

Meaning in Nature: Meaning in Life as a Mediator of the Relationship Between Nature Connectedness and Well-Being

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Abstract Research has established nature connectedness as a reliable correlate of well-being. In the current research, we examined whether meaning in life mediated the association between nature connectedness and well-being. In Study 1, 311 undergraduates completed multiple measures of nature connectedness, multiple measures of meaning in life, and multiple measures of well-being. Mediation analyses revealed that meaning in life fully mediated the association between nature connectedness and well-being. In Study 2, we examined whether mediation of the association between nature connectedness and well-being by meaning in life could be demonstrated alongside a previously documented mediation of the association between religiousness and well-being by meaning in life. Undergraduates ($N = 227$) completed measures of nature connectedness, religiousness, meaning in life, and well-being. Mediation analyses revealed that meaning in life fully mediated both the association between nature connectedness and well-being and the association between religiousness and well-being.

Keywords Nature connectedness · Meaning in life · Well-being

The biophilia notion powerfully asserts that much of the human search for a coherent and fulfilling existence is intimately dependent upon our relationship to nature (Kellert 1993, p. 43).

Meaning in life has been described as one of the ten greatest psychological ideas of all time (Haidt 2006). According to Steger (2009, p. 680), "... at its heart, meaning in life refers to people's beliefs that their lives are significant and that they transcend the ephemeral present". Meaning in life stems, in part, from an individual's ability for self-transcendence

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(Emmons 2005; Frankl 1959/1984; Steger 2009; Wong 1998), identification with elements of stable patterns and permanency within a changing world (Baumeister 1991), and beliefs that life fits within a larger scheme (Wong 2010). High meaning in life has been shown to correlate positively with a variety of indicators of well-being, including life satisfaction (Bonebright et al. 2000; Chamberlain and Zika 1988; Ryff 1989; Steger and Frazier 2005; Steger et al. 2006; Zika and Chamberlain 1987) and positive affect (Chamberlain and Zika 1988; King et al. 2006; Zika and Chamberlain 1987). In studies examining sources of meaning, experiences in nature have emerged as a significant category for adults in mid-life (O'Connor and Chamberlain 1996) and older adults (Reker and Woo 2011). It may be that those who are highly nature connected derive a sense of meaningful existence from their closeness with nature, and that this in turn boosts well-being. Thus, meaning in life may mediate the relationship between nature connectedness and well-being.

Nature connectedness has been defined as an “individual’s experiential sense of oneness with the natural world” (Mayer and Frantz 2004, p. 504). Relationships have been established between individual differences in *trait* nature connectedness (i.e., nature connectedness measured as a stable disposition) and various positive indices of well-being. Nature connectedness is positively correlated with life satisfaction (Mayer and Frantz 2004) and positive affect (Herzog and Strevey 2008; Mayer et al. 2009; Nisbet et al. 2011). Positive correlations have also been reported between nature connectedness and both psychological and social well-being (i.e., broad-spectrum measures of positive functioning in life; Cervinka et al. 2012; Howell et al. 2011). In experimental research, positive affect has been shown to increase among those exposed to nature in varying forms (Berman et al. 2012; Berman et al. 2008; Valtchanov et al. 2010; Valtchanov and Ellard 2010). Experimental research has also demonstrated that the increased positive affect and well-being reported among those exposed to nature is mediated by an increase in *state* nature connectedness (i.e., the extent to which individuals feel connected to the natural world at the present time; Mayer et al. 2009).

Empirical findings also suggest associations between nature connectedness and meaning in life. Nisbet et al. (2011) and Cervinka et al. (2012) showed that meaning in life was a significant correlate of nature connectedness. Theoretically, it has been suggested that key elements of meaning in life—self-transcendence, stable patterns and permanency, life fitting within a larger scheme, feeling alive, and connection—can be found in nature. Keltner and Haidt (2003) referred to the transcendent feeling of awe that is evoked in response to majestic aspects of nature. Both Camus (1955) and McKibben (1989) wrote of the comfort to be found in the order and permanence of nature, and Heintzelman et al., in press showed greater meaning in response to patterned versus randomized presentation of nature-related stimuli. Cohen et al. (2010) suggested that nature “gives people a sense of understanding and perspective” (p. 128), and Berger (1985) wrote how connecting with nature embeds us more deeply into the existence of life beyond the course of our single lifetime. Feeling alive has also been associated with the derivation of meaning from experience (Campbell 1988); in this vein, *vitality* has been demonstrated to increase after connecting with nature (Nisbet et al. 2011; Ryan et al. 2010). Baumeister and Vohs (2002) put forth that “the essence of meaning is connection” (p. 608), and various forms of connection (e.g., to religion, to science, to art) have been surmised to provide coherence and meaning in life (e.g., Camus 1955; Vernon 2008). Frankl (1959/1984) and Heine et al. (2006) emphasized that meaning is found in connecting the self to the external world. Haybron (2011) suggested that nature experiences may yield meaning by their provision of “engagement with matters of independent worth” (p. 238). Note (2009) argued that existential affirmation derives through a mindful attunement to our embeddedness in, and connectedness to, nature. Importantly, Butler (2006) proposed that a connection with

nature is related to our search for both meaning *and* happiness. Therefore, to the extent that nature provides us with feelings and experiences of self-transcendence, connectedness, and continuity in an unstable world, affiliating with nature can enhance our sense of meaning in life, and ultimately lead to increased happiness and well-being.

