

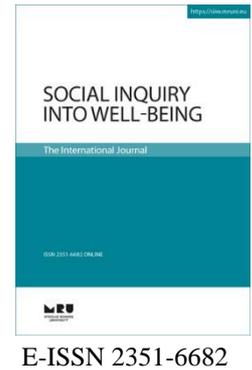


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Social Inquiry into Well-Being



30 Minutes in Nature a Day Can Increase Mood, Well-Being, Meaning in Life and Mindfulness: Effects of a Pilot Programme

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Abstract

Considering the lack of nature-based positive psychology interventions (PPIs), the present study examined the effects of Rewild Your Life (RYL), an online intervention programme that challenges users to spend 30 minutes a day in nature for 30 days. Participants who completed RYL ($n=35$) showed significant increases in mood, well-being, mindfulness and meaning compared to the control group ($n=27$). The effect was stronger when participants spent at least 30 minutes in nature, and meaning and mindfulness were affected only in “wilderness” but not urban “greenspace” (e.g., parks). Findings emphasise the importance of access to natural spaces, especially considering that people are spending increasing amounts of time indoors and disconnecting from nature, and the importance of increasing access to greenspace is discussed.

Keywords: well-being, happiness, mindfulness, meaning, nature, ecopsychology

The health benefits of nature have been known for centuries (Roszak, Gomes & Kanner, 1995), but more recently ‘ecotherapy’ (Clinebell, 1996), which involves the use and discussion of one’s relationship with nature as a healing process, has started to rise in popularity. Wilson’s (1984) biophilia hypothesis states that people are naturally drawn to “life and lifelike processes” (p. 1), which is perhaps evidenced by rising numbers of pet ownership (PMFA, 2014), the millions of annual visits made to zoos and national parks (Vining, 2003), and the higher prices placed on properties with nature views (Seiler, Bond & Seiler, 2001).

On the other hand, fewer than 10% of British children regularly play in wild, outdoor spaces (Natural England, 2009). The average person currently spends 95% of their time indoors, with an average of 8 hours per day viewing a screen (Swan, 2010). Louv (2008) refers to the increasing gap between people and nature as nature-deficit disorder, arguing that a decrease in the time spent outdoors by both

children and adults is causing detrimental effects to both their physical and mental health; this is partly because time spent outdoors is correlated to physical activity (Cooper et al., 2010). Similarly, O’Connor and Chamberlain (1996) argue that humanity is approaching an existential crisis due to a shift to urban living and an increasing disconnection from nature. Sampson (2013) refers to this human-nature disconnection as the Third Crisis, citing the first and second global crises as climate change and loss of habitat and species, and argues that as well as climbing obesity and mental health disorders, the health of the places we live in is under threat.

Nature Contact and Connectedness

A wealth of studies has highlighted the positive effects of nature¹ contact for both physical and mental health outcomes. It may not be surprising that physical health can be greatly improved by spending time outdoors (e.g., Brymer, Cuddihy & Sharma-Brymer, 2010; Frumkin, 2001), while outdoor play has been found to encourage the healthy development of children's motor skills (Fjørtoft, 2001). Some evidence even suggests that playing in greenspace can help reduce symptoms of ADD in children (Taylor, Kuo & Sullivan, 2001). Individuals do not necessarily need to be immersed in nature; even the presence of ornamental indoor plants is suggested to encourage recovery from surgery (Park & Mattson, 2009). Both depression and stress symptoms can be reduced by spending time in nature (Adevi & Mårtensson, 2013) or simply by living near greenspace (Thompson et al., 2012), while busy, urban environments are correlated with higher levels of stress (e.g., Ulrich et al., 1991). Time in natural settings or viewing natural scenes has been correlated with a number of positive outcomes, such as improved attention (Bratman, Hamilton & Daily, 2012), productivity (Lohr, Pearson-Mins & Goodwin, 1996), vitality (Ryan et al., 2010), prosocial behaviour and trust (Zhang, Piff, Iyer, Kovena & Keltner, 2014), and positive emotions in general (Mayer, Frantz, Bruehlman-Senecal & Dolliver, 2008). In a recent study, researchers tracked participants' daily mood using a smartphone app, and tracked the geographical location from which they responded. Collecting data from over 20,000 participants, the researchers found that people were happier in all kinds of outdoor, natural environments than in urban environments (MacKerron & Mourato, 2013).

Nature contact is thought to increase one's sense of connection to the natural world: Hinds and Sparks (2009) reported a correlation between the amount of time spent in nature and people's sense of 'environmental identity'. A strong sense of nature connectedness, in turn, has been correlated with life satisfaction, psychological well-being, positive and negative emotions (Nisbet, Zelenski & Murphy, 2011), creative, innovative thinking (Leong, Fidscher & McClure, 2014) and pro-environmental behaviour (Hedlund-de Witt, 2013). Schultz, Shriver, Tabanico and Khazian (2004) found that participants who felt the strongest connection to nature were more likely to hold global and environmental concerns. There are also potential health benefits, as those with a strong sense of connection to nature are more likely to spend time outdoors (Nisbet, Zelenski, & Murphy, 2009; Tam, 2013).

