Nature Engagement for Human and Nature's Wellbeing during the Corona Pandemic.

Submitted Version

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Abstract

Purpose: To explore the associations between noticing nature, nature connectedness, time in nature and human and nature's wellbeing during the Corona pandemic restrictions.

Approach: Natural England's People and Nature Survey (PANS) data (n=4206) from the UK was used to assess a number of wellbeing outcomes (loneliness, life satisfaction, worthwhile life and happiness) and pro-nature behaviours as a function of longer-term physical time in nature and psychological connectedness to nature and shorter-term visits and noticing of nature.

Findings: Longer-term factors of nature connectedness and time in nature were both consistent significant predictors of wellbeing measures (apart from loneliness) and pro-nature conservation behaviours. Considered alone short-term visits and noticing were again consistent and significant predictors of three wellbeing measures, but recent visits to nature were not associated with pro-nature conservation behaviours. A combined regression highlighted the importance of a longer-term relationship with nature in all outcomes apart from loneliness, but also revealed that, even when considered in concert with longer-term factors, currently noticing nature had a role in feeling one's life was worthwhile, pro-nature behaviours and loneliness.

Originality: The closeness of the human-nature relationship and noticing nature have rarely in concert with nature visits. Further, the reciprocal benefits of pro-nature behaviours are often overlooked.

Keywords: nature connectedness, nature visits, wellbeing, pro-nature conservation behaviour.

1. Introduction

Human wellbeing depends upon nature's wellbeing (Cardinale et al., 2020). There is a need to understand how the human-nature relationship is associated with human well-being and people's actions to support nature. Two key measures used in research into the human-nature relationship are physical visits or time in nature and the closeness of the psychological connection to the rest of nature. During the restrictions imposed to control the coronavirus pandemic people have turned to nature with increased visits (Natural England, 2020a). There have also been reports of greater awareness of nature (Rousseau and Deschacht, 2020) and of local nature being noticed more (Baillie, 2020; Büssing et al., 2020). Natural England's People and Nature Survey (PANS) in the UK (Natural England, 2020b) conducted during the initial pandemic response allows further analysis of how the longer-term physical and psychological relationship with nature, and shorter-term visits and noticing of nature are associated with wellbeing and pro-nature behaviours. The current paper presents such an analysis.

Visits to and spending time in nature are associated with greater mental wellbeing (Meredith et al., 2020; Tester-Jones et al., 2020). Self-reported visits and time are straightforward measures of exposure and engagement with nature but can lead to a reductionist 'dose-response' perspective (Dobson et al., 2020). More recently, psychological connection to nature has also been found to be associated with higher levels of hedonic and eudemonic wellbeing (Pritchard et al., 2020), with causal links being established between improved nature connectedness through noticing nature and mental wellbeing (McEwan et al., 2019).

There has been little research that has considered exposure to nature in concert with a close connection to nature, however when studied together nature connectedness emerges as a key factor in certain wellbeing outcomes, for example eudemonic wellbeing but not life satisfaction, when compared to visits to nature (Martin et al, 2020; Richardson et al., 2021). Similarly, Martin et al (2020) found that nature connectedness was a significant predictor of pro-nature conservation behaviours, whereas visits to nature was not. This finding was replicated by Richardson et al. (2020) using the first validated scale of pro-nature conservation behaviours (Barbett et al., 2019). This research also found that trait nature connectedness and in the moment connection through noticing nature were important factors in explaining pro-nature behaviours.

The focus on physical visits, time in nature and subsequent dose recommendations has parallels to the focus on the biomedical model of health rather than reflecting the psychological factors that are significant to wellbeing and reflected in the biopsychosocial model (Engel, 1977). The biomedical model of health essentially views people as separate from the environment and affected by events (Stevens, 2010), for example visits to nature. Recently 'One Health' models of health recognise that humans are embedded within the rest of the natural world where health depends on biology, psychology and nature (Rabinowitz et al., 2018). Similarly, clinical ecology captures how health and biodiversity are connected in a symbiotic relationship (Nelson et al., 2019). When healthcare takes this perspective personal health and planetary health become interlinked, thus engaging the patient in environmental issues. Further, the natural environment becomes essential for wellbeing, rather than a part time resource with a dose sought out when feeling unwell. Rather, nature connectedness and a close relationship with everyday nature becomes a basic psychological need for wellbeing (Baxter and Pelletier 2019; Hurly and Walker 2019; Richardson et al., 2020).