In sum, empirical findings support the existence of relationships between meaning and well-being, between nature connectedness and well-being, and between nature connectedness and meaning. However, these associations have yet to be integrated in a manner which accounts for their patterning and which structures them into a coherent model. Park (2011) recently called for a greater understanding of the underpinnings of meaning in life through work which strives to examine candidate precursors to meaning. In this vein, we propose that meaning in life is derived, in part, through connectedness with nature. Moreover, given that meaning in life is predictive of well-being, and that nature connectedness is predictive of well-being, we propose that the association between nature connectedness and well-being is mediated by meaning in life; that is, higher levels of well-being associated with nature connectedness are due to a sense of meaning in life that nature provides. This hypothesized model would be supported by a significant mediation of the association between nature connectedness and well-being by meaning in life, and by the lack of any remaining association between nature connectedness and well-being once meaning in life is taken into account.

In Study 1, therefore, we hypothesized that meaning in life mediates the relationship between nature connectedness and well-being. We tested this hypothesis by examining the pattern of interrelationships of participants' responses to multiple measures of nature connectedness, multiple measures of meaning in life, and multiple measures of well-being. We adopted well-validated measures of nature connectedness and meaning in life. For the criterion variable, we sought a comprehensive assessment of well-being; as such, we adopted a measure of Keyes (2005), who operationalized well-being as comprising emotional well-being, psychological well-being, and social well-being, and we adopted a measure of Seligman et al. (2005), who conceived of well-being as reflecting pleasure, activity engagement, and meaningful involvement. We also had participants complete a measure of socially desirable responding in order to be able to control for potential response bias resulting from the use of self-report measures of nature connectedness, meaning in life, and well-being.

1 Study 1

1.1 Method

1.1.1 Participants and Procedure

Data were collected from 311 consenting students enrolled in introductory psychology courses at a Canadian university. Females comprised 68 % of the sample, and 82 % of participants identified Canada as their country of birth. The average age of participants was 22.07 (SD = 6.05) with an age range of 18–53.

1.1.2 Measures

1.1.2.1 Nature Connectedness Nature connectedness was assessed with three measures. Mayer and Frantz's (2004) Connectedness to Nature Scale is comprised of 14 items (e.g., "I often feel a sense of oneness with the natural world around me") which assess a sense of oneness with the natural world, and are rated on 5-point scales with endpoints 1 = *strongly*

disagree and 5 = *strongly agree*. Mayer and Frantz reported a coefficient α of 0.84 for the summed scale score and factor analysis consistently yielded a one-factor solution. They validated their measure by establishing a nomological web of correlates, including positive associations with environmental concern and with other explicit and implicit measures of nature connectedness.

The Nature Relatedness Scale is a 21-item scale developed by Nisbet et al. (2009) which assesses individual differences in people's "appreciation for and understanding of our interconnectedness with all other living things on the earth" (p. 4). Items (e.g., "I enjoy digging in the earth and getting dirt on my hands") are rated on a scale with endpoints 1 = *disagree strongly* and 5 = *agree strongly*. An overall score is calculated by summing across all items. The scale has good internal consistency (coefficient α of 0.87) and good test–retest stability (0.85). The scale was validated by Nisbet et al. with undergraduate psychology students against related measures (e.g., ecology scales) and behaviors (e.g., buying organic food). Scores were also shown to correlate positively with experience sampling measures of time spent outdoors and in nature (Nisbet et al. 2009).

The Allo-Inclusive Identity Scale (Leary et al. 2008) includes eight items which address the extent to which nature is incorporated into one's identity. Items (e.g., "The connection between you and a tree") are rated by choosing one of seven diagrams depicting increasing degrees of overlap between a circle labeled "you" and one labeled "other". Leary et al. reported a coefficient $\alpha > 0.75$ for the total scale score, and generated preliminary evidence of the scale's validity (e.g., significant correlations with ecological concern; independence from socially desirable responding).

1.1.2.2 Meaning in Life Three measures of meaning were utilized. The Meaning in Life Questionnaire (Steger et al. 2006) contains a 5-item Presence subscale which assesses the extent to which a sense of meaningful existence is present in a person's life. Items (e.g., "I understand my life's meaning") are rated on a scale with endpoints 1 = *absolutely untrue* and 7 = *absolutely true*. The summed scale score has good internal consistency (coefficient α of 0.86) and good test–retest stability (coefficient α of 0.70). Steger et al. reported high convergent correlations (0.61–0.74) with other meaning measures.