¹ The term *nature* can be ambiguous; studies looking at the effects of nature have ranged from the presence of nature-based images (e.g., Ulrich et al., 1991) to full immersion in areas with no man-made structures (e.g., Fredrickson & Anderson, 1999). For the purposes of the current paper, natural environments/nature shall refer to "areas containing elements of living systems that include plants and nonhuman animals across a range of scales and

Well-Being, Nature Contact and Nature Connectedness

The field of positive psychology aims to focus on human strengths, positive traits and emotions (Lomas, Hefferon, and Ivtzan, 2014). One of its main areas of focus is subjective well-being, which covers aspects of human existence such as positive emotions (e.g., Lyubomirsky, King & Diener, 2005), 'happiness' (e.g., Seligman, 2004), and psychological well-being (Ryff, 1989). The terms 'happiness' and 'well-being' are often categorised within the field of positive psychology into hedonic and eudaimonic (see Lambert, Passmore & Holder, 2015).

Hedonic well-being refers to pleasant feelings, often measured by looking at satisfaction with life and the extent to which a person experiences positive or negative emotions (Seligman & Csikszentmihalyi, 2014), and is more associated with short-term happiness (Huta & Ryan, 2010). On the other hand, eudaimonic well-being refers more to a longer-lasting sense of meaning, purpose, self-development or virtue (Ryff & Singer, 2008). Generally, the relationship between the two types of well-being is positive, with those high in both having the greatest satisfaction with life overall (Huta & Ryan, 2010).

Positive psychology has often been criticised for overly focusing on hedonic happiness; Wong (2011) argues that an emphasis on pleasant experiences will lead to a generation of shallow, self-centred people with little regard for others or – perhaps – for the planet. Instead, he argues that positive psychology's grander purpose is to focus on meaning and purpose (e.g., Steger et al., 2006) or a sense of connection to something greater than oneself (Williams & Harvey, 2001).

As well as a range of other aforementioned benefits, nature contact appears to be correlated with both types of well-being. Some studies have found that nature contact can boost both eudaimonic and hedonic well-being (e.g., Passmore & Howell, 2014). A recent meta-analysis of 32 studies with over 2000 participants by McMahan and Estes (2015) found that contact with nature results in moderate, significant increases in positive affect and smaller, but still significant, decreases in negative affect. While several studies focus on the short-term effects of brief nature exposure, there is also evidence for the benefits of long-term nature exposure: a study of over 10,000 UK residents found that living in a green area was associated with greater life satisfaction (White, Alcock, Wheeler & Depledge., 2013). A recent meta-analysis containing over 8,500 participants concluded that connectedness to nature has a significant relationship with positive affect and life satisfaction (Capaldi, Dopko, & Zelenski, 2014), although the authors claim that it is not entirely clear whether nature contact increases feelings of connectedness to nature by promoting

degrees of human management, from a small urban park through to relatively pristine wilderness" (Bratman, Hamilton & Daily, 2012, p. 120). The term "greenspace" is also used due to its prevalence in existing research, which refers to any area that possesses elements of nature, for example a field, forest or park.

positive affect (e.g., Nisbet and Zelenski, 2011), or whether well-being increases from nature contact as a result of increases nature connectedness (e.g. Mayer et al., 2008).

There is also a growing body of evidence connecting nature contact and nature connectedness with eudaimonic well-being, specifically a sense of meaning. A consistent definition of meaning does not exist: for example, Steger et al., (2006) use the term to refer to a sense of personal achievement, while Butler (2006) equates meaning with a “sense of higher meaning, a need for balance, calmness, reflection, purpose, a reconnection to the roots of who we are, and an almost subliminal quest for happiness, contentment and joy” (p. 526). The feeling of connection to something greater than oneself is sometimes referred to as spiritual meaning, and can act as a source of hope for many, including individuals suffering from depression (Mascaro & Rosen, 2005) or experiencing extreme adversity (Frankl, 1963).

Cervinka, Roderer and Hefler (2012) discovered a robust correlation between connectedness to nature and meaning, while Nisbet et al. (2011) found purpose in life to be correlated with one’s level of nature relatedness. Connectedness to nature, spirituality and eudaimonic well-being have been found to be strongly correlated (Trigwell, Francis & Bagot, 2014). Examining the relationship more closely, Howell, Passmore and Buro (2013) found that meaning in life mediated the relationship between nature connectedness and well-being.

People often cite a relationship with nature as a source of meaning in their lives (O’Connor & Chamberlain, 1996), but can time spent in nature actually increase one’s sense of meaning or connectedness? Fredrickson & Anderson (1999) argued that their participants had a stronger sense of meaning in life after spending several days in the wilderness, and Richardson and Hallam (2013) observed how spending time in semi-rural nature every day transformed their subject from a casual observer of nature to somebody that felt deeply connected to it. Spending time in a wild environment, such as a forest, can induce feelings of awe and fascination (Vining, 2003; Keltner & Haidt, 2003). A reduction in pressure from the everyday distractions of society, as well as the fascination and awe that can arise within a wild environment, can lead to peak or ‘transcendent’ experiences, which are characterised by a sense of union with the universe, absorption in the significance of the moment and a sense of timelessness (McDonald, Wearing & Ponting, 2009; Williams & Harvey, 2001); it is also possible that being less focused on oneself increases the likelihood of adopting pro-environmental attitudes (Frantz, Mayer, Norton & Rock, 2005; Snell & Simmonds, 2012).

