IJW Tornquist, M., & Johnson, T. (2026). Nature exposure, nature connectedness, adaptive and maladaptive emotion regulation strategies, and mental well-being. *International Journal of Wellbeing*, *16*(1), 5183, 1-29. https://doi.org/10.5502/ijw.v16i1.5183

ARTICLE

Nature exposure, nature connectedness, adaptive and maladaptive emotion regulation strategies, and mental well-being

Michelle Tornquist · Tara Johnson

Abstract: Prior research has consistently demonstrated that nature exposure and nature connectedness improve mental wellbeing, but more research is needed to understand the interplay between nature exposure, nature connectedness, and mental wellbeing and the mechanisms by which nature exposure and nature connectedness improve mental wellbeing. Two studies therefore tested three paths by which nature exposure and nature connectedness may promote adaptive and maladaptive emotion regulation strategies and mental wellbeing. Participants (Study 1: N = 171; Study 2: N = 170) completed measures of nature exposure, nature connectedness, adaptive and maladaptive emotion regulation strategies, and mental wellbeing outcomes (i.e., life satisfaction and positive and negative affect). Compelling evidence demonstrated that greater nature exposure and increased nature connectedness were both related to more use of cognitive reappraisal; that greater nature connectedness was related to increased use of refocus on planning; and that greater nature exposure predicted increased use of cognitive reappraisal and refocus on planning by enhancing nature connectedness. Robust evidence further showed that greater nature exposure and nature connectedness both facilitated improved mental wellbeing by promoting increased use of cognitive reappraisal. This research advances our understanding of the facilitating impact of nature exposure and nature connectedness on emotion regulation strategies and mental wellbeing.

Keywords: nature exposure, nature connectedness, emotion regulation strategies, mental wellbeing

1. Introduction

Mental health problems are highly prevalent and continue to rise (WHO, 2022). More research on protective factors influencing mental health problems is therefore crucial. Increasing evidence suggest that two such factors could be the amount of physical contact that an individual has with nature (i.e., nature exposure: Bratman et al. 2019; Vanaken & Danckaerts, 2018), and peoples' subjective sense of their relationship with nature (i.e., nature connectedness: Martin et al., 2020). For example, Sarkar et al. (2018) found that exposure to residential greenness protected against depression in a sample of 94, 879 participants, and Piccininni et al. (2018) found that exposure to outdoor environments and perceived connectedness with nature reduced psychosomatic symptoms in a sample of 29,784 adolescents. Thus, nature exposure and nature connectedness play a key role in both reducing mental health problems and promoting positive health outcomes, such as mental wellbeing (Capaldi et al., 2014; Passmore & Holder, 2017). However, more

Michelle Tornquist
University of Liverpool
m.tornquist@liverpool.ac.uk

research is needed to examine the interplay between nature exposure, nature connectedness, and mental wellbeing, as well as to clarify the mechanisms through which nature exposure and nature connectedness promote mental wellbeing (Bratman et al., 2021; Liu et al., 2022).

1.1 Nature exposure and nature connectedness

Nature exposure can range from brief to frequent and involves interacting with the natural environment, for example, by being physically present in nature, being near natural elements indoors (e.g., plants), or viewing virtual natural elements (e.g., nature videos: Capaldi et al., 2015). Studies have consistently found that different forms of nature exposure leads to increased subjective wellbeing and positive affect (Berman et al., 2012; Hartig et al., 2003; Passmore & Holder, 2017; White et al., 2021), decreased stress and negative affect (Hartig et al., 2003; Ulrich et al., 1991), and lower risk of mental health disorders and depressive symptoms (Bezold et al., 2018; Gascon et al., 2015; Kondo et al., 2018; Van den Berg et al., 2015). A related yet distinct concept is nature connectedness, which is a psychological construct that covers how we think and feel about nature, and the extent to which we see ourselves as part of nature (Liu et al., 2022; Martin et al., 2020). Nature connectedness is often considered a stable trait that differs between individuals (Nisbet et al., 2009), although it can also be influenced by situational factors (e.g., outdoor nature walk) and can thus also be measured at the state level (Nisbet & Zelenski, 2011). As with nature exposure, evidence indicate that nature connectedness promotes hedonic (e.g., positive affect, life satisfaction: Capaldi et al., 2014, Capaldi et al., 2015) and eudaimonic (e.g., personal growth, purpose in life: Pritchard et al., 2020) wellbeing. These data provide robust evidence that nature exposure and nature connectedness are both associated with enhanced mental wellbeing.

One explanation for this comes from the biophilia hypothesis, which proposes that humans have an innate tendency to seek natural environments and to feel connected to the natural world (Kellert & Wilson, 1993; Wilson, 1986; see also Gaekwad et al., 2022; Seymour, 2016). That is, when people are in nature and feel a sense of connectedness and belongingness to the natural world, they experience psychological benefits (Mayer et al., 2009). Building on this, the Attention Restoration Theory (ART) holds that natural environments reduce the mental fatigue that is associated with modern life, restore people’s capacity to direct attention, and allow them to act without having to monitor their behaviour (Kaplan & Kaplan, 1989; Kaplan, 1995). The Stress Reduction Theory (SRT) similarly posits that nature exposure activates psychophysiological responses to reduce stress and autonomic arousal (Ulrich et al., 1991; Ulrich, 2023). Thus, nature exposure and nature connectedness facilitate mental wellbeing by promoting a sense of belonging, restoring mental fatigue, and improving attentional capacity and stress (Jimenez et al., 2021).

Research has also examined the association between nature exposure and nature connectedness, demonstrating a weak-to-moderate (Fränkel et al., 2019; Martin et al., 2020) or a moderate-to-large (Baceviciene et al., 2021; Picanço et al., 2024) positive correlation between these variables, although a recent large cross-nations study ($N = 56{,}968$) found no significant correlation (Swami et al., 2024). Moreover, studies have found that nature exposure predicts increased momentary feelings of nature connectedness (Nisbet & Zelenski, 2011), and that people who feel more connected to nature also tend to spend more time outdoors (Mayer & Frantz, 2004). Hence, there seem to be a bidirectional positive association between nature exposure and nature connectedness, and both these constructs independently predict enhanced mental wellbeing.

Nevertheless, studies examining the interplay between nature exposure, nature connectedness, and mental wellbeing are limited or have yielded mixed findings (Liu et al., 2022).

For example, Mayer et al. (2009) found evidence that nature connectedness mediates the effect of nature exposure on mental wellbeing; Passmore and Howell (2014) failed to find evidence that nature connectedness moderates the impact of nature exposure on mental wellbeing; and Liu et al., (2022) found evidence that nature connectedness functions as a mediator *and* moderator in the relationship between nature exposure and mental wellbeing. In the current research, we therefore include measures of both nature exposure and nature connectedness to examine how the interplay between nature exposure and nature connectedness influences mental wellbeing.

1.2 Emotion regulation

Given the affective benefits of nature exposure and nature connectedness, it has been argued that these variables may facilitate mental wellbeing by increasing adaptive emotion regulation and decreasing maladaptive emotion regulation (Bratman et al., 2021; Vitale & Bonaiuto, 2024). Emotion regulation involves influencing our own and others' emotions, which is essential for positive mental wellbeing (Berking & Wupperman, 2012; Gross 1998, 2015; Gross & Muñoz, 1995). The process model of emotion regulation (Gross, 1998, 2002) further proposes that there are five emotion regulation families and corresponding emotion regulation strategies, including situation selection (choosing a situation based on its anticipated emotional impact), situation modification (altering a situation to change its emotional impact), attentional deployment (allocating attention to modify an emotional response), cognitive change (re-evaluating emotional events to change emotional responses), and response modification (modifying an emotional response after it has begun). The first four are antecedent-focused (i.e., how an individual influences an emotion before it is fully experienced), whereas the fifth is response-focused (i.e., how an individual modifies their behaviour or emotion after the emotion is experienced: Gross, 2015; McRae & Gross, 2020).

Situation selection and situation modification strategies typically involve avoiding environments that elicit undesirable emotions, choosing situations that foster desirable emotions, or actively altering a situation once engaged. Attentional deployment includes strategies such as distraction and rumination. Distraction involves redirecting attention away from emotional stimuli or situations, whereas rumination entails replaying unpleasant thoughts, memories, or emotions. Cognitive change includes reappraisal and acceptance. Reappraisal involves reinterpreting a stimulus or event to reduce its emotional impact, whereas acceptance involves welcoming emotions with nonevaluative judgment. Response modulation includes expressive suppression, which involves reducing emotional experiences and expressions (Gross, 2002; McRae & Gross, 2020; Richards & Gross, 2000).

In addition to these strategies, Garnefski et al. (2001) identified several other cognitive emotion regulation strategies. Refocus on planning involves considering concrete steps for handling negative situations. Putting into perspective involves downgrading the importance or seriousness of negative events by comparing them to other events. Positive refocusing includes focusing on unrelated positive events rather than actual negative events. Self-blame involves blaming yourself for negative events, whereas other-blame involves blaming others for these events. Catastrophizing refers to thinking of the situation as being worse than it is (Carvajal et al., 2022; Garnefski et al., 2001). Reappraisal, refocus on planning, putting into perspective, and positive refocusing are considered adaptive strategies that enhance mental wellbeing, whereas suppression, rumination, self-blame, other-blame, and catastrophizing are considered maladaptive strategies that impair this outcome (Carvajal et al., 2022; Garnefski et al., 2001, 2002; Gross & John, 2003; Jermann et al., 2006).

1.3 Linking nature exposure, connectedness, and emotion regulation

Importantly, Bratman et al. (2021) proposed that emotion regulation theories such as the process model can provide a helpful way to understand how nature may encourage or discourage emotion regulation strategies, leading to affective benefits. Specifically, they argued that not only do people visit natural environments to self-regulate and experience desirable emotions as a form of situation selection, but they also move to nearby nature or incorporate natural elements like plants into office buildings, reflecting another form of emotion regulation. Moreover, they argued that natural environments, by lowering stress levels, make it easier for people to use reappraisal effectively and, by providing a space to freely express emotions, reduce reliance on suppression. Additionally, by offering a positive distraction away from repetitive and negative self-referent thinking, natural environments may decrease rumination. Finally, Mayer et al. (2009) argued that nature may enhance people's capacity for problem reflection and perspective taking, suggesting that nature exposure could support other adaptive cognitive emotion regulation strategies, such as refocus on planning, putting things into perspective, and positive refocusing.

However, even though studies have found that nature exposure has a positive impact on general emotion regulation such as decreased emotional difficulties (Liang et al., 2024; Mygind et al., 2022; Vitale & Bonaiuto, 2024), studies testing the impact of nature exposure on specific emotion regulation strategies are scarce. For example, Gu et al. (2023) found that nature contact was positively correlated with reappraisal but was unrelated to suppression in young adults in China, and Bratman et al. (2024) found that frequency and duration of nature contact was positively associated with reappraisal, providing initial evidence to link nature exposure with adaptive emotion regulation strategies such as reappraisal. Additionally, a qualitative study found that participants (N = 8) reported adaptive emotion regulation strategies such as putting things in perspective and reflecting on their life, problems, and emotions while being at the coast (Severin et al., 2022). Finally, research has shown that nature exposure is linked with decreased rumination (Beute & de Cort, 2018; Bratman et al., 2015, 2024), although others have failed to replicate this (Browning et al., 2023; Golding et al., 2018). Despite these links, few studies have explored whether nature exposure enhance mental wellbeing by encouraging or discouraging specific emotion regulation strategies. One exception is research demonstrating indirect effects of nature contact on negative affect, emotional ill-being, and wellbeing via reduced rumination and increased reappraisal (Bratman et al., 2021, 2024). However, whether other emotion regulation strategies mediate the effect of nature exposure on mental wellbeing remains to be tested.

In terms of nature connectedness, research shows that nature connectedness not only predicts better overall emotion regulation, such as fewer emotional difficulties (Richardson & McEwan., 2018), but also affects specific emotion regulation strategies. For instance, Fido et al. (2020) found a positive correlation between nature connectedness and the use of reappraisal, although nature connectedness was unrelated to suppression. Gu et al. (2023) replicated the former finding, although they also found a negative correlation between nature connectedness and suppression in their study. Interestingly, some studies have tested whether nature connectedness enhances mental wellbeing by promoting general emotion regulation. Richardson and McEwan (2018) conducted exploratory mediation analysis and found that increased nature connectedness predicted greater happiness via less emotional regulation difficulties. Moreover, Bakir-Demir et al. (2021) found that adaptive emotion regulation strategies mediated the link between nature connectedness and stress, although there was no mediating effect of maladaptive emotion regulation strategies. However, they computed composite scores of adaptive and maladaptive strategies rather than assessing specific strategies, and they did not measure nature exposure or mental wellbeing beyond stress. Thus, given that previous findings are lacking or have yielded inconsistent findings, more research is needed to examine whether nature exposure and nature connectedness enhance mental wellbeing by promoting the use of specific adaptive and maladaptive emotion regulation strategies.