Morgan and Farsides' (2009) Meaningful Life Measure consists of 23 items (e.g., "The beliefs I hold about the world enable me to make sense out of my existence") rated on a scale with endpoints 1 = *strongly agree* and 7 = *strongly disagree*. The scale has five subscales labeled accomplished life, principled life, exciting life, purposeful life, and valued life. Subscales all correlate positively with one another, and have acceptable internal reliability (coefficient α 's from 0.85 to 0.88) and temporal reliability (test–retest correlations of 0.64–0.70). Morgan and Farsides demonstrated high convergent validity of total scores on the Meaningful Life Measure with other meaning measures, with correlations between 0.89 and 0.92.

The General Life Purpose Scale is a 15-item tool developed by Byron and Miller-Perrin (2009) that measures an individual's overall sense of meaning in life. Items (e.g., "My life is valuable and worthwhile") are rated using a scale ranging from 1 = *strongly disagree* to 7 = *strongly agree*. Byron and Miller-Perrin reported good internal consistency reliability for the total score (coefficient α of 0.91).

1.1.2.3 Well-Being Two well-being measures were utilized. Keyes (2005) compiled a measure of emotional, psychological, and social well-being. Emotional well-being was assessed via ratings of positive affect and life satisfaction (e.g., Diener et al. 1999). Respondents reported their positive affect by rating the extent to which, over the past

30 days, they felt cheerful, in good spirits, extremely happy, calm and peaceful, satisfied, and full of life. Ratings were made on 5-point scales (*all, most, some, a little, or none of the time*). Respondents also reported their life satisfaction by rating a single item ranging from 0 (*worst possible life overall*) to 10 (*best possible life overall*). An overall emotional well-being index was calculated by averaging across the six affect ratings and adding the life satisfaction rating. Psychological well-being was assessed via the measurement of six dimensions (Ryff 1989). Three items assessed each of self-acceptance, positive relations with others, personal growth, purpose in life, environmental mastery, and autonomy. Ratings were made on 7-point scales with endpoints labelled 1 (*strongly agree*) and 7 (*strongly disagree*). We omitted participants' responses to the three purpose in life items to avoid overlap between the measurement of well-being and the measurement of meaning in life; total psychological well-being scores were summed across the remaining 15 items and divided by three (Keyes 2005). Social well-being was assessed via the measurement of five dimensions (Keyes 1998). Three items assessed each of social acceptance, social actualization, social contribution, social coherence, and social integration. Ratings were made on 7-point scales with endpoints labelled 1 (*strongly agree*) and 7 (*strongly disagree*). An overall index of social well-being was calculated by summing across the 15 items and dividing by three. Keyes reported internal consistency coefficients for emotional well-being (positive affect items only), psychological well-being, and social well-being scales of 0.91, 0.81, and 0.81, respectively. Confirmatory factor analyses have supported the three-factor structure of well-being (Gallagher et al. 2009; Robitschek and Keyes 2009).

The Steen Happiness Index (Seligman et al. 2005) is comprised of 20 items which reflect "three kinds of happy lives" (Seligman et al., p. 414): experiencing pleasure, fully engaging in activities, and partaking in meaningful activities. For each item, participants chose one response from a set of four statements ranging from negative (scored as 1; e.g., "I am joyless") to extremely positive (scored as 5; e.g., "Almost everything about my life fills me with joy") that best described how they felt over the past week. Despite the fact that the scale is said to reflect degree of engagement in meaningful activities, only one item refers to meaning (actually *purpose*) in life; when calculating a total score across items (Seligman et al.), we omitted that item in order to avoid overlap between the measurement of well-being and the measurement of meaning in life. Seligman et al. reported good convergent validity with other happiness measures.

1.1.2.4 Socially Desirable Responding Paulhus' (1994) Balanced Inventory of Desirable Responding is composed of two 20-item subscales: Self-deceptive enhancement reflects the tendency to provide unintentionally inflated self-descriptions and impression management reflects the tendency to present a deliberately favorable view of one's self to others. Items are rated on 7-point scales, but we followed Paulhus' recommendation to use binary scoring for each item, such that extreme responses were scored as 1 and other responses were scored as zero. Binary item scores within each scale were then summed, with higher scores reflecting greater self-deceptive enhancement or impression management.

1.2 Results

As shown in Table 1, scores on all three nature connectedness measures correlated significantly with the Steen Happiness Index scores, and with both psychological and social well-being scores; only the Connectedness to Nature Scale scores correlated significantly with emotional well-being scores. Scores from all three meaning in life measures

correlated significantly with scores from all well-being measures. All nature connectedness measures correlated significantly with all meaning in life measures. Partial correlations were conducted controlling for self-deceptive enhancement ($M = 4.57$, $SD = 3.42$, $\alpha = 0.75$) and impression management ($M = 4.81$, $SD = 3.55$, $\alpha = 0.77$); as shown in Table 1, the vast majority of zero-order correlations remained significant when controlling for desirable responding, although relationships were somewhat attenuated.

