales as predictors for each of the four subscales of the STICSA in turn. Bootstrapping

**Table 2.** Pearson's and Spearman's correlation coefficients for scales and subscales ( $n = 305$ ).

	STICSA s-cog	STICSA s-som	STICSA t-cog	STICSA t-som	NRS Self	NRS Pers	NRS Exp
STICSA s-cog	–	.57**	.84**	.47**	-.27**	-.17**	-.31**
STICSA s-som	.60**	–	.51**	.71**	-.07	-.12*	-.15*
STICSA t-cog	.86**	.53**	–	.61**	-.25**	-.13*	-.28**
STICSA t-som	.50**	.78**	.61**	–	-.04	-.02	-.15**
NRS Self	-.29**	-.17**	-.25**	-.14*	–	.53**	.67**
NRS Pers	-.19**	-.19**	-.14*	-.10	.53**	–	.42**
NRS Exp	-.32**	-.18**	-.28**	-.17**	.65**	.39**	–

STICSA: State Trait Inventory for Cognitive and Somatic Anxiety; NRS: Nature Relatedness Scale; STICSA s-cog: STICSA state cognitive; STICSA s-som: STICSA state somatic; STICSA t-cog: STICSA trait cognitive; STICSA t-som: STICSA trait somatic; NRS Pers: NRS Perspective; NRS Exp: NRS Experience.

Pearson's correlations are shown below the diagonal and Spearman's correlations are shown above the diagonal.

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

**Table 3.** Regression analyses predicting STICSA subscales from NRS subscales ( $n = 305$ ).

Subscales	STICSA s-cog $\beta$ ( $sr^2$ )	STICSA t-cog $\beta$ ( $sr^2$ )	STICSA s-som $\beta$ ( $sr^2$ )	STICSA t-som $\beta$ ( $sr^2$ )
NRS Self	-.12 (.01)	-.12 (.01)	-.03 (.00)	-.03 (.00)
NRS Pers	-.04 (.00)	.00 (.00)	-.13 (.01)	-.03 (.00)
NRS Exp	-.22** (.03)	-.20** (.02)	-.11 (.01)	-.13 (.01)
Total $R^2$	.11	.09	.05	.03

STICSA: State Trait Inventory for Cognitive and Somatic Anxiety; NRS: Nature Relatedness Scale; STICSA s-cog: STICSA state cognitive; STICSA s-som: STICSA state somatic; STICSA t-cog: STICSA trait cognitive; STICSA t-som: STICSA trait somatic; NRS Pers: NRS Perspective; NRS Exp: NRS Experience.

Significance assessed via bootstrapped bias-corrected adjusted 95% confidence intervals based on 1000 bootstrapped samples. \*\* $p < .01$ .

was used to counter any normality breaches. No influential multivariate outliers were found for any of the regression analyses. Table 3 presents the findings of the four regressions for comparative purposes. Overall, a relatively small percentage of variance in STICSA subscales was explained by NRS subscales, with a larger proportion of state (11%) and trait (9%) cognitive anxiety explained than somatic anxiety (3%–5%). Within the analyses of cognitive anxiety, it was the NRS experience subscale that provided the largest and only individually significant prediction to the regression models.

### Qualitative results

Qualitative results were explored in order to gain a broader perspective of participants' view

of connection to nature and, if appropriate, to help explicate the nature–anxiety relationship. In this context, participants were asked to reflect on what being in nature meant to them. Seven major themes were identified: relaxation, time out, enjoyment, connection, healthy perspective, sensory engagement and expanse. Themes were developed based on sub-themes and characteristic phrases that recurred around a central theme (see Table 4).

### General explication of themes

In this study, the various themes had multiple elements, for example, relaxation included de-stress, peace, calm, renewal, re-grounding and fulfilment. Within each theme, there were sometimes secondary or even tertiary effects for