1.4 Present research

Specifically, Vitale and Bonaiuto (2024) argued that, although nature exposure and nature connectedness are known to benefit emotions and emotion regulation, these mechanisms remain largely overlooked, with few studies examining them explicitly in terms of emotion regulation concepts and theories. Therefore, they conducted an evidence-based literature review to advance understanding of how these nature variables may impact emotion regulation and mental wellbeing, including only studies grounded in key theoretical frameworks of emotion regulation. Based on the findings of 33 studies, three conceptual models of how nature may promote emotion regulation and mental wellbeing were developed. The authors further noted that the wide range of methods used in past research highlight a need for more rigorous and consistent methods in future studies (see also Ríos-Rodríguez et al., 2024). Thus, we aimed to contribute to the literature by testing and extending the models developed by Vitale and Bonaiuto (2024).

That is, we tested their first model proposing that nature exposure is positively correlated with adaptive emotion regulation strategies, and negatively correlated with maladaptive emotion regulation strategies, although we extend this by also testing whether nature connectedness is positively associated with these emotion regulation strategies. We then tested their second model highlighting that the association between nature exposure and general emotion regulation is mediated by nature connectedness, although we expand on this by examining specific adaptive and maladaptive emotion regulation strategies rather than general emotion regulation. Importantly, we next tested their third model proposing that adaptive and maladaptive emotion regulation strategies mediate the association between nature connectedness and mental wellbeing. We extend this, however, by assessing a range of emotion regulation strategies and by examining whether these strategies also mediate the link between nature exposure and mental wellbeing.

We conducted two studies that included measures of nature exposure, nature connectedness, adaptive and maladaptive emotion regulation strategies, and mental wellbeing (operationalized as a composite score of affect and life satisfaction). We included identical measures in both studies, as identified by Vitale and Bonaiuto (2024), because evidence suggest that studies on nature, emotion regulation, and mental wellbeing may have produced discrepant findings due to inconsistencies in the choice of assessment tools (Ríos-Rodríguez et al., 2024; Vitale & Bonaiuto, 2024). Study 1 was largely exploratory, and we therefore focused on various well-established adaptive and maladaptive emotion regulation strategies including reappraisal, suppression, rumination, refocus on planning, putting into perspective, positive refocusing, self-blame, other-blame, and catastrophizing.

Despite Study 1's exploratory nature, we were able to state confirmatory hypotheses based on the literature. We hypothesised positive associations between nature exposure/nature connectedness and reappraisal, and that increased reappraisal would mediate the positive associations between nature exposure/nature connectedness and mental wellbeing. However, because prior studies are limited or have yielded inconsistent results, in Study 1 we explored the associations between nature exposure/nature connectedness and refocus on planning, putting into perspective, positive refocus, suppression, rumination, self-blame, other-blame, and catastrophizing, and whether these strategies would mediate the positive association between nature exposure/nature connectedness and mental wellbeing. Likewise, because studies testing whether nature connectedness mediates the link between nature exposure and specific emotion regulation strategies are lacking, we explored this in Study 1.

Study 1 therefore includes exploratory and confirmatory analyses, whereas Study 2 was designed to replicate the findings of Study 1. We used this approach to improve the quality, reproducibility, and reliability of our findings (Open Science Collaboration, 2015). Both studies received ethical approval from the University ethics committee, and all materials and data are available via the Open Science Framework (Study 1: https://osf.io/9ksdq/?view_only=24489f9a78184496bf12d845d5e06de9; Study 2: https://osf.io/e8c6j/?view_only=a10bd615d1ae4d608746326fd704194d). This research has the potential to provide a foundation for future research and nature interventions aimed at enhancing emotion regulation and mental wellbeing.

2. Study 1

Study 1 aimed to test and extend Vitale and Bonaiuto (2024). Our only confirmatory hypothesis in Study 1 was that greater nature exposure/nature connectedness would be associated with increased reappraisal, and that increased reappraisal would mediate the positive associations between nature exposure/nature connectedness and mental wellbeing.

2.1 Study 1 methods

2.1.1 Study 1 participants

Koopman et al., (2015) conducted a simulation study and concluded that, for detecting indirect effects in mediation models with sufficient statistical power and medium effect sizes, a minimum sample size of 100 participants is required (see also Maxwell, 2004). Given this recommendation, we exceeded this threshold to maximize statistical power and ensure reliable detection of indirect effects. Therefore, 171 participants (M_{age} = 28.73 years, SD_{age} = 14.73; 82% female) were recruited through the University subject pool in exchange for course credits (n = 104) as well as through social media (n = 67).

2.1.2 Study 1 materials

Nature connectedness. Participants' perceived connectedness with nature was measured through the Connectedness to Nature Scale (CNS; Mayer & Frantz, 2004). Participants rated 14 items (e.g., "I often feel a sense of oneness with the natural world around me") on a 5-point scale (1 = strongly disagree; 5 = strongly agree). Final scores are the mean of the 14 items (three items are reverse scored) with a higher score indicating increased connection to nature.

Nature exposure. Level of exposure to nature in everyday life was assessed using the Nature Exposure Scale II (NES-II: Swami et al., 2016; Wood et al., 2019). Participants rated six items (e.g., How much do you notice the environment in your everyday life?") on a scale ranging from 1 (*low/not much*) to 5 (*high/a great deal*). Final scores are the mean of the six items, with a higher score indicating greater exposure to nature.

Emotion regulation. Following Vitale and Bonaiuto (2024), we focused on emotion regulation strategies grounded in established theoretical frameworks (Gross, 1998, 2002; Garnefski et al., 2001), employing widely used and validated scales. Specifically, to assess participants' use of particular emotion regulation strategies, they completed the Emotion Regulation Questionnaire (ERQ: Gross & John 2003) and the Cognitive Emotional Regulation Questionnaire (CERQ: Garnefski et al., 2001; Garnefski & Kraaij, 2007). The ERQ includes four items measuring expressive suppression (e.g., "I keep my emotions to myself") and six items measuring cognitive reappraisal (e.g., "When I want to feel more positive emotion, I change the way I'm thinking about the situation") rated on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*).

The CERQ includes 36 items (four items per emotion regulation strategy) that measures acceptance (e.g., "I think that I have to accept that this has happened"), positive refocusing (e.g., "I think of nicer things that what I have experienced"), refocus on planning (e.g., "I think about what I can do best"), positive reappraisal (e.g., "I think I can learn something from the situation"), putting into perspective ("I think that it could have all been much worse"), self-blame (e.g., "I feel that I am the one to blame for it"), rumination (e.g., "I often think about how I feel about what I have experienced"), catastrophizing (e.g., "I keep thinking about how terrible it is what I have experienced"), and other-blame (e.g., "I feel that others are to blame for it": Garnefski & Kraaij, 2007) rated on a scale from 1 (*almost never*) to 5 (*almost always*). We do not report positive reappraisal or acceptance as the former is captured by the ERQ and because there is no consensus on whether acceptance should be considered an adaptive or maladaptive strategy (Bakir-Demir et al., 2021). Mean composite scores were computed for each strategy, with higher scores indicating greater use of that strategy.

Mental wellbeing. Mental wellbeing was operationalized as subjective wellbeing, which includes affective (i.e., the presence of positive emotions and the absence of negative emotions) and cognitive (i.e., the evaluation of one's life as satisfying: Diener et al., 1999; Diener, 2009) components. Specifically, subjective wellbeing was measured through the Satisfaction with Life Scale (SWLS: Diener et al., 1985), and the Positive Affect Negative Affect Schedule (PANAS: Watson et al., 1988). The SWLS is a 5-item questionnaire (e.g., "I am satisfied with my life") which assesses individuals' life satisfaction on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). The PANAS is a 20-item questionnaire to assess the degree of participants' positive and negative emotions in the past week (e.g., proud, nervous) on a scale from 1 (*Very slightly/not at all*) to 5 (*Extremely*). Following prior work, a composite subjective wellbeing score was calculated as a mean of z-scores for the SWL scale, the PANAS positive affect subscale and the reversed coded PANAS negative affect subscale (e.g., Medvedev & Landhuis, 2018). A higher score indicates greater mental wellbeing.[1]

2.1.3 Study 1 procedure

Participants gave consent, answered demographics questions, completed measures of nature connectedness, nature exposure, emotion regulation, life satisfaction, and affect, and were then debriefed. The study took approximately 20 minutes to complete in Qualtrics.

2.1.4 Study 1 data Analysis

To test and extend Vitale and Bonaiuto's (2024) first conceptual model, we conducted bivariate correlation analyses between nature exposure/nature connectedness and adaptive and maladaptive emotion regulation strategies. These correlation analyses—also including mental wellbeing—were then used to determine which variables to include in the mediation analyses testing their second and third models. Following established criteria (e.g., MacKinnon et al., 2007), only mediators that were significantly associated with both the independent and dependent variables were included in mediation analyses. Mediation analyses were conducted

[1] Measures relevant to the present research hypotheses are reported and analysed herein. In addition to the reported measures, a measure of personality (i.e., trait mindfulness) and a measure of common mental health problems was included in both studies to form the basis for undergraduate research projects. These measures are available via the OSF.

in SPSS PROCESS v4.3 using bootstrapping (with 5000 samples) to generate bias-corrected 95% confidence intervals.

2.2 Study 1 results

2.2.1 Study 1 descriptive statistics

Descriptive statistics and internal consistency coefficients for all study variables are presented in Table 1.

Table 1. *Descriptive statistics and Cronbach's alpha for study variables in Study 1*

Variable	*M*	*SD*	α
Nature connectedness	3.37	0.60	.86
Nature exposure	3.47	0.80	.79
Cognitive reappraisal	4.65	1.09	.89
Positive refocusing	3.09	0.80	.90
Refocus on planning	3.63	0.72	.81
Putting into perspective	3.62	0.87	.87
Expressive suppression	3.74	1.26	.77
Self-blame	3.29	0.81	.88
Rumination	3.46	0.73	.75
Catastrophizing	2.38	0.76	.72
Blaming others	2.37	0.83	.90
Positive affect	2.78	0.82	.90
Negative affect	2.28	0.77	.86
Life satisfaction	4.19	1.31	.87

2.2.2 Study 1 correlations between nature exposure/nature connectedness and emotion regulation

Consistent with our hypotheses, correlation analyses demonstrated that nature exposure and nature connectedness were both positively correlated with the use of reappraisal, although nature exposure and nature connectedness were also positively correlated with refocus on planning and putting into perspective, but were unrelated to positive refocusing, suppression, rumination, self-blame, other-blame, and catastrophizing (see Table 2 below).

2.2.3 Study 1 mediating effect of nature connectedness

Based on the correlations presented in Table 2, we next tested Vitale and Bonaiuto's (2024) second model, specifically the indirect effect of nature exposure on reappraisal, refocus on planning, and putting into perspective through nature connectedness (see Figure 1 below). Because nature connectedness was not correlation with any other emotion regulation strategies, no other mediation analyses were conducted.

Reappraisal. Nature exposure significantly predicted nature connectedness, and nature connectedness significantly predicted reappraisal. Thus, there was an indirect effect of nature exposure on reappraisal via nature connectedness (B = .19, SE = .06, 95% CI [.07, .30]). The direct effect between nature exposure and reappraisal was not significant.