Relationships which emerged among measures of nature connectedness, meaning in life, and well-being were simultaneously explored using structural equation modeling (SEM), performed with AMOS 18.0.0 (see Fig. 1). Because the normal assumptions were found to be violated, the presented results were based on 1,000 bootstrap samples which yielded two-sided, bias-corrected, tests and 95 % confidence intervals. These results were based only on complete records including no missing data ($N = 184$); the findings based on this reduced data set were found to be equivalent to those found applying multiple imputation to the full data set. In the aim of parsimony, social desirability was not controlled in these analyses as bivariate associations were not significantly affected when controlling for this effect. The measurement model for the three latent variables was fitted first and resulted in an acceptable fit of the data to the model after adding a path for correlated residuals between emotional well-being and the Steen Happiness Inventory, $\chi^2(31) = 47.4$, $p < 0.05$, CFI = 0.985, RMSEA = 0.054. The inclusion of the error correlation significantly improved model fit, and may reflect a shared emphasis on positive affect across the emotional well-being and Steen Happiness Index measures (i.e., hedonic well-being) that is not otherwise captured by the well-being latent variable (i.e., a more eudaimonic index of well-being).

To test for mediation, we compared the partially mediated model ($\chi^2(31) = 47.4$, $p < 0.05$, CFI = 0.985, RMSEA = 0.054), the fully mediated model ($\chi^2(32) = 49.2$, $p < 0.05$, CFI = 0.985, RMSEA = 0.054) and the direct effect only model ($\chi^2(32) = 52.5$, $p < 0.05$, CFI = 0.982, RMSEA = 0.059). The partially mediated model did not fit significantly better ($\chi^2(1) = 1.8$, ns) than the fully mediated model, but it fit significantly better ($\chi^2(1) = 5.1$, $p < 0.05$) than the direct effect only model, supporting the fully mediated model as the most parsimonious model between the two models showing no significantly different fit. These findings reveal that, as hypothesized, meaning in life fully mediates the association between nature connectedness and well-being.

1.3 Discussion

Results from Study 1 revealed that nature connectedness correlated significantly with well-being, meaning in life correlated significantly with well-being, and nature connectedness correlated significantly with meaning in life. This pattern of correlations persisted when controlling for socially desirable responding. Our hypothesis regarding meaning in life functioning as a mediator of the relationship between nature connectedness and well-being was supported.

Results of our mediation analysis are parallel to those found previously for interrelationships among religiousness, meaning in life, and well-being. In two studies, Steger and Frazier (2005) assessed religious practices and subjective religiousness, meaning in life (with the Meaning in Life Questionnaire, as used in Study 1 herein), and life satisfaction, self-esteem, and optimism. Steger and Frazier reported that meaning in life fully mediated the relationship between religiousness and well-being as measured by life satisfaction and self-esteem, and that meaning in life partially mediated the relationship between religiousness and well-being as measured by optimism. In a third study, Steger and Frazier

Table 1 Descriptive statistics and correlations among all variables: Study 1

Variable	<i>M</i>	<i>SD</i>	α	1	2	3	4	5	6	7	8	9
1. Connectedness to nature	46.32	7.80	.80									
2. Nature relatedness	72.88	13.13	.87	.52** (.52**)	–							
3. Allo-inclusive identity—nature	22.45	9.47	.88	.40** (.40**)	.51** (.51**)	–						
4. MLQ-presence	23.42	6.22	.86	.23** (.23**)	.14* (.10)	.17** (.16*)	–					
5. Meaningful life measure	114.44	21.60	.94	.31** (.32**)	.28** (.26**)	.21** (.21*)	.72** (.70**)	–				
6. General life purpose	78.39	13.84	.91	.25** (.25**)	.16* (.12)	.12* (.11)	.76** (.74**)	.86** (.84**)	–			
7. Steen Happiness Index	54.34	12.42	.92	.22** (.21**)	.17** (.14*)	.16** (.15*)	.60** (.56**)	.76** (.74**)	.69** (.66**)	–		
8. Emotional well-being	10.28	1.97	.85	.20** (.20**)	.11 (.10)	.06 (.06)	.42** (.41**)	.54** (.54**)	.54** (.54**)	.63** (.63**)	–	
9. Psychological well-being	26.19	4.07	.83	.25** (.26**)	.25** (.21*)	.12* (.11)	.56** (.50**)	.75** (.72**)	.73** (.70**)	.67** (.64**)	.54** (.55**)	–
10. Social well-being	22.70	4.04	.83	.26** (.26**)	.21** (.17*)	.17** (.16*)	.54** (.49**)	.62** (.57**)	.63** (.59**)	.56** (.52**)	.44** (.43**)	.67** (.62**)