A time and visits focus with biomedical dose perspective can also result in a policy focus on overcoming the barriers to physical access to nature. While essential for health and indeed a starting point for psychological connectedness, a more nuanced understanding of physical and psychological access to nature can deliver better outcomes for mental wellbeing and pro-nature behaviours. For example, moving beyond provision of local green space and trips to natural landscapes, to infrastructure and events to engage people with and celebrate nature from the ‘cliff-top to the bus-stop’.

Importantly, thinking in this area is evolving, yet there is a need for further evidence to support a more holistic approach based on exposure and connection to nature. The PANS in the UK (Natural England, 2020b) includes items to measure time, visits, nature connectedness (Richardson et al., 2019) and pro-nature conservation behaviours (Barbett, et al., 2019). The survey began in April 2020, coinciding with coronavirus pandemic lockdown restrictions in the UK. The current study takes the opportunity to compare longer term measures with short-term measures at a time when people were accessing and noticing nature more (Baillie, 2020; Büssing et al., 2020; Natural England, 2020a; Rousseau and Deschacht, 2020). The analysis explores the relationship between longer-term exposure to nature and nature connectedness, short-term exposure and noticing nature with four standard PANS wellbeing outcomes: loneliness, life satisfaction, eudemonic wellbeing and happiness. Plus, rounding off a one health perspective, pro-nature conservation behaviours.

2. Material and methods

2.1 Participants

The total sample consisted of 4206 respondents. In the PANS dataset (Natural England, 2020c), ages ranged from 16 to 93 ($M = 47.62$, $SD = 17.49$). Gender was almost evenly split between females (51%) and males (48.9%), with the remaining 0.1% identifying with another gender.

2.2 Measures of Dependent Variables

The PANS survey assesses various constructs associated with wellbeing. We selected items commonly used in population surveys to measure wellbeing. Loneliness was measured with the item, 'How often do you feel lonely?'. Respondents rated the items on a scale from 1 = 'Often / always' to 5 = 'Never'. Satisfaction with life, sense of worthwhile life and happiness were measured, respectively, with the items 'Overall, how satisfied are you with your life nowadays?', 'Overall, how worthwhile are the things you do in your life?' and 'How happy were you feeling yesterday?'. All three constructs were measured on a scale from 0 = *Not at all* to 10 = *Completely*.

2.3 Measures of Predictor Variables

Nature connectedness was measured using the single item 'I feel part of nature' from the Nature Connection Index (NCI; Richardson et al., 2019). Current levels of engagement with nature were measured using the item 'I am taking more time to notice and engage with everyday nature (e.g. listening to birdsong, noticing butterflies)'. Both items were rated on a seven-point scale from 1 = *Completely disagree* to 7 = *Completely agree*. Time in nature was measured using two items, one to measure longer-term baseline levels of time in nature and

one to measure more recent levels. Longer-term levels of time in nature were measured using the item ‘In the last 12 months, how often, on average have you spent free time outside in green and natural spaces?’ Respondents rated the item on an eight-point scale ‘*Never*’ to ‘*Every day*’ and recoded 1 to 8 for ease of interpretation. Recent time in nature was measured using the item ‘How many times, if at all, did you make this type of visit to green and natural spaces in the last 14 days?’. Such visits included visit to ‘green spaces in towns and cities’, ‘the countryside’ and ‘the coast’, but not ‘time in your garden’, ‘time outside as part of your job’ or ‘time spent outside the UK’. Respondents answered by giving a number representing the number of such visits they had made. Several demographic variables were measured, namely age, gender, ethnicity, work and relationship status.

3. Results

Following an examination of the bivariate correlations between the main variables of interest, we present the results of multiple regressions that investigate the effect on wellbeing and pro-nature conservation behaviour of baselines levels of time spent in nature and nature connectedness using longer-term items that reach into time before the Coronavirus pandemic. A second set of multiple regressions examines the effect on the outcome variables of increases in noticing nature and visits to nature during the pandemic. A final set of multiple regressions controls for longer-term baseline levels of time in nature and nature connectedness to clarify the effects on the outcome measures of notice and visiting nature during the pandemic, enabling key short-term items to be identified.

3.1 Correlations between predictors and well-being variables

To investigate the relationship between the four predictor items of interest (nature connectedness, time outside in the last 12 days, number of greenspace visits in the last 14 days, time noticing nature) and the five dependent variables (loneliness, life satisfaction, sense of worthwhile life, happiness, pro-nature conservation behaviour), a series of bivariate correlations were performed. As shown in Table 1, there were significant correlations between all predictor variables and all the dependent variables apart from loneliness.