**Table 4.** Thematic category development of qualitative question, 'What Being in Nature Meant'.

Thematic category	Sub-theme	Characteristic phrases
Relaxation	Peace	'At ease', 'quiet/calm and peaceful', 'release from daily stressors', 'relieves stress'
	Lifted, energised	'Never tiring', 'sense of renewal', 'refresh the batteries', 'feel fresh', 'replenishing my energy'
	Grounded	'Getting in touch with self', 'back to basics', 'getting down to earth', 're-root oneself'
Time out	Escape	'Be the real me', 'time to escape'
	Refuge	'Away from churn of life', 'away from technology/city/hustle and bustle', 'time out', 'Me time', 'no demands'
Enjoyment	Happy, joy	'Childlike happiness', 'joy and satisfaction', 'very happy and content', 'enjoying the world'
	Feel good	'Really/being alive', 'feelings of being ok', 'it fills my tank'
Connection	Connected	'Sense of connection', 'able to feel', 'connected with natural instincts', 'connect more emotionally'
	Spiritual experience	'Spiritually refreshing', 'soul connection', 'balances soul'
	At one	'Being one', 'oneness', 'connection to earth/world/others'
Healthy perspective	Awe	'Wider tapestry', 'bigger than self', 'marvel at the wonder'
	Perspective	'Healthier perspective', 'connect with what is important', 'become present', 'emotional regulator'
	Healing, well-being	'Feeling/sense of wellbeing', 'being healthy', 'find it therapeutic'
Sensory engagement	Beauty	'Aesthetically pleasing', 'being in beauty'
	Sensory experience	'Observing continuous change/natural scenery', 'engagement of senses', 'greenery and birds'
Expanse	Space	'Being outside', 'spend time outside', 'out in open', 'able to breathe'
	Fresh air	'Fresh/clean air', 'breathing in fresh air', 'sunshine'

participants, for example, time out also induced relaxation and peacefulness. Other differences that could be identified related to the importance of nature to participants. These different levels of importance were as follows: (a) deep level, for some participants nature was highly important and made a difference to their everyday life; (b) intermediate level, nature was important for its beneficial effect but was not reported as being essential and (c) minor level, nature was not considered more important than any other aspect of life but was still reported as having a beneficial effect. Some themes were about nature inducing the particular feeling, for example, relaxation.

In the main, participants in this study reported that nature induced relaxation and acted as a relief from stress. Nature was also described as

being responsible for feelings of peace and calm. Some participants indicated that nature provided a sense of renewal, was re-grounding and created feelings of fulfilment.

Another important theme was 'time out' which related to nature providing a sense of being away from the everyday, escape and refuge. Participants saw being in nature as being away from the urban environment and providing a sense of freedom. For most participants, being away from everyday life was important on its own; however, for some there were other benefits such as peacefulness and relaxation.

The theme of enjoyment suggested being in nature created feelings of joy, happiness and contentment. For most participants, enjoyment of nature was important because it was associated with secondary and sometimes tertiary

effects. Being in nature also induced a sense of fulfilment from the joy nature gave.

The theme of connection reflects being connected to something larger and revolved around feeling immersed, being part of something bigger, at one with, or connecting with what was important. Being connected to nature was occasionally spoken about in terms of being at one with the world which also had secondary benefits of feeling peaceful.

The theme of 'healthy perspective' reflected a perception that nature was responsible for well-being and positive health. Those participants who mentioned the health benefits of nature considered that nature was very important to their everyday lives, their mental health, overall well-being and fitness.

The theme of 'sensory engagement' suggested nature was stimulating to the senses and was associated with ideas of beauty. Nature was deeply and beneficially engaging of the senses for the majority of those participants who wrote about nature engaging the senses. This often included a spiritual aspect or a sense of the flawlessness of nature. For many participants in this study, nature provided an expansive sense of space. Nature allowed them to breathe fresh air, experience natural elements, such as sunshine, and find space to be alone.

## Discussion

The relationship between connection to nature and anxiety was investigated using quantitative and qualitative methods. The results show that connection to nature was directly linked to lower overall anxiety levels, and lower levels of state cognitive anxiety and trait cognitive anxiety but not to lower levels of somatic forms of anxiety. These findings suggest that there is a negative relationship between connection to nature and overall anxiety.

Accessing nature has contributed to state anxiety reduction in previous studies (see Chang and Chen, 2005; Mackay and Neill, 2010). This study has found that feeling connected to nature is specifically linked to lower levels of state cognitive anxiety but not state somatic anxiety.