MLQ-presence = Meaning in Life Questionnaire—presence subscale. Meaning and purpose related items were removed from the well-being measures and the Steen Happiness Index to avoid criterion contamination. Coefficients in parentheses are partial correlations controlling for self-deceptive enhancement and impression management

* $p < 0.05$; ** $p < 0.01$

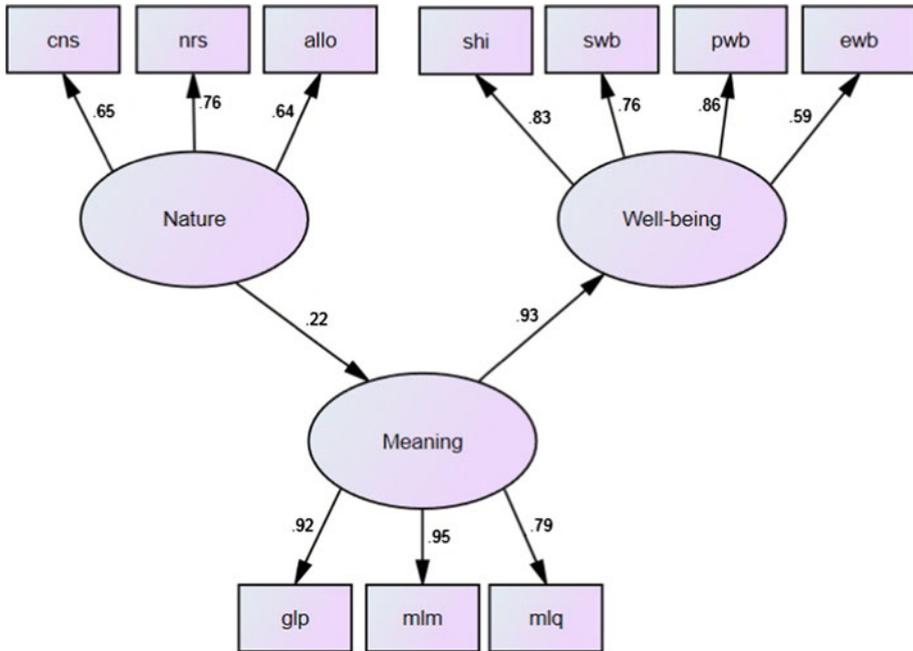


Fig. 1 Structural equation diagram depicting the fully mediated model in Study 1. Rectangles contain observed variables and ovals contain latent variables. Coefficients are standardized path coefficients. All path coefficients are $p < 0.01$ except for the path between nature and meaning ($p < 0.05$). *cns* Connectedness to Nature Scale, *nrs* Nature Relatedness Scale, *allo* Allo-Inclusive Identity Scale, *shi* Steen Happiness Index, *swb* social well-being, *pwb* psychological well-being, *ewb* emotional well-being, *glp* General Life Purpose Scale, *mlm* Meaningful Life Measure, *mlq* Meaning in Life Questionnaire. A significant error correlation of 0.33 for *shi* and *ewb* has not been included in the figure

used a daily diary method over a 2-week period to examine the hypothesis that religious activity would covary with well-being on a daily level, and that this relationship would be mediated by daily meaning in life. Consistent with mediation analysis of their initial studies, Steger and Frazier reported that the relationship between daily religious behaviors and daily well-being was mediated by daily ratings of meaning in life.

In a study of female college students, Byron and Miller-Perrin (2009) also examined the relationship between religious beliefs, meaning in life, and well-being. They utilized the General Life Purpose Scale (as used in Study 1 herein) as a measure of meaning in life, as well as measures of religiousness and well-being. In line with Steger and Frazier's (2005) findings, Byron and Miller-Perrin's analysis revealed a significant effect of meaning in life in mediating the relationship between religious faith and well-being. Most recently, Kashdan and Nezlek (2012) showed that relationships between daily fluctuations in spirituality (a construct viewed as subsuming religiousness) and both self-esteem and positive affect were fully mediated by meaning in life.

Given the parallel between the pattern emerging in Study 1 concerning nature connectedness, meaning, and well-being, and findings from past research concerning religiousness, meaning, and well-being, we conducted a second study to simultaneously measure relations among nature connectedness, religiousness, meaning in life, and well-being. Our prediction in Study 2 was that meaning would mediate the relationship between

religiousness and well-being as well as the relationship between nature connectedness and well-being.

2 Study 2

2.1 Method

2.1.1 Participants and Procedure

Data were collected from 227 consenting students enrolled in introductory psychology courses at a Canadian university. Females comprised 63 % of the sample, and 73 % of participants identified Canada as their country of birth. The average age of participants was 23.29 (SD = 7.67) with an age range of 18–60.

2.1.2 Measures

2.1.2.1 Nature Connectedness Nature connectedness was assessed with the Connectedness to Nature Scale (Mayer and Frantz 2004), as described in Study 1.