Table 1. Bivariate correlations between the main variables of interest (N in parentheses)

	1.	2.	3.	4.	5.	6.	7.	8.
1. Loneliness								
2. Life Satisfaction	.483*							
	(4653)							
3. Worthwhile	.458*	.775*						
	(4653)	(4654)						
4. Happiness	.488*	.76*	.736*					
	(4653)	(4654)	(4654)					
5. Pro-nature conservation	.111	.192*	.232*	.185*				
	(1263)	(1264)	(1264)	(1264)				
6. Nature Connectedness	.017	.138*	.172*	.118*	.347*			
	(4297)	(4207)	(4207)	(4207)	(1334)			
7. Time outside in last 12 months	-.006	.128*	.128*	.129*	.149*	.272*		
	(4653)	(4654)	(4654)	(4654)	(1493)	(5413)		
8. Number of visits in last 14 days	.029	.107*	.114*	.097*	.089*	.219*	.483*	
	(4206)	(4206)	(4206)	(4206)	(1035)	(3912)	(5638)	
9. Increase in time noticing nature	-.016	.115*	.172*	.111*	.35*	.554*	.274*	.231*
	(4136)	(4137)	(4137)	(4137)	(1184)	(4101)	(4137)	(3744)

* = $p < .01$

3.2 Multiple regressions to examine relationships between the predictors and both wellbeing and pro-nature conservation behaviour

In order to further investigate the relationship between nature connectedness, time in nature and engagement with nature and the five dependent variables, we performed a series of hierarchical multiple regressions. In each regression, there was an initial block of demographic variables consisting of age, gender, employment status and ethnicity. For each

regression, the assumptions for multicollinearity and independence of errors were met (VIF = 1.002 – 1.955, Tolerance: .512 – .998, Durbin-Watson = 1.931 – 2.058).

Several demographic variables predicted wellbeing and pro-nature conservation behaviour. Both age and being in a relationship were consistently significantly and positively related to all DVs (β s = .128 - .296). Being separated was associated with increased loneliness (β = -.042). Being female was significantly associated with being lonelier (β = -.091), less satisfied (β = -.043) and less happy (-.055). Not working was associated with less satisfaction (β = -.098), less happiness (β = -.078) and less sense of a worthwhile life (β = -.112) compared to being in work. Students reported being less lonely (β = .07) and more satisfied (β = .091) than those in work, and felt they had more worthwhile lives (β = .074).

3.3 Multiple regressions on the effects of long-term nature connectedness and time in nature. To understand the relationship between baseline time in nature and wellbeing and pro-nature conservation behaviour, one multiple regression was performed for each of the five dependent variables, with nature connectedness and time spent in nature in the last 12 months constituting the second block of predictors. One-way ANOVAS were performed to establish whether time spent in nature in the last 12 months and nature connectedness had remained consistent across all three waves of the survey. Both nature connectedness ($F(2,4510) = .26, p = .85$) and time spent in nature in the last 12 months ($F(2,6246) = 1.58, p = .21$) did not differ significantly across the three waves of the survey confirming their suitability as longer-term measures. As shown in Table 2, both nature connectedness and time spent in nature predicted all of the dependent variables, apart from loneliness. Neither of the items were significant predictors of loneliness.

Table 2. Summary of standardised betas and R-square values for baseline linear regressions, after controlling for individual covariates.

	NC	Nature time last 12 months	R Square Change - NC	R Square Change - Time	Adj. R Square - complete model
Loneliness	.011	.004	.000	.000	.137*
Satisfaction	.107*	.085*	.017*	.006*	.082*
Worthwhile	.139*	.083*	.026*	.006*	.100*
Happiness	.086*	.094*	.013*	.008*	.071*
ProCoBS	.306*	.094*	.109*	.008*	.182*

* = $p < 0.05$; NC = *Nature Connectedness*

3.4 Multiple regressions on the effects of noticing nature and time in nature during the

pandemic. A further set of multiple regressions were computed to investigate the effect of recent levels of engagement with nature and time in nature on wellbeing and pro-nature conservation behaviour. As reported in Table 3, both items significantly predicted all wellbeing variables, apart from loneliness. Only engagement with nature predicted loneliness, with increases in time noticing nature associated with increases in loneliness. Similarly, time noticing nature was the only significant predictor of pro-nature conservation behaviour, with increases in noticing associated with increases in pro-nature conservation behaviour.