Table 2. *Bivariate correlations for study variables in Study 1*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Nature Connectedness	—														
2. Nature Exposure	55**	—													
3. Cognitive Reappraisal	33**	30**	—												
4. Positive refocusing	.12	.12	45**	—											
5. Refocus on planning	38**	19*	60**	43**	—										
6. Putting into perspective	26**	29**	44**	31**	42**	—									
7. Expressive Suppression	-.03	-.06	-.10	-.07	-.04	.01	—								
8. Self-blame	.04	-.08	-.01	-.14	.11	.03	21*	—							
9. Rumination	.04	-.05	-.03	-.08	.09	-.12	-.06	.37**	—						
10. Catastrophizing	-.05	-.11	-.33**	-.07	-.28**	-.27**	.10	.21*	.22*	—					
11. Blaming others	-.11	-.08	-.18*	-.01	-.25**	-.24**	.00	-.13	.07	.36**	—				
12. Positive affect	29**	24**	.49**	.31**	.43**	.26**	-.23*	-.16*	-.13	-.16*	-.09	—			
13. Negative affect	-.10	-.22*	-.29**	-.30**	-.17*	-.23*	.22*	.39**	.37**	.32**	.09	.31**	—		
14. Life satisfaction	21*	35**	.40**	.18*	.22*	.25**	-.28**	-.25**	-.06	-.23*	-.16*	.46**	-.45**	—	
15. Mental wellbeing	.26**	35**	.51**	.34**	.35**	.32**	-.31**	-.34**	-.24**	-.31**	-.15	.76**	-.76**	.82**	—

Note. Mental wellbeing is the composite scale of subjective wellbeing combining the Satisfaction with Life and the PANAS Positive and reversed Negative affect scales. *p < .05. **$p \leq$ .001 (two-tailed).

Refocus on planning. Nature exposure significantly predicted nature connectedness, and nature connectedness significantly predicted refocus on planning. There was therefore an indirect effect of nature exposure on refocus on planning via nature connectedness (B = .19, SE = .05, 95% CI [.10, .28]). There was no direct effect of nature exposure on refocus on planning.

Putting into perspective. Nature exposure significantly predicted nature connectedness, but nature connectedness did not significantly predict putting into perspective. Hence, there was no indirect effect of nature exposure on putting into perspective via nature connectedness (B = .09, SE = .06, 95% CI [-.03, .21]). The direct effect of nature exposure on putting into perspective was significant.

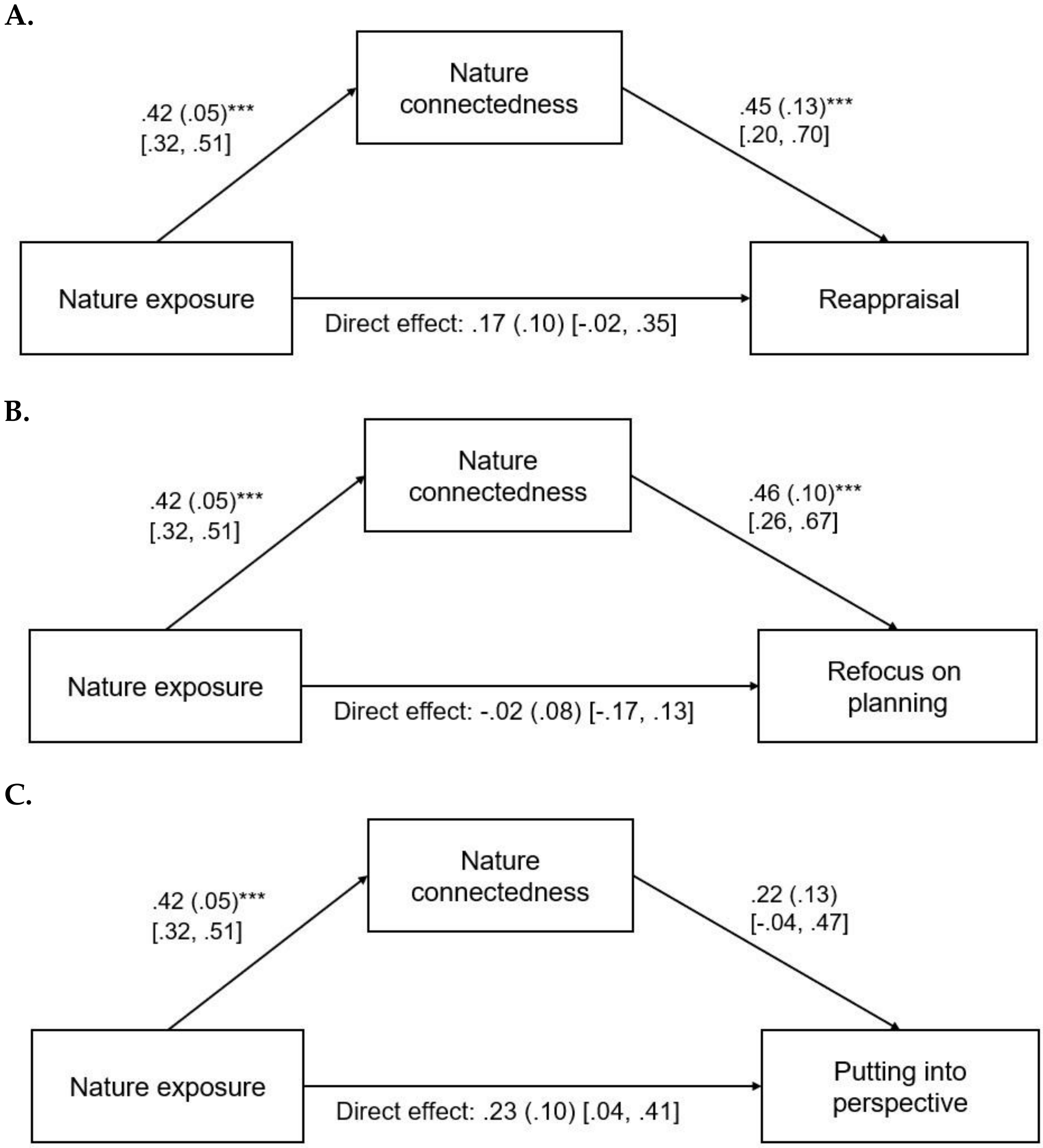

Figure 1. Mediation analysis in Study 1 of the effect of nature exposure on reappraisal (Panel A), refocus on planning (Panel B), and putting into perspective (Panel C) mediated through nature connectedness. $*p < 0.05$, $**p < 0.01$; $***p < 0.01$; unstandardized coefficients.

2.2.4 Study 1 mediating effects of emotion regulation strategies

In light of the correlations reported in Table 2, we then tested Vitale and Bonaiuto's (2024) third model, examining the indirect effects of nature exposure/nature connectedness on mental wellbeing via reappraisal, refocus on planning, and putting into perspective (see Figure 2 below). No other mediation analyses were conducted, as nature exposure/nature connectedness were not correlated with any other emotion regulation strategies.

Nature exposure significantly predicted reappraisal, and reappraisal significantly predicted mental wellbeing. Thus, there was an indirect effect of nature exposure on mental wellbeing via reappraisal (B = .11, SE = .05, 95% CI [.03, .20]), supporting our hypotheses. However, although nature exposure significantly predicted refocus on planning, refocus on planning did not predict mental wellbeing. Therefore, there was no indirect effect of nature exposure on mental wellbeing through refocus on planning (B = .01, SE = .02, 95% CI [-.03, .05]). Likewise, whilst nature exposure significantly predicted putting into perspective, putting into perspective did not predict mental wellbeing. Therefore, there was no indirect effect of nature exposure on mental wellbeing via putting into perspective (B = .02, SE = .02, 95% CI [-.02, .07]). There was a significant total effect between nature exposure and mental wellbeing, and the direct effect was also significant.

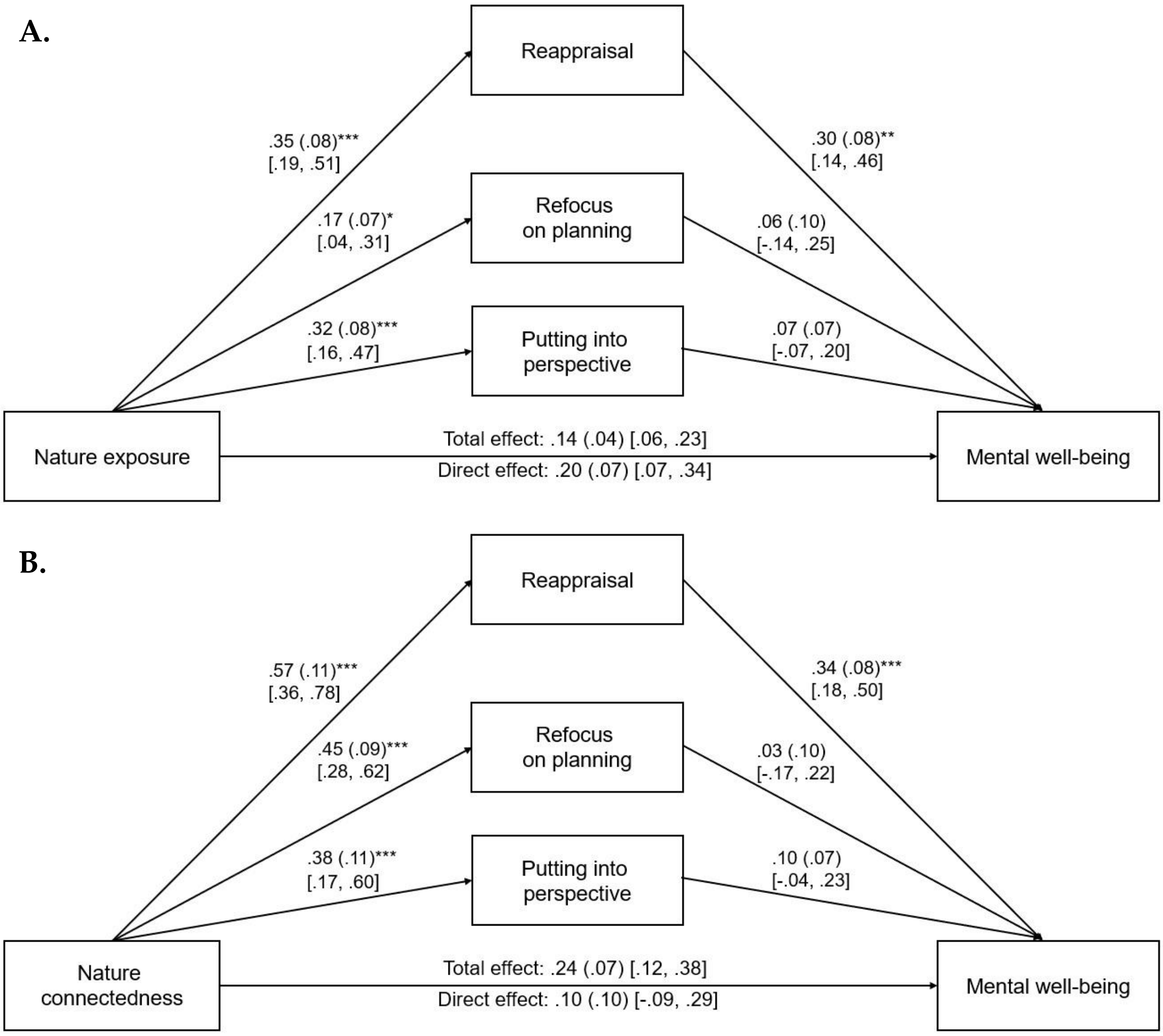

Figure 2. Mediation analysis in Study 1 of the effect of nature exposure (Panel A) and nature connectedness (Panel B) on mental wellbeing mediated through reappraisal, refocus on planning, and putting into perspective. $*p < 0.05$, $**p < 0.01$; $***p < 0.01$; unstandardized coefficients.

In terms of nature connectedness, nature connectedness significantly predicted reappraisal, and reappraisal significantly predicted mental wellbeing. Thus, there was an indirect effect of nature connectedness on mental wellbeing via reappraisal (B = .19, SE = .07, 95% CI [.07, .33]), supporting our predictions. However, even though nature connectedness significantly predicted refocus on planning, refocus on planning did not predict mental wellbeing, and there was therefore no indirect effect of nature connectedness on mental wellbeing through refocus on planning (B = .01, SE = .04, 95% CI [-.08, .10]). Moreover, nature connectedness significantly predicted putting into perspective, but putting into perspective did not predict mental wellbeing. Thus, there was no indirect effect of nature connectedness on mental wellbeing via putting into perspective (B = .04, SE = .03, 95% CI [-.02, .10]). There was a significant total effect between nature connectedness and mental wellbeing, but the direct effect was not significant.

2.3 Study 1 discussion

Study 1 showed positive correlations between nature exposure/nature connectedness and reappraisal, refocus on planning, and perspective taking, but not with positive refocusing, suppression, rumination, self-blame, other-blame, or catastrophizing. These data support our hypotheses, Vitale and Bonaiuto's (2024) first model, and studies linking nature exposure/nature connectedness to general/adaptive emotion regulation and specific strategies such as reappraisal (Bratman et al., 2024). However, our results diverge from Vitale and Bonaiuto (2024) and studies linking these nature variables to maladaptive strategies such as rumination (Bratman et al., 2015), but align with research that has not replicated these associations (Browning et al., 2023). Overall, we extend the limited and inconsistent literature by showing that nature may promote certain emotion regulation strategies but not others.