2.1.2.2 Meaning in Life Meaning in life was assessed with the Meaningful Life Measure (Morgan and Farsides 2009), as described in Study 1.

2.1.2.3 Well-Being The two well-being measures from Study 1 were utilized: the Steen Happiness Index (Seligman et al. 2005) and Keyes' (2005) measure of emotional, psychological, and social well-being. As in Study 1, we removed one item from the Steen Happiness Index and three items from the psychological well-being scale that referred to meaning in life, in order to avoid criterion contamination.

2.1.2.4 Religiousness The Religious Commitment Inventory-10 (RCI-10; Worthington et al. 2003) consists of 10 items (e.g., "It is important to me to spend periods of time in private religious thought and reflection") rated on a scale with endpoints 1 = *not at all true of me* and 5 = *totally true of me*. Worthington et al. reported internal consistency between 0.88 and 0.93, and test–retest reliability between 0.83 and 0.87. Validation was supported via significant correlations with self-rated religious commitment, frequency of religious service attendance, and self-rated spiritual intensity.

2.1.2.5 Socially Desirable Responding Paulhus' (1994) 40-item Balanced Inventory of Desirable Responding was employed, as in Study 1.

2.2 Results

As shown in Table 2, nature connectedness correlated significantly with well-being and with meaning in life. Meaning in life correlated significantly with all well-being scales and with religiousness. The religiousness measure correlated significantly with the Steen Happiness Index and with measures of emotional and social well-being, but it did not correlate significantly with psychological well-being. Finally, the nature connectedness measure did not correlate significantly with the religiousness measure. Partial correlations

Table 2 Descriptive statistics and correlations among all variables: Study 2

Variable	<i>M</i>	<i>SD</i>	α	1	2	3	4	5	6
1. Connectedness to nature	46.41	8.42	.82	–					
2. Meaningful life measure	118.55	20.87	.94	.24** (.21**)	–				
3. Steen Happiness Index	57.93	11.58	.92	.23** (.19**)	.75** (.71**)	–			
4. Emotional well-being	10.44	2.13	.85	.19** (.17*)	.71** (.70**)	.68** (.67**)	–		
5. Psychological well-being	26.29	4.25	.84	.23** (.19**)	.80** (.77**)	.70** (.64**)	.62** (.61**)	–	
6. Social well-being	22.91	4.35	.83	.19** (.16*)	.72** (.69**)	.63** (.60**)	.59** (.57**)	.71** (.68**)	–
7. RCI-10	20.95	12.02	.97	.12 (.09)	.31** (.25**)	.22** (.15*)	.25** (.22**)	.14 (.05)	.26** (.21**)

RCI-10 = Religious Commitment Inventory-10. Meaning and purpose related items were removed from the well-being measures and the Steen Happiness Index to avoid criterion contamination. Coefficients in parentheses are partial correlations controlling for self-deceptive enhancement and impression management

* $p < 0.05$; ** $p < 0.01$

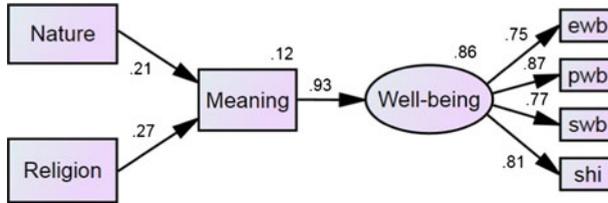


Fig. 2 Structural equation diagram depicting the fully mediated model in Study 2. Rectangles contain observed variables and ovals contain latent variables. Coefficients are standardized path coefficients. All path coefficients are $p < 0.01$. “Nature” was measured with the Connectedness to Nature Scale; “Religion” was measured with the Religious Commitment Inventory—10; and “Meaning” was measured with the Meaningful Life Measure. ewb emotional well-being, pwb psychological well-being, swb social well-being, shi Steen Happiness Index. A significant error correlation of 0.14 for shi and ewb has not been included in the figure

were conducted controlling for self-deceptive enhancement ($M = 5.18$, $SD = 3.50$, $\alpha = 0.74$) and impression management ($M = 5.58$, $SD = 3.88$, $\alpha = 0.79$); all significant zero-order correlations remained significant when controlling for desirable responding.

Relationships which emerged among measures of nature connectedness, religiousness, meaning in life, and well-being were simultaneously explored using SEM (see Fig. 2). Because the normal assumptions were found to be violated, the presented results were based on 1,000 bootstrap samples which yielded two-sided, bias-corrected, tests and 95 % confidence intervals. These results were based only on complete records including no missing data ($N = 163$); the findings based on this reduced data set were found to be equivalent to those which emerged when applying multiple imputation to the full data set. In the aim of parsimony, social desirability was not controlled in these analyses as bivariate associations were not significantly affected when controlling for this effect.

The measurement model for well-being, the only latent variable in the model, showed an excellent fit, $\chi^2(1) = 1.6$, *ns*, CFI = 0.998, RMSEA = 0.062, including (as in Study 1) the correlated residuals between emotional well-being and the Steen Happiness Inventory.