In addition, Wolsko and Lindberg (2013) found that a connection with nature was correlated with mindfulness. Individuals who score highly on an ‘awareness’ subscale for mindfulness report more environmentally friendly behaviour (EFB) (Amel, Manning & Scott, 2009), suggesting that a mutually beneficial relationship between humans and nature may be mediated, in part, by mindfulness. For example, forest-bathing (Morita et al., 2007) emphasises the importance of being mindful of one’s surroundings. Recent research by Unsworth, Palicki and Lustig (in press) suggests that mindful meditation in nature leads to stronger increases

in nature connectedness than in a non-meditation nature setting.

Considering the physical and psychological benefits of spending time in nature as well as the potential benefits for the environment, could cultivating a connection to nature, perhaps through or in combination with mindfulness, be the antidote to nature deficit disorder (Louv, 2008) and the ‘three crises’ suggested by Sampson (2013)?

Nature-Based Interventions

Positive psychology aims to provide research-backed activities, often referred to as ‘interventions’ (positive psychology interventions = PPIs), which can be described as “treatment methods or intentional activities aimed at cultivating positive feelings, positive behaviors [sic], or positive cognitions” (Sin & Lyubomirsky, 2009, p467). It has not been until relatively recently that positive psychology has taken the role of nature into consideration; listing positive psychology interventions (PPIs), neither Seligman, Steen, Park and Peterson (2005) nor Lyubomirsky (2008) mention the effects of nature upon well-being. Seligman et al. (2005) point out that many PPIs encouraged by practitioners have little quantitative backing; those that do, do not appear to include any links with nature.

Similarly, as demonstrated by Sin and Lyubomirsky’s (2009) definition, PPIs tend to focus on positive affect; there are few studies that explicitly focus on increasing a sense of meaning - some notable exceptions include Steger, Shim, Barenz and Shin’s (2014) study in which participants photographed things that made their lives feel meaningful - a study that found significant increases in meaning in life as well as positive affect - and Van Tongeren, Green, Davis, Hook and Husley’s (2016) research into how engaging in prosocial activity can increase meaning in life

However, this is not to say that nature-based interventions are not being tried and tested. Nature has started to be incorporated into therapy in a variety of ways, from counselling in outdoor settings (Berger & McLeod, 2006), to gardening for stress relief (Adevi & Martensson, 2013) or wilderness therapy, which additionally incorporates an element of adventure or challenge (Russell, 2001). White’s (2012) Mindful Affective Perception Imagination in Nature (MAPIN) strategy, which involves meditation and mindfulness in nature, reportedly leads to feelings of awe, calm, joy and a sense of connection with the universe, while the Canadian Mental Health Association has trained mental health organisations across Ontario in running hiking programmes in nature for adults with mental illness; so far, the results of these “Mood Walks” show significantly greater energy and happiness levels and decreased anxiety (Mood Walks, 2015).

In addition, several academic studies have explored the effects of nature-based activities, ranging from viewing nature-based images (Ulrich, 1981) to full immersion in the wilderness (Fredrickson & Anderson, 1999). A meta-analysis by Bratman et al. (2012) reveals that the majority of research has focused on the effects of urban greenspace, rather than wilderness that is far removed from human activity. This may understandably be due to convenience; however, there is some suggestion that urban greenspace

(such as parks and fields) is not as effective in its restorative effects as ‘wild’ areas such as forests or mountains (White, Pahl, Ashbullby, Herbert & Depledge, 2013; Korpela, Ylén, Tyrvaäinen & Silvennoinen, 2010), although McMahan and Estes’s (2015) meta-analysis found no difference between exposure to ‘tame’ and ‘un-tamed’ nature on mood increases. Several people report therapeutic effects after spending time in their own gardens (Freeman, Dickson, Porter & van Heezik, 2012), and participants in Passmore and Howell’s (2014) study experienced increased positive affect and a sense of meaning after spending time in natural areas near their homes. Additionally, some research shows that urban greenspace is more effective than artificial, simulated nature in increasing well-being (Kjellgren & Buhrkall, 2010); in other words, any nature is better than none at all.

One of the few empirical studies into a nature-based intervention, the David Suzuki Foundation began the 30x30 Nature Challenge campaign in 2012. The campaign encouraged people to spend 30 minutes a day in nature. Results from 9345 people showed that most participants doubled their weekly nature contact and were significantly less stressed and showed increases in mood and vitality (Nisbet, 2014). Additionally, increases in the trait of nature connectedness were connected to increased improvements in well-being and the more time spent in nature, the greater the increase in mood (Nisbet, 2014).

The current study recognises that several correlations have been drawn between well-being, meaning, environmentally-friendly behaviour, connection to nature and time spent in nature, but that there are few interventions that have been empirically tested; additionally, it acknowledges a lack of focus on nature and on interventions that target eudaimonic happiness in the field of positive psychology. With this in mind, the current study aimed to investigate the effects of a nature-based intervention programme on well-being, meaning, mindfulness and EFB. The researchers partnered with an online, nature-based programme named Rewild Your Life (RYL, 2014), which ran through March 2015 and was free at the time of implementation. RYL was a challenge similar to the 30x30 challenge (Nisbet, 2014) in which participants committed to spending thirty minutes in nature per day.

Method

Participants

Participants were recruited online through a series of Facebook groups, for example Psychology Students, Positive Psychology, and other groups targeted at individuals who were interested in nature, well-being or self-improvement. The researcher posted a call for participants in these groups and alternately assigned those interested into either control or experimental group.