Study 1 further demonstrated that increased nature connectedness mediated the positive association between nature exposure and reappraisal/refocus on planning but not the association between nature exposure and other strategies such as putting into perspective. Although we did not hypothesise these associations in Study 1, our findings support Vitale and Bonaiuto's (2024) second model and prior evidence that nature connectedness mediates the link between nature exposure and general emotion regulation (Bakir-Demir et al., 2019). We extend this work by showing that this applies to specific strategies such as reappraisal and refocus on planning.

Finally, Study 1 found that increased reappraisal– but not other strategies– mediated the positive associations between nature exposure/nature connectedness and mental wellbeing, supporting our hypotheses. These data support Vitale and Bonaiuto's (2024) third model and evidence that general/adaptive emotion regulation mediate the link between nature connectedness and mental wellbeing, but are inconsistent with the idea that maladaptive emotion regulation also mediates this link (Bakir-Demir et al., 2021). Notably, we extend prior work by showing that only reappraisal appears to explain the link between nature connectedness and mental wellbeing, as well as the link between nature exposure and mental wellbeing. The latter supports recent evidence by Bratman et al. (2024) who found indirect effects of nature contact on mental wellbeing outcomes via increased reappraisal, but does not support their indirect effects of nature contact on these outcomes via reduced rumination.

3. Study 2

We conducted a second study, using the same measures as in Study 1, to replicate and confirm its findings, given that the methodological diversity in past research on nature, emotion regulation, and mental wellbeing may account for previous inconsistent findings (Ríos-Rodríguez et al., 2024; Vitale & Bonaiuto, 2024). Due to the significant positive correlations between nature exposure/nature connectedness and reappraisal in Study 1, and because increased reappraisal mediated the positive association between nature exposure/nature connectedness and mental wellbeing, we expected to replicate these findings in Study 2. Moreover, although nature exposure/nature connectedness were positively associated with putting into perspective and refocus on planning in Study 1, these strategies did not mediate the relationship between nature exposure/nature connectedness and mental wellbeing. We therefore explored these associations in Study 2 rather than stating a hypothesis. Finally, because nature connectedness mediated the association between nature exposure and reappraisal/refocus on planning (but not putting into perspective) in Study 1, we expected to replicate these findings in

Study 2. To test this, participants in Study 2 completed measures of nature exposure, nature connectedness, reappraisal, putting into perspective, refocus on planning, and mental wellbeing. No additional emotion regulation strategies were included in Study 2, as they showed no significant associations in Study 1.

3.1 Study 2 methods

3.1.1 Study 2 participants

We used the same approach as in Study 1 to determine our target sample size. As such, 170 undergraduate students were recruited in exchange for course credits. Participants were mostly white females (M_{age} = 22.27 years, SD_{age} = 5.32; 131 females, 37 males, 1 non-binary, 1 prefer not to say; 42% White, 33% Hispanic/Latino, 14% Asian American/British, 7% Mixed/Multiple/Other Ethnic Group, 3% Black American/British, and 2% Native Hawaiian/Pacific Islander).

3.1.2 Study 2 materials

Nature connectedness and nature exposure. Participants completed the same nature connectedness and nature exposure measures as in Study 1.

Emotion regulation. Participants completed the ERQ reappraisal subscale and the CERQ refocus on planning and putting into perspective subscales described in Study 1.

Mental wellbeing. As in Study 1, participants completed measures of life satisfaction and affect, which were used to calculate a composite mental wellbeing score.[1]

3.1.3 Study 2 procedure

The procedure was identical to Study 1's procedure except that participants in Study 2 only completed the reappraisal subscale of the ERQ and the putting into perspective and refocus on planning subscales of the CERQ. The study took 15 minutes to complete.

3.1.4 Study 2 data analysis

To replicate Study 1, we used the same analytic approach, conducting correlation analyses followed by mediation analyses using SPSS PROCESS.

3.2 Study 2 results

3.2.1 Study 2 descriptive statistics

Descriptive statistics and internal consistency coefficients for all study variables are presented in Table 3 (below).

3.2.2 Study 2 correlations between nature exposure/nature connectedness and emotion regulation

In replicating Study 1, correlation analyses showed that nature exposure and nature connectedness were positively correlated with reappraisal in Study 2, supporting our hypotheses. Moreover, consistent with Study 1, nature connectedness was positively correlated with refocus on planning, although nature exposure was not correlated with refocus on planning, inconsistent with Study 1. Nature exposure and nature connectedness were unrelated to putting into perspective, inconsistent with Study 1 (see Table 4 below).

Table 3. *Descriptive statistics and Cronbach's alpha for study variables in Study 2*

Variable	*M*	*SD*	α
Nature connectedness	3.44	0.46	.73
Nature exposure	3.56	0.64	.64
Cognitive reappraisal	4.75	1.02	.80
Refocus on planning	3.77	0.65	.71
Putting into perspective	3.70	0.78	.80
Positive affect	3.06	0.78	.88
Negative affect	2.39	0.72	.83
Life satisfaction	4.08	1.40	.88

Table 4. *Bivariate correlations for study variables in Study 2*

Variable	1	2	3	4	5	6	7	8	9
1. Nature Connectedness	—								
2. Nature Exposure	.27**	—							
3. Cognitive Reappraisal	.24**	.18*	—						
4. Refocus on planning	.31**	.11	.58**	—					
5. Putting into perspective	.04	-.02	.16*	.16*	—				
6. Positive affect	.24*	.24*	.29**	.41**	.06	—			
7. Negative affect	-.10	-.10	-.18*	-.09	.01	-.31**	—		
8. Life satisfaction	.19*	.23*	.24*	.31**	.11	.51**	-.46**	—	
9. Mental wellbeing	.22*	.24**	.30**	.35**	.07	.77**	-.75**	.83**	—

Note. Mental wellbeing is the composite scale of subjective wellbeing combining the Satisfaction with Life and the PANAS Positive and reversed Negative affect scales. $^{*}p < .05$. $^{**}p \leq .001$ (two-tailed).

3.2.3 Study 2 mediating effect of nature connectedness

We next aimed to replicate the indirect effect of nature exposure on reappraisal/refocus on planning via nature connectedness found in Study 1 (see Figure 3 below). Because nature connectedness was not correlated with putting into perspective in Study 2, we did not test this indirect effect.

Reappraisal. Nature exposure significantly predicted nature connectedness, and nature connectedness significantly predicted reappraisal. Thus, in line with our hypotheses and Study 1, there was an indirect effect of nature exposure on reappraisal via nature connectedness (B = .09, SE = .05, 95% CI [.02, .20]). There was no significant direct effect between nature exposure and reappraisal.

Refocus on planning. Nature exposure significantly predicted nature connectedness, and nature connectedness significantly predicted refocus on planning. There was therefore an indirect effect of nature exposure on refocus on planning via nature connectedness (B = .08, SE =

.03, 95% CI [.03, .16]), consistent with our hypotheses and Study 1. There was no significant direct effect of nature exposure on refocus on planning.

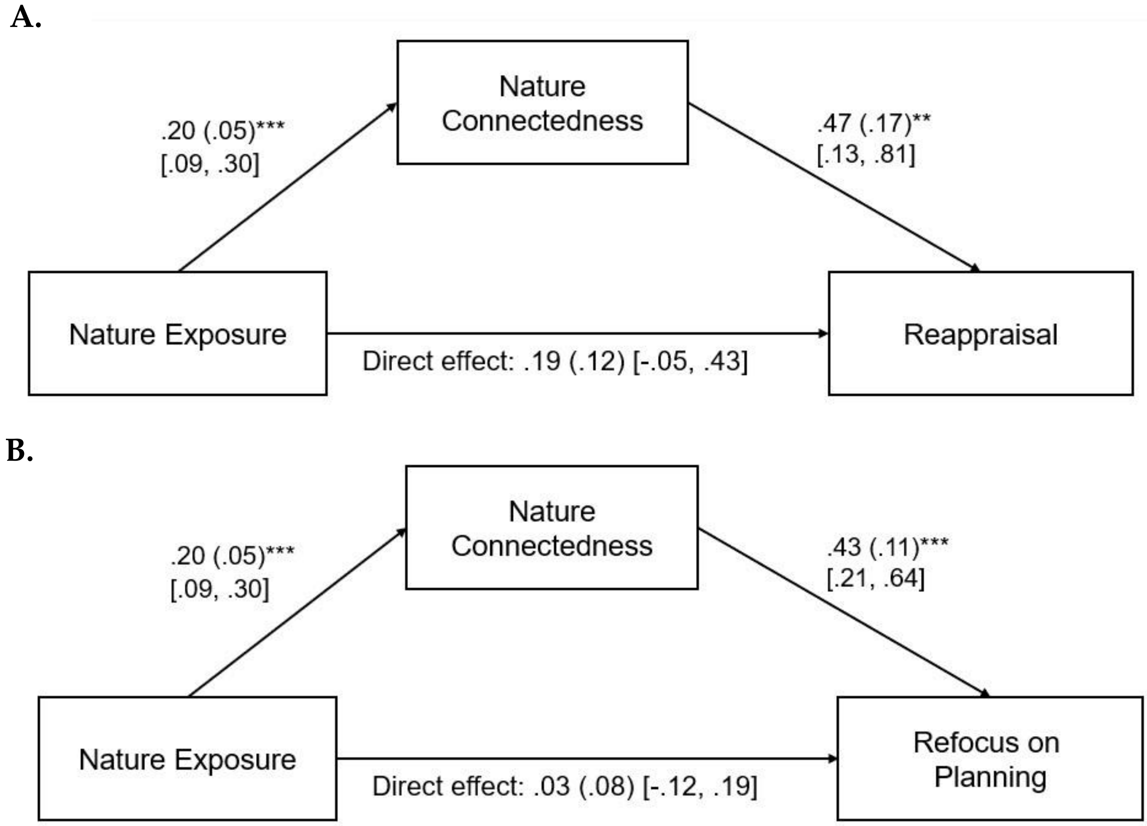

Figure 3. Mediation analysis in Study 2 of the effect of nature exposure on reappraisal (Panel A) and refocus on planning (Panel B) mediated through nature connectedness. $*p < 0.05$, $**p < 0.01$; $***p < 0.01$; unstandardized coefficients.

3.2.4 Study 2 mediating effects of emotion regulation strategies

We next sought to replicate the indirect effects of nature exposure and nature connectedness on mental wellbeing via reappraisal observed in Study 1. Furthermore, based on the correlations reported in Table 4, we also tested the indirect effect of nature connectedness on mental wellbeing via refocus on planning, extending Study 1's findings (see Figure 4 below). No other indirect effects were examined because nature exposure and nature connectedness were unrelated to putting into perspective.

Nature exposure significantly predicted reappraisal, and reappraisal significantly predicted mental wellbeing. Thus, there was an indirect effect of nature exposure on mental wellbeing via reappraisal (B = .06, SE = .03, 95% CI [.002, .13]), replicating Study 1 and supporting our hypotheses. There was also a significant direct effect between nature exposure and mental wellbeing.

In terms of nature connectedness, nature connectedness significantly predicted reappraisal, and reappraisal significantly predicted mental wellbeing. There was therefore an indirect effect of nature connectedness on mental wellbeing via reappraisal (B = .11, SE = .05, 95% CI [.03, .23]), consistent with Study 1 and our predictions. There was a significant direct effect between nature connectedness and mental wellbeing. Finally, in extending Study 1, nature connectedness predicted refocus on planning, and refocus on planning predicted mental wellbeing. Thus, there was an indirect effect of nature connectedness on mental wellbeing through refocus on planning

(B = .16, SE = .06, 95% CI [.06, .28]). There was no significant direct effect between nature connectedness and mental wellbeing.