To investigate the structure between the latent variable well-being and the manifest variables nature, religion, and meaning in life, five models were compared: the partially mediated model ($\chi^2(11) = 18.8$, *ns*, CFI = 0.987, RMSEA = 0.066), the direct effect only model ($\chi^2(13) = 41.1$, $p < 0.05$, CFI = 0.952, RMSEA = 0.116), the fully mediated model for religion and nature ($\chi^2(13) = 19.5$, *ns*, CFI = 0.989, RMSEA = 0.056), and the two models where either religion or nature is partially mediated but the other is fully mediated (fully mediated nature: $\chi^2(12) = 18.9$, *ns*, CFI = 0.988, RMSEA = 0.059, fully mediated religion: $\chi^2(12) = 19.4$, *ns*, CFI = 0.987, RMSEA = 0.062). The partially mediated model exhibits a significant better fit ($\chi^2(2) = 22.3$, $p < 0.05$) than the direct effect only model, but does not fit significantly better than any of the fully mediated models (nature and religion: $\chi^2(2) = 0.7$, *ns*; nature: $\chi^2(1) = 0.1$, *ns*; religion: $\chi^2(1) = 0.6$, *ns*). These results support the fully mediated model as the most parsimonious model between the four models showing no significantly different model fit. The results confirm that relationships between nature connectedness and well-being and between religiousness and well-being were fully mediated by meaning in life.

2.3 Discussion

Results from Study 2 replicate our findings from Study 1: Significant correlations emerged between nature connectedness and well-being, between meaning and well-being, and between nature connectedness and meaning; correlations persisted when controlling for socially desirable responding; and meaning in life fully mediated the relationship between nature connectedness and well-being. Results of Study 2 also showed a replication of past research: Positive interrelationships emerged among religiousness, meaning in life and well-being; and, as hypothesized, meaning in life fully mediated the relationship between religiousness and well-being. Therefore, Study 2 demonstrated parallel findings concerning the mediation by meaning in life of relationships between nature connectedness and well-being and between religiousness and well-being.

3 General Discussion

In both studies, nature connectedness correlated positively with various aspects of well-being, and these correlations remained significant when controlling for socially desirable responding. These findings add to the growing body of research demonstrating that mental health is significantly associated with one's experiential sense of closeness to nature. In both studies, and across multiple measures, nature connectedness emerged as a significant correlate of meaning in life. These findings buttress the heretofore limited evidence of an association between nature connectedness and meaning in life, and are in keeping with the suggestion frequently put forth that experiencing the natural world, or cultivating one's relationship with nature, can be an important aspect of meaning in life (Camus 1955; Frankl 1959/1984; Kellert 1993; Kjell 2011; Note 2009; Schnell 2009; Verbeek and de Waal 2002). Lastly, in both studies, meaning in life mediated the relationship between nature connectedness and well-being and, in Study 2, meaning in life mediated the relationship between religiousness and well-being. These findings support the significant involvement of meaning in relation to well-being, and suggest that aspects of experience

involving transcendence beyond the self (i.e., those involving nature or religiousness) are attached to elevated well-being via their association with enhanced meaning.

People's tendency to find meaning in life has been described as an essential need or instinctual drive (Frankl 1959/1984; Maddi 1970). Similarly, Wilson's (1984) biophilia hypothesis proposes that we have an evolved inclination to connect with the natural world, and that this biophilic instinct is a universal human trait. Another well-established human propensity that has been described as a fundamental or instinctual need is our gravitation towards religiousness or spirituality. Leuba (1901) viewed religious thought as natural because "we are so made" (p. 573); Wilson (2002) described religion as "an ancient feature of our species" (p. 175) and placed this within an evolutionary framework; and Wade (2009) explicitly referred to religion as an instinctual drive. Wilson (1998) wrote not only of our desire to affiliate with nature as instinctual, but also of the human propensity for religion. Indeed, Leuba's (1901) definition of the religious impulse as "the love of life at any and every level" is strikingly similar to the concept of biophilia (p. 572). Or, as expressed by Soulé (1993, p. 44), "Biophilia may be difficult to tease apart from what some people call a relationship with 'spirit' or 'God'".

It is natural, therefore, to suggest that these fundamental motivations of nature connectedness and religiousness are intertwined, and yet our current research showed no relationship between religiousness and nature connectedness. It is possible that the distinction between intrinsic and extrinsic religiousness (i.e., whether religion is an end in itself or a means to other ends; Allport 1950) is relevant here; specifically, the former may be more likely to be associated with nature connectedness than the latter. While the RCI-10 is a well-validated measure of religiousness, several items seem to capture more of an extrinsic, than intrinsic, dimension (e.g., I keep well informed about my local religious group and have some influence on its decisions). Further research exploring the interrelationship between nature connectedness and religiousness is warranted. Empirical results that provide a grounding for this include the current finding that the mediation effect of meaning in life on the relationship between religiousness and well-being was paralleled in the relationship between nature connectedness and well-being, and the finding from past studies that an increase in generous behavior after priming participants with religious ideation (Norenzayan and Shariff 2007) was paralleled for immersing participants in nature (Weinstein et al. 2009).