The sample size was calculated accepting an alpha risk of 0.05 and a beta risk of 0.2 in a two-sided test with a minimum correlation coefficient between the initial and final measurement of 0.5. Foreseeing a dropout rate, in order to recognize as statistically significant a difference greater than or equal to 0.5 standard deviations (effect chosen as a way

to make the study feasible), 60 participants would be necessary. The experimental procedure was carried out until these numbers were achieved. From an initial sample of 85 (43 in the experimental condition, 42 in the control group), 62 completed the study (35 from the experimental, 27 from the control group). From these participants, 24.2% were male, 74.4% female and 1.9% “other”. The mean age was 40.12 (SD = 14.3).

Table 1 Demographics of participants

	n	%
Gender		
Male	15	24.2
Female	46	74.4
Other	1	1.6
Age		
19-25	11	17.7
26-35	17	27.4
36-45	10	16.1
46-55	13	21
56+	11	17.8
Nationality		
USA	28	45.2
Canada	10	16.1
UK	5	8.1
Other	19	30.6
Religion		
Christian	15	24.2
Pagan or nature based	6	9.7
Other religion	10	16.1
No religion	31	50

Procedure

After being assigned to groups, participants were asked to fill in each of the questionnaires (detailed in the materials section) online, using Google Docs to collect their answers. Participants in the experimental group were provided with instructions detailing how they should attempt to spend at least 30 minutes a day in any type of outdoor/natural environment for 30 days, performing nature-oriented activities such as focusing on birdsong, meditating by a lake or river, or learning about local wildlife. Participants were urged to switch off all electronic devices, apart from cameras. An accompanying Facebook group was created so that participants could share their photographs, discuss their experiences and receive inspiration for other types of nature-based activities.

As participants were encouraged to spend time in areas of nature that they felt drawn to, and to follow their own desires, the programme did not take the form of a prescriptive form of ecotherapy. As scientifically grounded nature-based interventions are rare, a broad approach was thought to be a more effective starting point for research than setting specific instructions for where, and how, to enjoy time in nature.

Control group participants were told that they were assisting with research into psychology and well-being. After 30 days, both experimental and control groups were emailed again and asked to complete a second round of the

initial questionnaires; following that stage, control participants were invited to begin the intervention.

Materials

Hedonic Well-Being.

Mood: *The Positive and Negative Affect Schedule (PANAS)* (Watson, Clark & Tellegen, 1988) was used to measure positive and negative affect (mood). The PANAS asks participants to rate how strongly they have felt certain emotions, for example "interested" or "nervous", in a specified time period on a scale (for the current study, the specified period was two weeks) from 1 (very slightly or not at all) to 5 (extremely). The PANAS calculates a score for positive and negative emotions separately, rather than placing affect on a continuum. The PANAS has been found to have good construct validity and reliability (e.g., Crawford & Henry, 2004) and has been used in several studies exploring the link between happiness and nature contact (McMahan & Estes, 2015). Both scales were found to be internally reliable (positive affect $\alpha = .88$ at time 1 and $\alpha = .89$ at 2 respectively, and negative affect $\alpha = .91$ at time 1, $\alpha = .81$ at time 2).

Subjective well-being – or happiness – was examined in addition to mood via the *Warwick-Edinburgh Mental Well-Being Scale (WEMWBS)* (Tennant et al., 2007). The WEMWBS is a 14 question survey which encompasses affect, life satisfaction and positive psychological functioning (Tennant et al., 2007). A 5-point Likert scale, ranging from "none of the time" to "all of the time", is used to measure mental well-being on items such as relationships and positive emotions over the past two weeks ($\alpha = .91$ at time 2, $\alpha = .92$ at time 2). Items include "In the past two weeks I've been thinking clearly" and "I've been feeling close to other people". The scale has been found to be robust in terms of reliability, internal consistency and validity (e.g., Huppert & Johnson, 2010).

Connectedness to Nature. *The Connectedness to Nature Scale (CNS)* (Mayer & Frantz, 2004) focuses on one's emotional connection to nature. Some argue that the scale in fact measures cognitive beliefs about nature rather than an emotional connection (Perrin & Benassi, 2009). However, Mayer and Frantz (2004) found the scale correlated with identification as an environmentalist and anti-consumerist behaviour, while scores on the scale have also been found to predict simple conservation behaviours such as recycling (Gosling & Williams, 2010). The scale contains 14 items on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree" ($\alpha = .84$ at time 1, $\alpha = .85$ at time 2), and includes statements such as "I often feel a sense of oneness with the natural world around me" and "I have a deep understanding of how my actions affect the natural world." The scale has strong convergent validity with other measures of nature connection (Tam, 2013).

Meaning and Spirituality. *The Meaning in Life Questionnaire* (Steger et al., 2006) contains 10 items on a 7-point Likert scale, with statements ranging from "absolutely untrue" to "absolutely true". An attempt to quantify meaning in life, the scale contains two 5-item subscales; "presence" evaluates the current level of meaning that one feels they have in their life, while "search" looks at people's tendency

to seek meaning. The "presence" sub-scale alone was used for the purposes of the current research (MLQ-P). Items contain statements such as "My life has a clear sense of purpose." The scale has been found to have satisfactory internal consistency and validity (Rose, Zask & Barton, in press), for the current study Cronbach's alpha was .94 at time 1 and .88 at time 2.