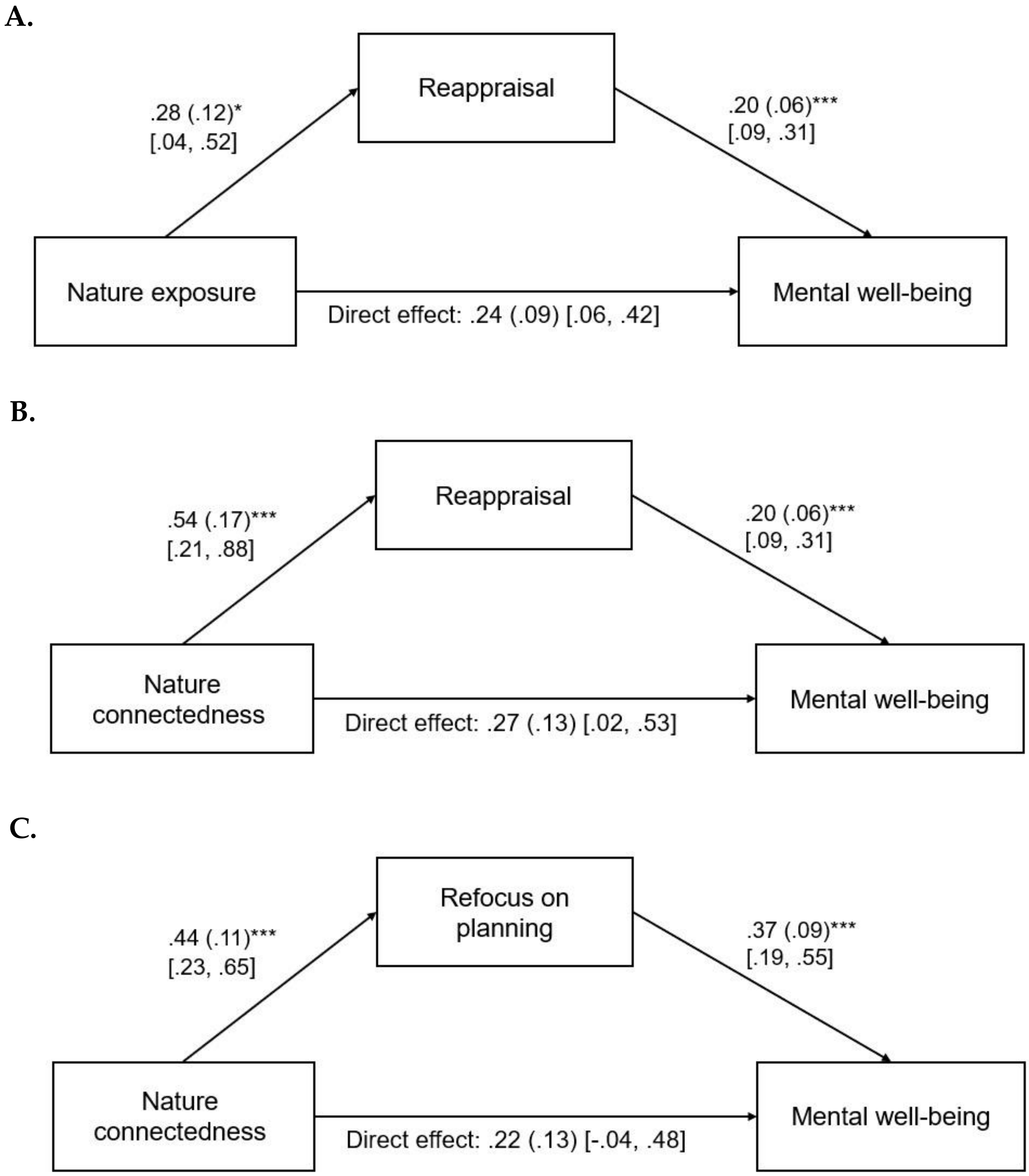

Figure 4. Mediation analysis in Study 2 of the effect of nature exposure (Panel A) and nature connectedness (Panel B) on mental wellbeing mediated through reappraisal, as well as the effect of nature connectedness on mental wellbeing through refocus on planning (Panel C). $*p < 0.05$, $**p < 0.01$; $***p < 0.01$; unstandardized coefficients.

3.3 Study 2 discussion

Study 2 showed that nature exposure/nature connectedness were positively correlated with reappraisal, supporting Study 1 and our hypotheses. Consistent with Study 1, nature connectedness was also positively correlated with refocus on planning. However, unlike Study 1, nature exposure was unrelated to refocus on planning, and nature exposure/nature connectedness were unrelated to putting into perspective. Thus, by supporting and extending

Vitale and Bonaiuto's (2024) model and prior work (Bratman et al., 2024), our two studies provide strong evidence that greater nature exposure and nature connectedness may specifically promote increased reappraisal, and that greater nature connectedness may promote increased refocusing on planning. It seems less clear, however, whether nature exposure is linked to refocus on planning and whether nature exposure/nature connectedness are linked to putting into perspective.

Study 2 yielded indirect effects of nature exposure on reappraisal and refocus on planning via nature connectedness, in line with Study 1 and our hypotheses. These data support Vitale and Bonaiuto's (2024) framework and studies showing that nature connectedness mediates the relationship between nature exposure and general emotion regulation (Bakir-Demir et al., 2019). Notably, we extend this work by finding robust evidence that increased nature exposure facilitates greater use of reappraisal/refocus on planning by increasing nature connectedness, but that nature connectedness does not explain the association between nature exposure and other strategies such as putting into perspective.

Importantly, we found indirect effects of nature exposure/nature connectedness on mental wellbeing via reappraisal in Study 2, supporting Study 1 and our hypotheses. Additionally, in extending Study 1, we found an indirect effect of nature connectedness on mental wellbeing via refocus on planning. These findings support and extend Vitale and Bonaiuto's (2024) model and research proposing indirect effects of nature connectedness on mental wellbeing via general/adaptive emotion regulation, and align with recent work showing indirect effects of nature contact on mental wellbeing via reappraisal (Bratman et al., 2024). Hence, across two studies, we found convincing evidence that nature exposure *and* nature connectedness may both facilitate mental wellbeing by promoting increased reappraisal, and there was also some less convincing evidence in Study 2 that nature connectedness may facilitate mental wellbeing by promoting increased refocus on planning.

4. General Discussion

Two studies tested three paths by which nature exposure and nature connectedness may promote emotion regulation strategies and mental wellbeing (Vitale & Bonaiuto, 2024). Specifically, we tested the associations between nature exposure/nature connectedness and adaptive and maladaptive emotion regulation strategies; the indirect effect of nature exposure on adaptive and maladaptive emotion regulation strategies via nature connectedness; as well as the indirect effect of nature exposure/nature connectedness on mental wellbeing via adaptive and maladaptive emotion regulation strategies. Study 1 included both exploratory and confirmatory analyses, whereas Study 2 aimed at replicating the findings of Study 1. Both studies yielded positive associations between nature exposure/nature connectedness and reappraisal, and between nature connectedness and refocus on planning. Study 1 also found positive associations between nature exposure/nature connectedness and putting into perspective, and between nature exposure and refocus on planning. Moreover, both studies demonstrated indirect effects of nature exposure on reappraisal/refocus on planning via nature connectedness. Finally, both studies showed indirect effects of nature exposure/nature connectedness on mental wellbeing via reappraisal, and Study 2 found an indirect effect of nature connectedness on mental wellbeing through refocus on planning.

4.1 Nature exposure, nature connectedness, and emotion regulation strategies

Across studies, we found positive associations between nature exposure/nature connectedness and mental wellbeing. These findings replicate studies showing that nature exposure promotes increased subjective wellbeing and positive affect (Berman et al., 2012; Hartig et al., 2003; Passmore & Holder, 2017; White et al., 2021), and studies showing that nature connectedness predicts enhanced hedonic/eudaimonic wellbeing (Capaldi et al., 2014, Capaldi et al., 2015; Pritchard et al., 2020), perhaps because nature exposure/nature connectedness reduce mental fatigue and stress and improve attentional capacity, as proposed by the ART and the SRT (Kaplan & Kaplan, 1989; Kaplan, 1995; Ulrich, 1991; Ulrich et al., 2023). We also extend prior work as studies examining the role of nature exposure and nature connectedness in mental wellbeing in a single study are scarce. When including measures of both, Study 1 showed that the correlation between nature exposure and mental wellbeing was somewhat stronger than the one between nature connectedness and mental wellbeing (nature exposure: r = 35; nature connectedness: r = .26), although the correlations were similar in magnitude in Study 2 (nature exposure: r = .24; nature connectedness: r = .22). Thus, even though nature exposure and nature connectedness both facilitate mental wellbeing, it remains unclear which variable more strongly predict mental wellbeing. It should be noted, however, that our data was collected throughout the year, and we did not consider the potential impact of environmental conditions, which could explain the stronger correlation in Study 1. For example, because nature exposure improves mental wellbeing during heatwaves (Lafortezza et al., 2009), future studies could collect weather data to test whether the links between nature exposure/nature connectedness and mental wellbeing depend on environmental conditions.

Importantly, in both studies, we found positive associations between nature exposure/nature connectedness and reappraisal, consistent with our hypotheses. These findings align with recent research proposing that nature exposure and nature-related aspects such as nature connectedness may promote more frequent use of reappraisal (Bratman et al., 2021; Gu et al., 2023; Vitale & Bonaiuto, 2024), although our findings add to this work as only a few studies have directly examined the correlations between nature exposure/nature connectedness and reappraisal (Bratman et al., 2024; Fido et al., 2020; Gu et al., 2023). One possible explanation for why nature may promote increased reappraisal comes from Bratman et al. (2021) who proposed that natural settings provide a low-stress environment, making it easier for people to successfully engage in reappraisal. Thus, because we found robust evidence to link greater nature exposure/nature connectedness with increased reappraisal, future studies should extend this work by testing the causal impact of nature exposure/nature connectedness on reappraisal, and whether this is explained by lower stress.

Moreover, in Study 1 we found that nature exposure and nature connectedness were positively correlated with the adaptive emotion regulation strategies of refocus on planning and putting into perspective. While no prior quantitative studies have examined the associations between nature exposure/nature connectedness and these strategies, our findings corroborate a qualitative study showing that participants reported putting things into perspective and reflecting on their life, problems, and emotions while being at the coast (Severin et al., 2022). Thus, these findings indicate that being exposed to nature and feeling connected to nature may promote increased planning, perspective taking, reflection and coping with problems (see also Mayer et al., 2009). An interesting avenue for future research would be to test whether the impact of nature exposure/nature connectedness on refocus on planning and putting into perspective directly translate into problem-solving ability.

Furthermore, while the correlation between nature connectedness and refocus on planning replicated in Study 2, the correlation between nature exposure and refocus on planning as well as the correlations between nature exposure/nature connectedness and putting into perspective, did not replicate in Study 2. These inconsistent results could be due to differences in sample characteristics between our studies. For example, compared to our younger participants in Study 2 (M_{age} = 22.27), our slightly older participants in Study 1 (M_{age} = 28.73) might be faced with somewhat different and potentially more complex life challenges (e.g., family, financial), and may therefore be particularly motivated to seek out nature to reflect on these challenges. Nonetheless, given these mixed findings and that research on nature and specific emotion regulation strategies is still in its nascent stage, future work must replicate these finding before any conclusions can be drawn. Once these findings have been confirmed, studies could consider exploring other factors that may influence the links between nature exposure/nature connectedness and refocus on planning and putting into perspective (e.g., motivation to engage with nature: Lee et al., 2022).

In contrast, nature exposure and nature connectedness were unrelated to positive refocusing in Study 1, and we did therefore not include this subscale in Study 2. While there seem to be some overlap between positive refocusing and reappraisal, these strategies are in fact distinct. That is, positive refocusing involves thinking about pleasant unrelated things *instead* of the negative event (e.g., "I think of something nice instead of what has happened"), while reappraisal involves changing the *meaning* of the negative event to alter the emotional experience (e.g., "When I'm faced with a stressful situation, I make myself think about it in a way that helps me stay calm"; Garnefski et al., 2001; Garnefski et al., 2002; Gross & John, 2003). Perhaps natural environments offer an important space for re-interpreting negative experiences rather than substituting thoughts about negative experiences with positive ones, although this speculation warrants further investigation.

Interestingly, despite the proposition that nature may promote less use of maladaptive emotion regulation strategies (Bratman et al., 2021; Vitale & Bonaiuto, 2024), nature exposure and nature connectedness were not correlated with any maladaptive emotion regulation strategies assessed herein including suppression, rumination, self-blame, other-blame, and catastrophizing. These data are inconsistent with studies that have found that nature exposure/nature connectedness predict decreased rumination and suppression (Beute & de Cort, 2018; Bratman et al., 2015, 2024; Gu et al., 2023), but are consistent with studies that have failed to find associations between nature exposure/nature connectedness and these strategies (Browning et al., 2023; Golding et al., 2018; Fido et al., 2020; Gu et al., 2023). However, our data extend prior work by showing that nature exposure/nature connectedness are also unrelated to other maladaptive emotion regulation styles such as self-blame, other-blame, and catastrophizing. Thus, nature exposure and nature connectedness may increase the use of specific adaptive emotion regulation strategies such as reappraisal rather than decreasing the use of maladaptive emotion regulation ones.