A distinction has been made between the two overlapping constructs of religiousness and spirituality. In general, literature in this field characterizes religion as referring to specific institutions or organized models of belief systems, while spirituality is viewed as encompassing a broader perspective relating to perceptions of sacredness and the divine that are not necessarily based in belief in a specific deity, faith, or credo (Newberg and Newberg 2005; Pargament and Mahoney 2009; Wills 2009). Future research in this domain could, therefore, broaden the scope of the construct *religion* to the more inclusive construct *spirituality*, and explicitly examine relationships among nature connectedness, meaning in life, and spirituality. Peterson (2006) theorized a close relationship between spirituality and nature connectedness, a relationship that has now been empirically supported (Leary et al. 2008; Saraglou et al. 2008). In addition, Caldwell-Harris et al. (2011) found that atheists agreed with statements which measured aspects of spirituality construed as "respect for nature" to the same extent as did Catholics and Buddhists, and that approximately one-third of atheists endorsed the term "spirituality" in relation to an appreciation of nature. Finally, Keltner and Haidt (2003) include nature among the most common elicitors of awe, an emotion they describe as "central to the experience of religion" (p. 297), and Shiota et al. (2007) reported that participants instructed to think of time spent in a natural setting

reported feeling the presence of something greater than themselves. These findings suggest that spirituality and nature connectedness are correlated aspects of experience that together may be predictive of meaning and well-being.

Additional avenues for exploring associations among nature connectedness, spirituality, and meaning concern the relationship of nature connectedness to alternative routes toward well-being, to various strengths of character, and to important psychological needs. First, research could examine whether nature connectedness is more closely associated with pathways toward well-being which emphasize meaning and transcendence relative to those which do not. For example, Seligman (2011) proposed five pathways toward well-being: positive emotions, engagement, meaning, relationships, and accomplishments. Of these, it may be that nature connectedness is more closely associated with engagement and meaning, given that both these elements emphasize aspects of self-transcendence. Second, it may also be instructive to examine whether nature connectedness is associated with certain strengths of character (Peterson and Seligman 2004) more than others. It may be that the so-called faith-based strengths of character (i.e., hope, spirituality, and kindness; Peterson 2006) are more closely associated with nature connectedness than are other strengths (e.g., love of learning; fairness). Or, perhaps those strengths of character that fall within the virtue of transcendence (e.g., hope, spirituality, appreciation of beauty, gratitude) are most likely to be associated with nature connectedness. Third, it may be instructive to examine the relationship of nature connectedness to needs argued to be of central importance to optimal human functioning and personal growth (i.e., needs for autonomy, competence, and relatedness according to self-determination theory; Deci and Ryan 2000). Indeed, Kellert (1997) speculated that involvement in nature satisfies these very needs. Moreover, van Dierendonck (2012) presented evidence that spirituality can be conceptualized as a fourth important psychological need (i.e., it predicted various outcomes indicative of a life well-lived above and beyond the three needs of self-determination theory). It would be interesting to examine, therefore, the degree of association among nature connectedness, spirituality, and the three needs of self-determination theory.

There are limitations, as well as potential extensions and applications, of the current findings. Measures were restricted to self-reports; future research could profitably employ behavioral measures, implicit measures, or “on-line” measures of nature involvement, meaning, or well-being (i.e., based on moment-to-moment sampling). Our samples were restricted to undergraduates taking psychology courses such that the degree to which these findings would generalize to disparate populations is unknown. The studies were cross-sectional, which precludes the drawing of conclusions concerning the causal nature of emerging relationships. Nonetheless, empirical findings have shown a causal role of nature involvement on well-being (e.g., Ryan et al. 2010), and heightened *state* nature connectedness has emerged as a mediator of these effects (Mayer et al. 2009). A fruitful line of future work in this context would be examining whether an enhanced sense of meaning in life can be induced through the boosting of nature connectedness or nature involvement. The current findings, coupled with those from studies manipulating nature involvement, suggest that therapists should consider nature involvement and nature connectedness when assessing clients and planning therapy strategies. Indeed, involvement in nature was recently identified as one of a limited number of *life style* interventions (along with such interventions as exercise and volunteering) characterized as well-evidenced for improving mental well-being but perhaps under-utilized by practicing psychologists (Walsh 2011). Similarly, therapists such as Berger and McLeod (2006) have suggested that the use of nature analogies and embedding clients’ experiences “in a larger natural story of life” can help clients bestow and extract meaning (p. 91). Research such as that presented herein

may contribute to an expanding awareness of the potential role of nature connectedness and nature involvement in a life well (and meaningfully) lived.

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