In addition, the *Spiritual Transcendence Scale (STS)* (Piedmont, 1999) was used as an attempt to measure spiritual meaning and one's level of spirituality. The STS is a 24-item scale with three sub-scales; Universality, Prayer Fulfilment, and Connectedness. Statements are rated on a Likert scale from 1 (strongly disagree) to 5 (strongly agree), and consist of items such as "all life is interconnected" and "there is a higher plane of existence that binds all people" ($\alpha = .90$ at time 1, $\alpha = .91$ at time 2). Piedmont (1999) found that the scale had high validity and robustness, as well as generalisability across cultures (Piedmont & Leach, 2002).

Mindfulness. *The Freiburg Mindfulness Inventory* (Walach, Buchheld, Buttermuller, Kleinknecht & Schmidt, 2006) has strong internal validity and has been correlated with relevant traits such as self-awareness (Walach et al., 2006), self-efficacy and positive affect (Trousselard et al., 2010). The scale contains 14 items on a 1-4 Likert scale, ranging from "rarely" to "almost always". Example items are "I feel connected to my experience in the here-and-now" and "I am friendly to myself when things go wrong" ($\alpha = .85$ at time 1, $\alpha = .88$ at time 2).

All measures were scored according to their original instructions: all scores were added up, with any reverse scored items reversed accordingly.

Environmentally-friendly Behaviour. Finally, an adapted scale from Lynn and Longhi's (2011) Understanding Society survey was used to measure EFB. The scale contains 11 items, with participants asked how often they engage in each behaviour on a scale of 0 (never) to 5 (always). Items include, for example, switching off lights and leaving the TV on standby ($\alpha = .47$ at time 1, $\alpha = .53$ at time 2).

Additional Questions. To test the effectiveness of the intervention, all participants were asked about the amount of time they currently spent in nature. Additionally, those in the experimental group were asked – at the end of the 30-day intervention – how many of the 30 days they had spent in nature, with the options "none", "less than 10", "10-20", "20-29" and "all 30". They were also asked on average how much time they had spent on each occasion, with options being "less than 15 minutes", "15-30 minutes" or "more than 30 minutes". Those who spent less than 10 of the 30 days in nature, or who spent less than 15 minutes on average in nature, were deemed not to have truly completed the intervention and were removed from the experimental group data.

Participants were also asked about the type of environment in which they spent the majority of their time, in order to test for potential differences between 'types' of nature environment (the choices were garden, urban greenspace (e.g. parks), forest, mountains, seaside or other).

Results

In order to test the reliability of previous research on the effects of nature connectedness and wellbeing, several Pearson’s correlations were carried out on the data collected at time 1. The results of the correlations can be seen in

Table 2 and demonstrate significantly correlations between mood, happiness, connectedness to nature, meaning, spiritual transcendence, mindfulness and environmentally-friendly behavior.

Table 2: Correlation coefficients values (Pearson’s r) between measures of wellbeing, spiritual transcendence, connection to nature and environmental behavior.

	1	2	3	4	5	6	7
1. PANAS positive							
2. PANAS negative	-.355**						
3. WEMWS	.781**	-.612**					
4. CNS	.360**	-.248**	.382**				
5. Meaning	.425**	-.343**	.524**	.312**			
6. STS	.253**	-.129**	.283**	.366**	.328**		
7. Mindfulness	.553**	-.420**	.633**	.458**	.514**	.347**	
8. EFB	.108*	-0.024	.129*	.298**	.214**	.187**	.214**

Notes: PANAS positive - positive emotions; PANAS neg - negative emotions; WEMWS - Warwick-Edinburgh Mental Wellbeing scale; CNS - Connectedness to Nature Scale; STS - Spiritual transcendence scale; EFB - Environmentally friendly behavior.

*p < 0.05, **p < 0.01

A series of two-way repeated measures ANOVAs were used to detect for significant differences on a range of measures both before and after the 30-day intervention, while paired-samples t-tests were used to test for significance in pre and post-intervention results on each scale. The intervention was shown to have a significant

effect in the expected direction for a range of factors; namely positive affect $t(34) = -6.66, p < .001$, negative affect $t(34) = 3.33, p < 0.05$, well-being $t(34) = -5.78, p < .001$, meaning $t(34) = -2.32, p < .05$, and mindfulness $t(34) = -3.96, p < .001$; see Table 3 for an overview of results.

Table 3. Differences on each scale, divided by time and group

	Control group		Experimental group		Time x Group
	Time 1	Time 2	Time 1	Time 2	F (time*group)
PANAS positive	33.3 (5.79)	32.59 (8.38)	29.74 (6.69)	37.51** (5.2)	22.59**
PANAS negative	20.48 (6.86)	19.19 (5.83)	20.94 (10.1)	15.17** (4.76)	4.45*
WEWS	46.81 (7.32)	48.3 (9.57)	43.83 (9.73)	52.97** (7.4)	11.79**
CNS	51.52 (10.79)	53.78 (9.73)	57.23 (6.76)	59.29 (7.48)	0.01
Mindfulness	39.96 (7.1)	39.52 (7.24)	34.54 (6.97)	40.17** (7.37)	10.91**
Meaning	26.48 (6.16)	25.74 (6.22)	24.8 (7.46)	26.94* (5.85)	4.09*
STS	85.96 (13.94)	86.85 (15.88)	89.46 (14.63)	92.03 (15.39)	0.25
EFB	36.48 (5.54)	35.56* (5.43)	35.4 (6.88)	35.6 (7.76)	1.01

Note. Standard deviation in brackets. Mixed measures ANOVAs were conducted for the effect of time and group, while the asterisks in the time 2 columns denote the result of paired samples t-tests, comparing scores at times 1 and 2 for each group. Standard deviations are in brackets. Time 1 = before the RYL intervention, time 2 = after 30 days.