One potential reason for this comes from Bakir-Demir et al. (2021) who proposed that, whilst nature strongly promotes positive outcomes, it may not be sufficient to filter out negative outcomes. This also aligns with meta-analytic findings showing that the effect of nature exposure on positive affect is moderate, while the effect of nature exposure on negative affect is small (McMahan & Estes, 2015), as well as research showing that nature connectedness is positively associated with positive affect but unrelated to negative affect (Nisbet et al., 2011). Future research should explore the circumstances under which nature exposure/nature connectedness influence maladaptive emotion regulation. They could, for example, assess the role of individual differences (e.g., awareness of the surrounding environment: Bakir-Demir et al., 2021), given the importance of considering personality when examining the psychological/affective benefits of nature (Capaldi et al., 2014).

4.2 Mediating effect of nature connectedness

In both studies, we found a positive bivariate correlation between nature exposure and nature connectedness, although this correlation was large in Study 1 and small-to-medium in Study 2. The former finding replicates prior studies that have found a moderate-to-large positive correlation between these variables (e.g., Baceviciene et al., 2021; Picanço et al., 2024; but see Swami et al., 2024), whereas the latter replicates studies that have found a weak-to-moderate correlation between these variables (e.g., Fränkel et al., 2019; Martin et al., 2020). Broadly, these results support the view that, when people are exposed to nature, they also feel a sense of connectedness to the natural world (Mayer et al., 2009).

More importantly, both studies showed that increased nature connectedness mediated the association between high nature exposure and greater use of reappraisal and refocus on planning, supporting our hypotheses. These results are consistent with research showing that nature exposure predicts increased nature connectedness (Nisbet & Zelenski, 2011), and support Vitale and Bonaiuto's (2024) second conceptual model and research showing that nature connectedness mediates the association between nature exposure and general emotion regulation (Bakir-Demir et al., 2019). Notably, we extend prior work by finding robust evidence that people who are more frequently exposed to nature engage more in the specific adaptive emotion regulation strategies of reappraisal and refocus on planning because they feel a sense of connectedness to nature. Future studies could build on these findings by including additional nature-related mediators (e.g., environmental attitudes: Schultz, 2001) that may explain the links between nature exposure, nature connectedness, and the use of these and other emotion regulation strategies.

In contrast, despite significant correlations between nature exposure, nature connectedness, and putting into perspective in Study 1, there was no indirect effect of nature exposure on putting into perspective through nature connectedness. Likewise, there was no evidence for this indirect effect in Study 2. Thus, inconsistent with Vitale and Bonaiuto (2024), nature exposure does not seem to promote increased use of putting into perspective (or any other emotion regulation strategies assessed herein) by increasing nature connectedness. Of course, we might have missed an indirect effect of nature exposure on putting into perspective via nature connectedness given that our study was powered to detect medium effects (in line with Koopman et al., 2015). Future research could conduct studies that have the power to detect a small indirect effect of nature exposure on putting into perspective through nature connectedness, although it is questionable whether small effects should be considered meaningful (e.g., Tornquist et al., 2024).

4.3 Mediating effect of emotion regulation strategies

Across studies, we found that increased reappraisal mediated the positive relationship between nature exposure/nature connectedness and mental wellbeing, supporting Vitale and Bonaiuto's (2024) third model and our hypotheses. These data align with prior research that has found that a composite score of adaptive emotion regulation and emotion regulation difficulties mediate the association between nature connectedness and mental wellbeing (Bakir-Demir et al., 2021; Richardson & McEwan, 2018), and a recent study showing that reappraisal mediates the relationship between nature contact and mental wellbeing (Bratman et al., 2024). Importantly, our results extend prior work as none of these studies have measured nature exposure *and* nature connectedness or various emotion regulation strategies when examining the indirect effect of nature on mental wellbeing through emotion regulation. Thus, we found compelling evidence that people who spend more time in nature and who feel more connected to nature report greater mental wellbeing because they positively reappraise their thoughts and emotions more frequently.

Furthermore, the framework put forward by Bratman et al. (2021) as well as the ART and SRT (Kaplan, 1995; Ulrich et al., 1999) together propose that nature provides a low-stress environment that restores mental fatigue and improves attentional capacity/stress, which may encourage or discourage emotion regulation strategies. Our findings contribute to these perspectives by linking nature exposure/nature connectedness and mental wellbeing with reappraisal specifically. That is, our results might suggest that, if nature indeed reduces mental fatigue and improves attentional capacity/stress, then this may provide people with additional capacity to successfully reappraise their thoughts and feelings, which subsequently enhance their mental wellbeing. Future studies could extend our work by testing the influence of variables such as attentional capacity (e.g., Mayer et al., 2009) on reappraisal and mental wellbeing via multiple pathways in more complex structural equation models. Moreover, it would be interesting to test the influence of different types of nature exposure on reappraisal and wellbeing. For example, White et al., (2021) found that visiting green spaces more strongly predicted enhanced mental health than visiting inland and coastal blue spaces.

Whilst Study 1 found no evidence that any other adaptive emotion regulation strategies assessed herein mediated the relationship between nature exposure/nature connectedness and mental wellbeing, Study 2 found an indirect effect of nature connectedness on mental wellbeing through refocus on planning. This finding suggests that people who feel more connected to nature report greater mental wellbeing because they are more likely to think about the steps necessary to handle negative situations. These data support perspectives highlighting that nature promotes reflection on problems (Mayer et al., 2009), and qualitative research showing that people put things into perspective and reflect on their problems while being at the coast (Severin et al., 2022), although we extend this work as no studies have tested whether refocus on planning mediates the relationship between nature and mental wellbeing. It is important to note, however, that we only found this indirect effect in Study 2. Future studies need to determine whether refocus on planning (and similar strategies such as positive refocusing and putting into perspective) mediate the link between nature exposure/nature connectedness and mental wellbeing.

Contrary to the view that maladaptive emotion regulation strategies may mediate the association between nature-related variables such as nature connectedness and mental wellbeing (Vitale & Bonaiuto, 2024), we found no evidence that maladaptive emotion regulation strategies (suppression, rumination, self-blame, blaming others, and catastrophizing) explain the relationship between nature exposure/nature connectedness and mental wellbeing. These findings are inconsistent with studies demonstrating that emotion regulation difficulties mediate the association between nature connectedness and happiness (Richardson & McEwan, 2018), and that rumination mediates the association between nature contact and negative affect, emotional ill-being, and wellbeing (Bratman et al., 2021, 2024). These findings are, however, consistent with research that has failed to find an indirect effect of nature connectedness on stress through maladaptive emotion regulation strategies (Bakir-Demir et al., 2021). Thus, nature exposure and nature connectedness seem to promote enhanced mental wellbeing by encouraging increased use of adaptive emotion regulation strategies such as reappraisal rather than discouraging the use of maladaptive ones, consistent with the view that nature might be better at facilitating positive outcomes as opposed to eliminating negative ones (Bakir-Demir et al., 2021).

4.4 Limitations

Whilst we used Vitale and Bonaiuto's (2024) conceptual framework to make predictions about the direction of the relationships in our mediation models, a limitation that has yet to be addressed is our cross-sectional design and the reciprocal relationships between our variables. For example, we hypothesised that nature exposure/nature connectedness would predict mental wellbeing through adaptive and maladaptive emotion regulation strategies, although adaptive and maladaptive emotion regulation strategies may in fact predict mental wellbeing through nature exposure/nature connectedness. This illustrates the need for future experimental and longitudinal studies to establish causality between these variables. Moreover, although we tested the mediating role of emotion regulation strategies in the relationship between nature exposure/nature connectedness and mental wellbeing, future studies could test the moderating role of these strategies in this relationship (Theodorou et al., 2023). In addition, we relied on self-reports in our studies, which may be subject to social desirability and recall bias. Future research could, for example, use more objective measures of mental wellbeing (Voukelatou et al., 2021).

Across studies, we used assessments tools identified by Vitale and Bonaiuto (2024), on which we based our work. However, other research indicates that some items in the Connectedness to Nature Scale measure cognitive beliefs of nature connection rather than an affective relationship with nature (Perrin & Benassi, 2009). This may explain the stronger correlations between nature connectedness and cognitive forms of emotion regulation strategies such as reappraisal and refocus on planning, compared to the correlations between nature exposure and these strategies, as well as some inconsistent results between our studies. However, it does not explain the stronger correlation between nature exposure and putting into perspective in Study 1. Future studies should seek to replicate these findings while assessing people's affective relationship with nature more directly, for example, by using the Nature Relatedness Scale (Nisbet et al., 2009) or the Nature Connection Index (Richardson et al., 2019).

Based on recommendations by Vitale and Bonaiuto (2024), we focused on emotion regulation strategies grounded in established emotion regulation concepts and theories. That is, following Gross (1998, 2002) and Garnefski et al. (2001), we examined suppression, reappraisal, positive refocusing, refocus on planning, putting into perspective, self-blame, catastrophizing, and other-blame. However, Bratman et al. (2024) observed a significant association between increased nature contact and lesser use of distraction, indicating that it may be important to include other emotion regulation strategies not examined herein, such as distraction.

Finally, given that young people tend to score particularly low on nature-related variables and mental wellbeing (Blanchflower et al., 2025; Richardson et al., 2019), we specifically examined the associations between nature exposure/nature connectedness, emotion regulation, and mental wellbeing in this population. In our studies, the score for nature exposure (Study 1 M =3.47; Study 2 M = 3.56) and nature connectedness (Study 1 M =3.37; Study 2 M = 3.44) were around the midpoint of the 5-point scales, indicating average levels in both studies. However, future research is needed to determine the generalizability of these findings to other populations, such as older individuals, who typically score higher on nature-related variables.

4.5 Implications

Our findings highlight the importance of ensuring that people have access to natural environments and encouraging them to spend more time in these environments to improve their mental wellbeing through increasing their use of the adaptive emotion regulation strategy of reappraisal. For example, research indicates that nature-based interventions (e.g., gardening, visiting nature) increase people's mental and physical health (Shanahan et al., 2019). Our findings suggest that such interventions may also be promising in increasing people's use of reappraisal, thus boosting their mental wellbeing further given the well-established positive impact of reappraisal on mental wellbeing (Gross & John, 2003; McRae & Gross, 2020). However, assigning people to nature-based interventions may not always be feasible. In these cases, our results indicate that it may be valuable to target people's feelings of nature connectedness to increase their use of reappraisal (and perhaps refocus on planning) and mental wellbeing. For example, research has found that participating in environmental education, reflection, and meditation can increase nature connectedness (Lengieza & Swim, 2021), which may encourage increased reappraisal and improved mental wellbeing. Our focus on younger individuals suggests that they may be especially suitable for these interventions, which warrants further investigation.

4.6 Conclusions

This research is the first to examine three conceptual models by which nature exposure and nature connectedness may promote specific adaptive and maladaptive emotion regulation strategies and mental wellbeing. Our findings support and extend these models in several ways. In terms of the first model, we found robust evidence that nature exposure and nature connectedness are positively associated with reappraisal, and that nature connectedness is positively associated with refocus on planning. We also found less robust evidence that nature exposure and nature connectedness are positively associated with putting into perspective, and that nature exposure is positively associated with refocus on planning, although these findings require replication. Regarding the second model, results consistently showed that nature exposure encourages increased reappraisal and refocus on planning by increasing nature connectedness. Finally, in terms of the third model, compelling evidence showed that nature exposure and nature connectedness facilitate mental wellbeing by promoting increased reappraisal. There was also some less convincing evidence that nature connectedness facilitates mental wellbeing by promoting increased refocus on planning, although this needs to be confirmed through replication. This research has practical implications, highlighting the importance of targeting nature exposure/nature connectedness to increase people's use of reappraisal and mental wellbeing, particularly among younger individuals. Future research should examine the longitudinal/causal impact of nature exposure/nature connectedness on reappraisal and mental wellbeing in other populations, and the mediating/moderating effect of other factors in the relationship between nature exposure/nature connectedness, reappraisal, and mental wellbeing.