In particular, the experience subscale of the NRS was significantly related to lower levels of state cognitive anxiety. A possible explanation as to why somatic anxiety levels were not significantly related to connection to nature is that, in the case of the Australian portion of the sample, only 14.4 per cent of people experience some sort of anxiety disorder over a 12-month period (Australian Bureau of Statistics, 2007). As such, at the time of taking the survey, majority of the Australian participants were unlikely to have been anxious enough to report somatic symptoms. Furthermore, as cognitive anxiety symptoms are a precursor to somatic anxiety symptoms, cognitive anxiety symptoms would be detected before somatic symptoms were detected (Ree et al., 2008). The relationship between low cognitive anxiety and the NRS suggests that physical interactions with nature or at least the recollection of physical comfort with nature might be the mediating factor in this finding. That is low state cognitive anxiety levels might be directly linked to positive experiences and recollections of actual experiences in the natural world.

The results from this study suggest that connection to nature is also linked to lower levels of trait cognitive anxiety. No previous studies have considered the link between nature and trait anxiety. This study has detected significant cognitive but not somatic differences in trait anxiety with connection to nature. As with the state anxiety findings, this study also found that the experience subscale of the NRS was most significantly linked to lower levels of trait cognitive anxiety. This suggests that either people with lower anxiety levels are more easily able to experience connection to nature or that cognitive aspects of state and trait anxiety are closely related to experiences of connection to nature. The relationship between lower levels of trait cognitive anxiety and experiences in nature would also suggest that the physical relationship with nature is most important. The results from this study suggest that experiences that involve interacting with or relating with nature in a manner that enhances feelings of physical familiarity are vital.

The qualitative results suggest that the experience of nature for these participants provides an opportunity to take time out from everyday life, recuperate, experience fun and relax. These elements might explain how nature experiences are related to low levels of cognitive anxiety. In line with observations made by Röderer and Cervinka (2012), this study suggests that experiences in nature might afford restorative opportunities and space for a more effortless attention.

### *Theoretical perspective*

In this study, the quantitative results are supportive of PET and ART in that feeling connected to nature is correlated with lower levels of cognitive state and trait anxiety and overall anxiety. These findings are supportive of the reductions in state anxiety and overall anxiety that has been found in previous studies (Chang and Chen, 2005; Mackay and Neill, 2010). No previous research has addressed the cognitive aspect of state or trait anxiety with regard to nature. Furthermore, the qualitative results have helped to explicate the relationships that were found. These results are also supportive of the biophilia hypothesis and PET. In summary, feelings of being connected to nature were related to lower overall anxiety and cognitive anxiety. In this study, connection to nature had beneficial effects for most participants. The results suggest that it might not be necessary to continually access nature to obtain the anxiety reducing benefits. Experiences that facilitate feeling connected to nature, and in particular feeling physical comfort with nature, may be sufficient to provide beneficial effects without having to continually access nature. It may also be possible for a person to feel connected to nature even when not in nature. In turn, these feelings of being connected to nature might act as a buffer against anxiety.

### *Limitations*

The results report findings from a general population which was largely self-selected and as such it may be that only people who were

interested in nature responded to the invitation to participate. However, this study raises important questions and illuminates tantalising possibilities which can be readily generalised to real-world settings as more than 64 per cent of the sample was from the general population. The anxiety measure (STICSA) was well validated, the data were complete and two coders were used to cross check qualitative themes in order to reduce potential bias. Still, as the effects were small, it may be that other factors contributed to the anxiety and well-being of participants. Future research should consider whether to focus on cognitive aspects of anxiety rather than somatic anxiety. Future research might also explore the qualitative experience of participants with the aim of eliciting a more in-depth understanding of how nature-based experiences might help reduce anxiety. Future research might also focus on a nature-based intervention designed to enhance connection to nature and physical comfort with nature in order to investigate if an experience of interacting with nature enhances connection to nature and lowers cognitive aspects of state and trait anxiety.

### **Conclusion**

The results of this study align with recent research and theoretical perspectives that posit health and well-being benefits from engaging with nature. In particular, this study adds clarification to the nature–anxiety relationship by demonstrating that connection to nature is directly related to small reductions in overall anxiety and cognitive aspects of state and trait anxiety. The results also support the idea that people who report being connected to nature are less anxious, whereas previous research suggested that people need to access nature in some way for anxiety to be reduced. Qualitative results suggest that connection to nature is essential for mental well-being and reductions in anxiety. Furthermore, this study suggests that experiences that encourage physical interaction and feelings of physical comfort with nature might be most appropriate for managing unhelpful anxiety.

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