* p < 0.05 ** p < 0.01

Despite splitting participants randomly into control or experimental groups, it was observed that the experimental group were significantly more connected to nature than the control group $t(41.22) = -2.41, p < .05$ while the control group scored significantly higher in mindfulness $t(55.8) = 2.451, p < .05$ and positive affect $t(59.2) = 2.239, p < .05$; otherwise there were no significant differences between groups.

From the 35 participants in the experimental group, 8 (22.9%) claimed that they had spent all 30 days outdoors, 17 (48.6%) between 20 and 29 days, and 10 (28.6%) between 10 and 19 days. Although the number of days on which participants went outside did not affect results on any measure, the length of time that they spent outside yielded some significant findings. Participants in the experimental

group were asked: “On the days where you did go outside, approximately how long did you spend there?”, with choices being “less than 15 minutes”, “15-30 minutes” and “30 minutes or more”. None of the participants selected “less than 15 minutes”. For participants who had spent more than 30 minutes in nature a day, the differences between their scores on almost all measures differed significantly between times 1 and 2, while many of these differences ceased to be significant for those who responded “15-30 minutes”, perhaps due to the small number of participants who gave this answer (see Table 4).

Exploratory analyses were also conducted on the types of settings in which participants spent the majority of their outdoor time during the intervention. Full information regarding setting and proportion of time in each setting were

not obtained, however some information can be analysed based on answers. Participants reported spending the majority of their time in nature in the following settings: 20% in forests, 20% in a garden, 8.6% in the mountains, 8.6% at the seaside, 11.4% in the countryside, and 31.4% in urban greenspace. Type of setting was tested against each measure, and a significant effect was found for type of setting for both the WEWS (Wilks' Lambda = .607, $F(6,55) = 3.420$, $p < .01$) and PANAS positive scoring (Wilks' Lambda = .604, $F(6,55) = 4.99$, $p < .01$). To further examine

which types of setting influenced the outcome of the experiment specifically, settings were categorized into "wild" (forest, mountains, seaside or countryside) and "urban" (gardens and urban greenspace). Using a series of paired-samples t-tests and focusing only on those who had spent 30 minutes or more outdoors, as they were deemed to have truly completed the intervention as intended, both mindfulness ($t(15) = -3.934$, $p < .05$) and meaning ($t(15) = -4.141$, $p < .01$) scores were shown to increase significantly in "wild" settings but not in "urban" ones.

Table 4. Mean scores for measures based on length of time spent in nature

	15-30 minutes outdoors ($n=3$)		More than 30 minutes ($n=32$)		t (df)
	Time 1	Time 2	Time 1	Time 2	
PANAS positive	28.67 (6.66)	34.0 (8.0)	29.84 (6.79)	37.84** (4.92)	-6.347(34)
PANAS negative	16.33 (3.51)	12.00 (1.0)	21.38 (10.43)	15.47 (4.87)*	3.133(34)
WEWS	44.33 (8.02)	49.67 (8.39)	43.78 (9.98)	53.28** (7.38)	-5.294(34)
CNS	61.00 (3.6)	57.00 (18.36)	56.88 (6.91)	59.50 (6.23)*	-2.269(34)
Mindfulness	36.69 (3.51)	39.67 (2.08)	35.44 (7.24)	40.22** (7.7)	-3.784(34)
Meaning	27.67 (6.51)	24.0 (7.21)	24.53 (7.58)	27.22** (5.77)	-3.249(34)
STS	92.67 (22.19)	96.33 (10.26)	89.16 (14.21)	91.63 (15.84)	-1.359(34)
EFB	39.33 (9.07)	32.00 (14.00)	35.03 (6.70)	35.94 (7.22)	-.989(34)

Note. Standard deviations are in brackets, asterisks denote the results of paired-samples t-tests

Discussion

The significant correlations found in the initial sample give weight to previous research suggesting a relationship between CNS, well-being and meaning (Nisbet et al., 2011). It appears that a correlation exists between almost every factor measured, suggesting that mood, subjective well-being, meaning, connectedness to nature, a sense of meaning and spirituality and EFB are all interwoven. Further research and statistical analysis might provide further insights into the full nature and direction of these relationships; nevertheless, the findings suggest that happier, more mindful people with more meaning in their lives are more likely to feel connected to nature and to engage in EFB.

The hypothesis that participating in the RYL (2014) intervention would significantly increase well-being was confirmed, although care should be taken when rejecting the null hypothesis due to the study's small sample size. Nevertheless, the results suggest that positive mood increased, negative mood decreased, and that general subjective well-being, a sense of meaning and mindfulness increased after 30 days of the intervention. Such findings are supportive of previous studies examining the influence of nature on mood and life satisfaction (e.g., MacKerron & Mourato, 2013; McMahan and Estes, 2015; Nisbet, 2014), and provide a quantitative accompaniment to reports from previous studies that spending time in nature can increase one's sense of meaning (e.g., Snell & Simmonds, 2012). Supporting the findings of the present study, mindfulness has been found to be reactive in earlier studies; levels of mindfulness, as measured by the Freiburg Mindfulness Inventory (used in the present study), increased after a

mindfulness retreat (Walach et al., 2006). Hinds (2011) writes that wonderment with the environment potentially has similar effects to mindfulness, while Unsworth et al. (in press) found that nature contact was most effective when participants were instructed to conduct mindful meditation. RYL participants were not explicitly given instructions to be mindful but were encouraged to pay attention in ways they normally would not: instructions that may also be given during mindfulness practice.