Authors

Michelle Tornquist
Department of Psychology, University of Liverpool, United Kingdom
https://orcid.org/0000-0002-2160-9662
m.tornquist@liverpool.ac.uk

Tara Johnson
Department of Psychology, University of Liverpool, United Kingdom

Author contribution statement

MT is responsible for the study conception and design. TJ assisted with data collection and the management of the study. MT analysed the data and wrote the manuscript with support from TJ.

Funding

No funding was received for conducting this study.

Conflict of interest statement

The authors report no conflicts of interest.

AI statement

AI was not used in study design, data analysis, interpretation, or manuscript writing. It was used only at the revision stage to improve clarity in a small number of sentences.

Data availability statement

All data and materials are available in the OSF repository (Study 1: https://osf.io/9ksdq/?view_only=24489f9a78184496bf12d845d5e06de9; Study 2: https://osf.io/e8c6j/?view_only=a10bd615d1ae4d608746326fd704194d).

Publishing Timeline

Received 5 June 2025
Revised version received 18 November 2025
Accepted 28 December 2025
Published 12 January 2026

References

Baceviciene, M., Jankauskiene, R., & Swami, V. (2021). Nature Exposure and Positive Body Image: A Cross-Sectional Study Examining the Mediating Roles of Physical Activity, Autonomous Motivation, Connectedness to Nature, and Perceived Restorativeness. *International Journal of Environmental Research and Public Health*, *18*(22), 12246. https://doi.org/10.3390/ijerph182212246

Bakir-Demir, T., Berument, S. K., & Akkaya, S. (2021). Nature connectedness boosts the bright side of emotion regulation, which in turn reduces stress. *Journal of Environmental Psychology*, *76*, 101642. https://doi.org/10.1016/j.jenvp.2021.101642

Bakir-Demir, T., Berument, S. K., & Sahin-Acar, B. (2019). The relationship between greenery and self-regulation of children: The mediation role of nature connectedness. *Journal of Environmental Psychology, 65,* 101327. https://doi.org/10.1016/j.jenvp.2019.101327

Berking, M., & Wupperman, P. (2012). Emotion regulation and mental health: recent findings, current challenges, and future directions. *Current Opinion in Psychiatry*, *25*(2), 128–134. https://doi.org/10.1097/YCO.0b013e3283503669

Berman, M. G., Kross, E., Krpan, K. M., Askren, M. K., Burson, A., Deldin, P. J., Kaplan, S., Sherdell, L., Gotlib, I. H., & Jonides, J. (2012). Interacting with nature improves cognition and affect for individuals with depression. *Journal of Affective Disorders*, *140*(3), 300–305. https://doi.org/10.1016/j.jad.2012.03.012

Beute, F., & de Kort, Y. A. W. (2018). Stopping the train of thought: A pilot study using an ecological momentary intervention with twice-daily exposure to natural versus urban scenes to lower stress and rumination. *Applied Psychology: Health and Well-Being, 10*(2), 236–253. https://doi.org/10.1111/aphw.12128

Bezold, C. P., Banay, R. F., Coull, B. A., Hart, J. E., James, P., Kubzansky, L. D., Missmer, S. A., & Laden, F. (2018). The Association Between Natural Environments and Depressive Symptoms in Adolescents Living in the United States. *The Journal of Adolescent Health: Official Publication of the Society for Adolescent Medicine*, *62*(4), 488–495. https://doi.org/10.1016/j.jadohealth.2017.10.008

Blanchflower, D. G., Bryson, A., & Xu, X. (2025). The declining mental health of the young and the global disappearance of the unhappiness hump shape in age. *PloS one*, *20*(8), e0327858. https://doi.org/10.1371/journal.pone.0327858

Bratman, G. N., Anderson, C. B., Berman, M. G., Cochran, B., de Vries, S., Flanders, J., Folke, C., Frumkin, H., Gross, J. J., Hartig, T., Kahn, P. H., Jr, Kuo, M., Lawler, J. J., Levin, P. S., Lindahl, T., Meyer-Lindenberg, A., Mitchell, R., Ouyang, Z., Roe, J., Scarlett, L., … Daily, G. C. (2019). Nature and mental health: An ecosystem service perspective. *Science Advances*, *5*(7), eaax0903. https://doi.org/10.1126/sciadv.aax0903

Bratman, G. N., Daily, G. C., Levy, B. J., & Gross, J. J. (2015). The benefits of nature experience: Improved affect and cognition. *Landscape and Urban Planning, 138*, 41–50. https://doi.org/10.1016/j.landurbplan.2015.02.005

Bratman, G. N., Young, G., Mehta, A., Lee Babineaux, I., Daily, G. C., & Gross, J. J. (2021). Affective Benefits of Nature Contact: The Role of Rumination. *Frontiers in Psychology*, *12*, 643866. https://doi.org/10.3389/fpsyg.2021.643866

Bratman, G. N., Olvera-Alvarez, H. A., & Gross, J. J. (2021). The affective benefits of nature exposure. *Social and Personality Psychology Compass*, *15*(8), e12630. https://doi.org/10.1111/spc3.12630

Bratman, G. N., Mehta, A., Olvera-Alvarez, H., Spink, K. M., Levy, C., White, M. P., Kubzansky, L. D., & Gross, J. J. (2024). Associations of nature contact with emotional ill-being and well-being: the role of emotion regulation. *Cognition & Emotion*, *38*(5), 748–767. https://doi.org/10.1080/02699931.2024.2316199

Browning, M. H. E. M., Shin, S., Drong, G., & others. (2023). Daily exposure to virtual nature reduces symptoms of anxiety in college students. *Scientific Reports, 13*, 1239. https://doi.org/10.1038/s41598-023-28070-9

Busseri, M. A. (2018). Examining the structure of subjective well-being through meta-analysis of the associations among positive affect, negative affect, and life satisfaction. *Personality and Individual Differences*, *122*, 68–71. https://doi.org/10.1016/j.paid.2017.10.003

Capaldi, C. A., Dopko, R. L., & Zelenski, J. M. (2014). The relationship between nature connectedness and happiness: A meta-analysis. *Frontiers in Psychology, 5,* 976. https://doi.org/10.3389/fpsyg.2014.00976

Capaldi, C. A., Passmore, H.-A., Nisbet, E. K., Zelenski, J. M., & Dopko, R. L. (2015). Flourishing in nature: A review of the benefits of connecting with nature and its application as a wellbeing intervention. *International Journal of Wellbeing*, *5*(4). https://doi.org/10.1080/08941920.2018.15502

Carvajal, B. P., Molina-Martínez, M. Á., Fernández-Fernández, V., Paniagua-Granados, T., Lasa-Aristu, A., & Luque-Reca, O. (2022). Psychometric properties of the Cognitive Emotion Regulation Questionnaire (CERQ) in Spanish older adults. *Aging & Mental Health*, *26*(2), 413–422. https://doi.org/10.1080/13607863.2020.1870207

Diener, E. (2009). Subjective well-being. In E. Diener (Ed.), *The Science of Well-Being: The Collected Works of Ed Diener* (pp. 11–58). Springer Science + Business Media. https://doi.org/10.1007/978-90-481-2350-6_2

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction With Life Scale. *Journal of Personality Assessment, 49*(1), 71–75. https://doi.org/10.1207/s15327752jpa4901_13

Diener, E., Suh, E. M., Lucas, R. E., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin, 125*(2), 276–302. https://doi.org/10.1037/0033-2909.125.2.276

Fido, D., Rees, A., Wallace, L., & Mantzorou, L. (2020). Psychopathy moderates the relationship between nature connectedness and cognitive reappraisal. *Ecopsychology, 12*(4), 301–308. https://doi.org/10.1089/eco.2019.0075

Fränkel, S., Sellmann-Risse, D., & Basten, M. (2019). Fourth graders' connectedness to nature – Does cultural background matter? *Journal of Environmental Psychology, 66,* 101347. https://doi.org/10.1016/j.jenvp.2019.101347

Gaekwad, J. S., Sal Moslehian, A., Roös, P. B., & Walker, A. (2022). A Meta-Analysis of Emotional Evidence for the Biophilia Hypothesis and Implications for Biophilic Design. *Frontiers in Psychology*, *13*, 750245. https://doi.org/10.3389/fpsyg.2022.750245

Garnefski, N., & Kraaij, V. (2007). The Cognitive Emotion Regulation Questionnaire: Psychometric features and prospective relationships with depression and anxiety in adults. *European Journal of Psychological Assessment, 23*(3), 141–149. https://doi.org/10.1027/1015-5759.23.3.141

Garnefski, N., Kraaij, V., & Spinhoven, P. (2001). Negative life events, cognitive emotion regulation and emotional problems. *Personality and Individual Differences, 30*(8), 1311–1327. https://doi.org/10.1016/S0191-8869(00)00113-6

Garnefski, N., Van Den Kommer, T., Kraaij, V., Teerds, J., Legerstee, J., & Onstein, E. (2002). The relationship between cognitive emotion regulation strategies and emotional problems: Comparison between a clinical and a non-clinical sample. *European Journal of Personality*, *16*(5), 403–420. https://doi.org/10.1002/per.458

Gascon, M., Triguero-Mas, M., Dadvand, P., Forns, J., Plasència, A., Nieuwenhuijsen, M. J., & Nieuwenhuijsen, M. (2015). Mental health benefits of long-term exposure to residential green and blue spaces: A systematic review. *International Journal of Environmental Research and Public Health*, *12*(4), 4354–4379. https://doi.org/10.3390/ijerph120404354

Golding, S. E., Gatersleben, B., & Cropley, M. (2018). An Experimental Exploration of the Effects of Exposure to Images of Nature on Rumination. *International Journal of Environmental Research and Public Health*, *15*(2), 300. https://doi.org/10.3390/ijerph15020300

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology*, *2*(3), 271–299. https://doi.org/10.1037/1089-2680.2.3.271

Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology, 39*(3), 281–291. https://doi.org/10.1017/S0048577201393198

Gross, J. J. (2015). Emotion regulation: Current status and future prospects. *Psychological Inquiry*, *26*(1), 1–26. https://doi.org/10.1080/10478 40X.2014.940781

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology, 85*(2), 348–362. https://doi.org/10.1037/0022-3514.85.2.348

Gu, X., Zheng, H., & Tse, C. S. (2023). Contact with nature for emotion regulation: The roles of nature connectedness and beauty engagement in urban young adults. *Scientific Reports, 13*, 21377. https://doi.org/10.1038/s41598-023-48756-4

Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., & Gärling, T. (2003). Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology*, *23*(2), 109–123. https://doi.org/10.1016/S0272-4944(02)00109-3

Jermann, F., Van der Linden, M., d'Acremont, M., & Zermatten, A. (2006). Cognitive Emotion Regulation Questionnaire (CERQ): Confirmatory factor analysis and psychometric properties of the French translation. *European Journal of Psychological Assessment, 22*(2), 126–131. https://doi.org/10.1027/1015-5759.22.2.126

Jimenez, M. P., DeVille, N. V., Elliott, E. G., Schiff, J. E., Wilt, G. E., Hart, J. E., & James, P. (2021). Associations between Nature Exposure and Health: A Review of the Evidence. *International Journal of Environmental Research and Public Health*, *18*(9), 4790. https://doi.org/10.3390/ijerph18094790

Kaplan R., Kaplan S. (1989). *The Experience of Nature: A Psychological Perspective*. Cambridge; New York, NY: Cambridge University Press.

Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology, 15*(3), 169–182. https://doi.org/10.1016/0272-4944(95)90001-2

Kellert, S. R., & Wilson, E. O. (1993). *The biophilia hypothesis*. Washington, DC: Island Press.