There are several potential explanations for why interventions such as RYL might be effective. The biophilia hypothesis (Wilson, 1984) argues that humans have evolved to have strong emotional reactions to natural landscapes, and that we therefore have an innate desire to connect with nature. Another explanation is Attention Restoration Theory (Kaplan, 1995), which argues that nature provides people with soft fascination: a welcome antidote to the hard focus given to the majority of tasks in modern society, for example focusing on screens at work. Kaplan (1995) argued that spending time around nature had restorative properties and helped to reduce stress.

It is worth noting that neither Connectedness to Nature nor Spiritual Transcendence was affected by the RYL intervention. The transcendent experiences in natural settings discussed by Williams and Harvey (2001) suggested that spiritual meaning may increase after spending time in nature. Meanwhile, Mayer et al. (2008) found that even 15 minutes of walking in nature could increase scores on the Connectedness to Nature scale, although their participants' scores were not measured at any point after the study so it is uncertain as to whether one's score is likely to fluctuate over time and to be particularly high immediately after being exposed to nature. Similarly, Nisbet's (2014) 30x30

challenge led to an increase in people's connection to nature, therefore there is evidence to suggest that nature connectedness might be malleable, rather than a fixed trait as it is sometimes defined (e.g. Mayer & Frantz, 2004). Unsworth et al. (in press) found the greatest increases in nature connectedness came through mindful meditation. It is vital to note that participants in the current study were recruited from a number of nature or psychology-related Facebook groups and already had a relatively high level of connectedness to nature.

Additionally, EFB remained unaffected after the intervention. Previous research has indicated that EFB is higher in those who feel a stronger connection to nature (Mayer & Frantz, 2004; Hedlund-De Witt, 2013); while the correlations measured at the beginning of the study support these findings, the present intervention did not increase EFB. Had such an effect been apparent, it is possible that an increase in EFB would also have been seen. On the other hand, positive mood and mindfulness have also been linked to EFB (Amel et al., 2009; Carter, 2011), although the current findings did not find EFB to increase alongside positive affect and mindfulness. However, as the scale used to measure EFB was not commonly used and had a relatively low Cronbach's alpha, the possibility that other measures of environmental concern and EFB could yield different results must not be discounted.

There is also some suggestion that type of environment is important; while some have found all types of natural setting equally effective (e.g., McMahan & Estes, 2015), others have found urban greenspace less restorative than "wild" forests or mountains (White et al., 2013b). The present study found that location had a significant effect on positive mood and subjective well-being, as well as finding that meaning and mindfulness increase significantly only in "wild" areas such as forests or mountains, and then only when participants spent 30 minutes or more in these settings every day. Although the sample sizes are too small to break these categories down for further analysis, the suggestion that "wild" areas may be more effective in increasing mindfulness and meditation reflects the findings that all individuals can benefit from calming, "manicured" environments such as gardens or parks (Hartig & Staats, 2006), but it is mainly "wild" landscapes that have been found to provoke feelings of awe or meaning (Davis & Gatersleben, 2013; Herzog & Kropscott, 2004s).

Another factor that became evident was that the amount of time spent in nature had strong effects on the outcome of the intervention; several effects ceased to be significant for those who had spent 15-30 minutes per day in nature when compared to 30 minutes or more, although it is important to note that only 3 participants claimed to have spent 15-30 minutes in nature. These trends support previous research that has found levels of nature contact to be correlated to positive outcomes (Hinds & Sparks, 2009; Sato & Conner, 2013). However, Sato and Conner (2013) also argue that the quality of time spent in nature is important; for example, simply sitting in a wild area while using one's phone is unlikely to yield the same effects as practicing mindfulness. It is possible that there is also a maximum amount of time that one can spend in nature after which the effects cease to be positive, however there is currently little to no research

examining whether spending time in nature has such a saturation point.

Limitations

The first limitation that should be considered is the small sample size. While other studies focusing on the effects of nature contact have yielded samples of between 8000-9000 (e.g. Capaldi et al., 2014; Nisbet, 2014), the present study only used 62 participants in total. Small sample sizes risk the false rejection of the null hypothesis (Simmons, Nelson & Simonsohn, 2011); therefore, the authors recognize the importance of replicating the study in future with a larger sample. However, the present study was intended as a pilot intervention, and the directions of its findings suggest potential for further, larger studies. Another potential limitation is the fact that participants were recruited from Facebook groups relating to nature or positive psychology, suggesting that the sample may have already been more interested in, and connected to, nature than an average sample would have been.

The long-term benefits of RYL need to be considered. The present study found beneficial outcomes after 30 days, however it is possible that these increases in well-being could wear off shortly after the intervention's completion. Frequently, interventions fail to yield lasting results as people quickly adapt to positive changes in their lives (Seligman et al., 2005), so it is important that interventions produce lasting benefits and, if continued, do not become boring or routine. Future research could look at the long-term effects of time in nature, and examine whether benefits can be gained from infrequent, intense periods in natural settings as well as from short, frequent visits.