Kondo, M. C., Fluehr, J. M., McKeon, T., & Branas, C. C. (2018). Urban green space and its impact on human health. *International Journal of Environmental Research and Public Health*, *15*(3), 445. https://doi.org/10.3390/ijerph15030445

Koopman, J., Howe, M., Hollenbeck, J. R., & Sin, H.-P. (2015). Small sample mediation testing: Misplaced confidence in bootstrapped confidence intervals. *Journal of Applied Psychology, 100*(1), 194–202. https://doi.org/10.1037/a0036635

Lengieza, M. L., & Swim, J. K. (2021). The Paths to Connectedness: A Review of the Antecedents of Connectedness to Nature. *Frontiers in Psychology*, *12*, 763231. https://doi.org/10.3389/fpsyg.2021.763231

Lee, E. S., Maillet, M. A., & Grouzet, F. M. E. (2022). Why do individuals engage with the natural world? A self-determination theory perspective on the effect of nature engagement and well-being. *Applied Research in Quality of Life*, *17*(3), 1501–1532. https://doi.org/10.1007/s11482-021-09970-2

Lafortezza, R., Carrus, G., Sanesi, G., & Davies, C. (2009). Benefits and well-being perceived by people visiting green spaces in periods of heat stress. *Urban Forestry & Urban Greening, 8*(2), 97–108. https://doi.org/10.1016/j.ufug.2009.02.003

Liang, J. H., Yang, R. Y., Liu, M. L., Pu, Y. Q., Bao, W. W., Zhao, Y., Hu, L. X., Zhang, Y. S., Huang, S., Jiang, N., Pu, X. Y., Huang, S. Y., Dong, G. H., & Chen, Y. J. (2024). Urban green, blue spaces and their joint effect are associated with lower risk of emotional and behavior problem in children and adolescents, a large population-based study in Guangzhou, China. *Environmental Research*, *240*, 117475. https://doi.org/10.1016/j.envres.2023.117475

Liu, H., Nong, H., Ren, H., & Liu, K. (2022). The effect of nature exposure, nature connectedness on mental well-being and ill-being in a general Chinese population. *Landscape and Urban Planning, 222*, 104397. https://doi.org/10.1016/j.landurbplan.2022.104397

MacKinnon, D. P., Fairchild, A. J., & Fritz, M. S. (2007). Mediation analysis. *Annual Review of Psychology*, *58*, 593–614. https://doi.org/10.1146/annurev.psych.58.110405.085542

Martin, L., White, M., Hunt, A., Richardson, M., Pahl, S., Burt, J. (2020). Nature contact, nature connectedness and associations with health, wellbeing and pro-environmental behaviours, *Journal of Environmental Psychology*, *68*, 101389. https://doi.org/10.1016/j.jenvp.2020.101389

Maxwell, S. E. (2004). The persistence of underpowered studies in psychological research: Causes, consequences, and remedies. *Psychological Methods*, *9*, 147–163. doi:10.1037/1082-989X.9.2.147

Mayer, F. S. & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology, 24*, 503–515. https://doi.org/10.1016/j.jenvp.2004.10.001

Mayer, F. S., Frantz, C. M., Bruehlman-Senecal, E., & Dolliver, K. (2009). Why Is Nature Beneficial?: The Role of Connectedness to Nature. *Environment and Behavior*, *41*(5), 607–643. https://doi.org/10.1177/0013916508319745

McMahan, E. A., & Estes, D. (2015). The effect of contact with natural environments on positive and negative affect: A meta-analysis. *The Journal of Positive Psychology, 10*(6), 507–519. https://doi.org/10.1080/17439760.2014.994224

McRae, K., & Gross, J. J. (2020). Emotion regulation. *Emotion, 20*(1), 1–9. https://doi.org/10.1037/emo0000703

Medvedev, O. N., & Landhuis, C. E. (2018). Exploring constructs of well-being, happiness and quality of life. *PeerJ*, *6*, e4903. https://doi.org/10.7717/peerj.4903

Mygind, L., Elsborg, P., Schipperijn, J., Boruff, B., Lum, J. A. G., Bølling, M., Flensborg-Madsen, T., Bentsen, P., Enticott, P. G., & Christian, H. (2022). Is vegetation cover in key behaviour settings important for early childhood socioemotional function? A preregistered, cross-sectional study. *Developmental Science*, *25*(3), e13200. https://doi.org/10.1111/desc.13200

Nisbet, E. K., & Zelenski, J. M. (2011). Underestimating nearby nature: affective forecasting errors obscure the happy path to sustainability. *Psychological Science*, *22*(9), 1101–1106. https://doi.org/10.1177/0956797611418527

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The Nature Relatedness Scale: Linking Individuals' Connection With Nature to Environmental Concern and Behavior. *Environment and Behavior*, *41*(5), 715–740. https://doi.org/10.1177/0013916508318748

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2011). Happiness is in our nature: Exploring nature relatedness as a contributor to subjective well-being. *Journal of Happiness Studies: An Interdisciplinary Forum on Subjective Well-Being, 12*(2), 303–322. https://doi.org/10.1007/s10902-010-9197-7

Passmore, H. A., & Holder, M. D. (2017). Noticing nature: Individual and social benefits of a two-week intervention. *The Journal of Positive Psychology*, *12*(6), 537–546. https://doi.org/10.1080/17439760.2016.12211

Passmore, H. A., & Howell, A. J. (2014). Nature involvement increases hedonic and eudaimonic well-being: A two-week experimental study. *Ecopsychology, 6*(3), 148–154. https://doi.org/10.1089/eco.2014.0023

Perrin, J. L., & Benassi, V. A. (2009). The connectedness to nature scale: A measure of emotional connection to nature?. *Journal of Environmental Psychology*, *29*(4), 434–440. https://doi.org/10.1016/j.jenvp.2009.03.003

Picanço, A., Arroz, A. M., Tsafack, N., Sánchez, A. F., Pereira, E., De Benedictis, M., Amorim, I. R., da Luz Melo, M., & Gabriel, R. (2024). Assessing nature exposure: a study on the reliability and validity of a Portuguese version of the nature exposure scale. *Frontiers in Psychology*, *15*, 1290066. https://doi.org/10.3389/fpsyg.2024.1290066

Piccininni, C., Michaelson, V., Janssen, I., & Pickett, W. (2018). Outdoor play and nature connectedness as potential correlates of internalized mental health symptoms among Canadian adolescents. *Preventive Medicine*, *112*, 168–175. https://doi.org/10.1016/j.ypmed.2018.04.020

Pritchard, A., Richardson, M., Sheffield, D., & McEwan, K. (2020). The relationship between nature connectedness and eudaimonic well-being: A meta-analysis. *Journal of Happiness Studies: An Interdisciplinary Forum on Subjective Well-Being, 21*(3), 1145–1167. https://doi.org/10.1007/s10902-019-00118-6

Richardson, M. (2019). Beyond restoration: Considering emotion regulation in natural well-being. *Ecopsychology*, *11*(2), 123–129. https://doi.org/10.1089/eco.2019.0012

Richardson, M., & McEwan, K. (2018). 30 days wild and the relationships between engagement with nature's beauty, nature connectedness and well-being. *Frontiers in Psychology, 9*, 1500. https://doi.org/10.3389/fpsyg.2018.01500

Richardson, M., Hunt, A., Hinds, J., Bragg, R., Fido, D., Petronzi, D., Barbett, L., Clitherow, T., & White, M. (2019). A Measure of Nature Connectedness for Children and Adults: Validation, Performance, and Insights. *Sustainability*, *11*(12), 3250. https://doi.org/10.3390/su11123250

Ríos-Rodríguez, M. L., Rosales, C., Hernández, B., & Lorenzo, M. (2024). Benefits for emotional regulation of contact with nature: a systematic review. *Frontiers in Psychology*, *15*, 1402885. https://doi.org/10.3389/fpsyg.2024.1402885

Sarkar, C., Webster, C., & Gallacher, J. (2018). Residential greenness and prevalence of major depressive disorders: a cross-sectional, observational,associational study of 94 879 adult UK Biobank participants. *The Lancet Planetary Health*, *2*(4), e162–e173. https://doi.org/10.1016/S2542-5196(18)30051-2

Schultz, P. W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology, 21*(4), 327–339. https://doi.org/10.1006/jevp.2001.0227

Severin, M. I., Raes, F., Notebaert, E., Lambrecht, L., Everaert, G., & Buysse, A. (2022). A Qualitative Study on Emotions Experienced at the Coast and Their Influence on Well-Being. *Frontiers in Psychology*, *13*, 902122. https://doi.org/10.3389/fpsyg.2022.902122

Seymour, V. (2016). The human-nature relationship and its impact on health: A critical review. *Frontiers in Public Health*, *4*, 1–12. https://doi.org/10.3389/FPUBH.2016.00260

Shanahan, D. F., Astell-Burt, T., Barber, E. A., Brymer, E., Cox, D. T. C., Dean, J., Depledge, M., Fuller, R. A., Hartig, T., Irvine, K. N., Jones, A., Kikillus, H., Lovell, R., Mitchell, R., Niemelä, J., Nieuwenhuijsen, M., Pretty, J., Townsend, M., van Heezik, Y., Warber, S., … Gaston, K. J. (2019). Nature-Based Interventions for Improving Health and Wellbeing: The Purpose, the People and the Outcomes. *Sports*, *7*(6), 141. https://doi.org/10.3390/sports7060141

Swami, V., Barron, D., Weis, L., and Furnham, A. (2016). Bodies in nature: associations between exposure to nature, connectedness to nature, and body image in US adults. *Body Image* 18, 153–161. doi: 10.1016/j.bodyim.2016.07.002

Swami, V., White, M. P., Voracek, M., Tran, U. S., Aavik, T., Abdollahpour Ranjbar, H., Adebayo, S. O., Afhami, R., Ahmed, O., Aimé, A., Akel, M., Al Halbusi, H., Alexias, G., Ali, K. F., Alp-Dal, N., Alsalhani, A. B., Álvarez-Solas, S., Amaral, A. C. S., Andrianto, S., Aspden, T., ... Stieger, S. (2024). Exposure and connectedness to natural environments: An examination of the measurement invariance of the Nature Exposure Scale (NES) and Connectedness to Nature Scale (CNS) across 65 nations, 40 languages, gender identities, and age groups. *Journal of Environmental Psychology, 99*, 102432. https://doi.org/10.1016/j.jenvp.2024.102432

Theodorou, A., Spano, G., Bratman, G. N., et al. (2023). Emotion regulation and virtual nature: Cognitive reappraisal as an individual-level moderator for impacts on subjective vitality. *Scientific Reports, 13*, 5028. https://doi.org/10.1038/s41598-023-30287-7

Tornquist, M., Herrmann, E., & Chiappe, D. (2024). Expressing gratitude and visualising one's best possible self: Assessing the effectiveness of a four-week intervention on affect and health behaviours during the COVID-19 lockdown. *Current Psychology*, *43*(19), 17900-17913. https://doi.org/10.1007/s12144-023-05276-8

Ulrich, R. S. (2023). Stress reduction theory. In D. Marchand, E. Pol & K. Weiss (Eds.), *100 Key Concepts in Environmental Psychology* (pp. 143-146). New York, NY: Routledge.

Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, *11*(3), 201–230. https://doi.org/10.1016/S0272-4944(05)80184-7

Van den Berg, M., Wendel-Vos, W., Van Poppel, M., Kemper, H., van Mechelen, W., & Maas, J. (2015). Health benefits of green spaces in the living environment: A systematic review of epidemiological studies. *Urban Forestry and Urban Greening*, *14*(4), 806–816. https://doi.org/10.1016/j.ufug.2015.07.008

Vanaken, G. J., & Danckaerts, M. (2018). Impact of green space exposure on children's and adolescents' mental health: A systematic review. *International Journal of Environmental Research and Public Health*, *15*(12). https://doi.org/10.3390/ijerph15122668

Vitale, V., & Bonaiuto, M. (2024). The role of nature in emotion regulation processes: An evidence-based rapid review. *Journal of Environmental Psychology*, *96*, 102325. https://doi.org/10.1016/j.jenvp.2024.102325

Voukelatou, V., Gabrielli, L., Miliou, I., et al. (2021). Measuring objective and subjective well-being: Dimensions and data sources. *International Journal of Data Science and Analytics, 11*(4), 279–309. https://doi.org/10.1007/s41060-020-00224-2

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology*, *54*(6), 1063–1070. https://doi.org/10.1037//0022-3514.54.6.1063

White, M. P., Elliott, L. R., Grellier, J., Economou, T., Bell, S., Bratman, G. N., Cirach, M., Gascon, M., Lima, M. L., Lõhmus, M., Nieuwenhuijsen, M., Ojala, A., Roiko, A., Schultz, P. W., van den Bosch, M., & Fleming, L. E. (2021). Associations between green/blue spaces and mental health across 18 countries. *Scientific Reports*, *11*(1), 8903. https://doi.org/10.1038/s41598-021-87675-0

Wilson E. O. (1986). *Biophilia*. Cambridge, MA: Harvard University Press

Wood, C., Barron, D., & Smyth, N. (2019). The current and retrospective intentional nature exposure scales: Development and factorial validity. *International Journal of Environmental Research and Public Health*, *16*(22). https://doi.org/10.3390/ijerph16224443