An additional element of the study should be taken into consideration; the RYL (2014) programme included access to a Facebook group. People within the group shared their photographs, commented on each other's pictures and generally engaged in discussion. Other studies have emphasised the importance of relationships with people, for example Fredrickson and Anderson's (1999) participants cited the bonds built with other women to be part of what made their nature adventure trips so meaningful. In the case of the present study, it cannot be made entirely clear whether the beneficial effects of the programme were entirely due to spending time in nature, feeling part of an online community, or a combination of the two. Passmore and Howell (2014b) argue that a connection to nature is similar to a connection with others; both provide a sense of meaning. It is possible that the combination of developing a sense of connection to others and to nature simultaneously could lead to the greatest increases in eudaimonic well-being and meaning; this could be tested in future research.

Implications

The benefits of RYL (2014), as well as previous research into the psychological and physical benefits of nature (e.g., MacKerron & Mourato, 2013), highlight why it is important that people have access to safe greenspace. Considering that 7.4 billion people will potentially live in cities by 2050 (The World Bank, 2013); the potential negative effects of urban

living (Ulrich et al., 1991) and nature's ability to negate its stresses (Kaplan, 1995) should not be ignored. Furthermore, the restorative benefits of nature have been shown to be stronger in deprived communities (Thompson et al., 2012). It is therefore important that city planners and governments recognise the importance of access to natural spaces, especially for those from lower socio-economic backgrounds who cannot afford to take trips to the wilderness.

One of the aims of positive psychology is to make life better (Lomas et al., 2014). Some argue that the discipline has so far overly focused on individual well-being and ignored the potential ways that societies can thrive (Biswas-Diener, 2011). As well as enabling individuals to increase their well-being and sense of meaning, encouraging interaction with nature could have a wealth of wider benefits for society and the environment. Schumaker (2001, p. 157) remarks that modern society is "characterised by a collective dissociative amnesia that involves a complete forgetting of the human-nature relationship". A rising obsession with materialism may be partly responsible for this disconnection; focusing on extrinsic goals such as money, wealth and looks is associated with lower subjective well-being (Kasser & Ryan, 2001). Weinstein, Przybylski and Ryan (2009) argue that extrinsic aspirations increase through time in non-natural environments, and in turn, extrinsic aspirations are correlated with lower pro-environmental attitudes (Frantz et al, 2005). In other words, spending less time outdoors and more time looking at screens could not only be making people unhappier, but more materialistic and less concerned with the environment. This lack of environmental concern, compounded by the environmental effects of materialistic consumption, may lead to an unwitting contribution to the destruction of nature, thus increasing the likelihood of people experiencing mental and physical health problems in the future (see Adevi & Martensson, 2013).

As we continue to live under the ever-threatening shadow of climate change (e.g., Field, 2014) it is important that any interventions designed to increase well-being are environmentally sustainable (O'Brien, 2008). Programmes such as RYL (2014) are not only sustainable but might encourage EFB by encouraging familiarity with nature, for, as Sampson (2013, p. 212) argues, "how can we foster caring [for the environment] if our experience of nature is overwhelmingly limited to indoor plants and pets, punctuated by brief outdoor intervals between climate-controlled settings?" Although the present study did not significantly increase EFB or nature connectedness, the

sample potentially already scored higher than average on these measures.

The potential existing bias towards nature in the present sample has further implications for the use of RYL (2014) as a positive psychology intervention. Although RYL (2014) increased mood and well-being in the present study, caution should be taken when recommending it or a similar nature-based programme to those who do not have an existing interest in nature, as exposure to natural environments does not always yield positive results. Fear of being attacked by wildlife or getting lost were described by Van den Berg & Ter Heijne's (2005) participants, while Herzog and Rector (2008) found that perceived danger undermined the restorative effects of a natural environment. Davis and Gatersleben's (2013) findings that "wild" cliffs brought on feelings of awe in those already highly connected to nature, but caused fear and disturbance in those low in nature connection, gives further weight to these concerns. Similarly, there is evidence to suggest that preference for natural landscapes may be cultural. Buijs, Elands and Langers (2009) found that immigrants from Islamic countries showed lower preference for wild landscapes than did Dutch citizens. It is worth considering that the findings of Buijs et al. (2009) reflect a preference for nature based on prior positive experience and cultural norms, suggesting that it is early positive experiences in nature that foster connectedness to nature.

The importance of early, positive childhood experiences in nature has become increasingly publicised; e.g., Louv's *Last Child in the Woods* (2008) and the documentary *Project Wild Thing* (The Wild Network, 2015) have started a dialogue about children's access to nature, and The National Trust (2015) recently launched a campaign called *50 Things To Do Before You're 11¼* in an attempt to encourage children to play outdoors. If early experience in nature is vital for fostering a sense of connectedness to nature, then it is vital that young people are able to access nature in a safe way; otherwise, the future may bring more ill health, materialism and environmental destruction, enabled by a lack of care for the environment. The current intervention may be one step on a path towards increased positive emotion, a deeper sense of meaning and awareness, and a deepening connection with, and appreciation for, the environment; although the present study was preliminary and further research is needed before being able to recommend it as a one-size-fits-all intervention.

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