Table 3. Standardised Betas and R-Square values for current linear regressions, after controlling for individual covariates.

	More time noticing	Recent nature visits	R Square Change – noticing & visits	Adj. R Square - complete model
Loneliness	-.048*	.012	.002*	.141*
Satisfaction	.081*	.06*	.012*	.071*
Worthwhile	.131*	.061*	.024*	.094*
Happiness	.087*	.055*	.012*	.062*
ProCoBS	.326*	.04	.109*	.175*

* = $p < 0.05$; NC = *Nature Connectedness*

3.5 Multiple regressions on the effects of long-term nature connectedness and time in nature and noticing nature and time in nature during the pandemic. A final set of multiple regressions included all predictors used in the previous two sets of multiple regressions. With demographic variables again in the first block, a second block comprised baseline measures of nature connectedness and time in nature, and a third block included recent levels of engagement with nature and time in nature. As shown in Table 4, the only significant predictor of loneliness was recent time spent engaging with nature. Increases in this item were associated with increases in loneliness. Satisfaction and happiness were predicted only by the block of baselines measures; recent engagement with and time in nature were unrelated to both satisfaction and happiness. All items apart from recent time spent in nature were significant predictors of sense of worthwhile life and pro-nature conservation behaviour.

Table 4. Standardised Betas and R-Square values for combined linear regressions, after controlling for individual covariates.

	NC	Nature time last 12 months	More time noticing	Recent nature visits	Adj. R Square - complete model
Loneliness	.031	-.008	-.062*	.011	.142*
Satisfaction	.091*	.062*	.02	.021	.079*
Worthwhile	.095*	.049*	.069*	.028	.102*
Happiness	.069*	.074*	.036	.012	.070*
ProCoBS	.234*	.077*	.182*	-.024	.213*

* = $p < 0.05$; NC = *Nature Connectedness*

4. Discussion

The results provide insight into how the longer-term exposure to nature and nature connectedness, and short-term visits and noticing of nature are associated with wellbeing and pro-nature behaviours. The longer-term measures of nature connectedness and time in nature were both consistent significant predictors of three wellbeing measures and pro-nature conservation behaviours. Considered alone, without controlling for longer-term measures, more current indicators were again consistent and significant predictors of three wellbeing measures. However, there was a weak significant association between increased noticing of nature and increased loneliness and recent visits to nature was not associated with pro-nature conservation behaviours. The combined regression highlighted the importance of a longer-term relationship with nature in all outcomes apart from loneliness, but also revealed currently noticing nature had a role in feeling one's life was worthwhile life, pro-nature behaviours and an association with loneliness.

The finding that longer-term measures of nature connectedness and time in nature over twelve months were both consistent and significant predictors higher levels of three wellbeing measures (satisfaction, happiness and worthwhile life) and pro-nature conservation behaviours is broadly consistent with previous research. As noted above, there has been little research that has considered exposure to nature and nature connectedness together.

Previously, visits to nature, rather than nature connectedness, has been related to life satisfaction; with nature connectedness, rather than time in nature, being associated with a worthwhile life (Martin et al, 2020). Richardson et al., (2021) found that time in nature was not a significant predictor of happiness or worthwhile living, but nature connectedness and noticing nature were. These inconsistencies could be reflective of the sample or differences

between measuring self-reports of time in nature rather than visits to nature. However, although the current study found a more consistent role for time in nature in wellbeing, the strength of relationship was generally lower than for nature connectedness, apart from for happiness. Finally, the need to consider nature connectedness in addition to exposure to nature is confirmed, a finding repeated three times in recent research with different large scale data sets. Both physical and psychological access to nature matter.

Moving on to pro-nature conservation behaviours, the results are again consistent with recent research that has considered exposure and nature connectedness together. Martin et al (2020) found that nature connectedness, rather than visits to nature, was a significant predictor of pro-nature conservation behaviours. A finding replicated by Richardson et al. (2020) using the pro-nature conservation behaviours scale (Barbett et al., 2019). Using that same scale, the current research also found that both nature connectedness and time outside are related to pro-nature conservation behaviours, but the relationship between higher nature connection and pro-nature behaviour is much stronger. It can also be observed that a relationship with nature explains more variance in pro-nature behaviours than it does for wellbeing, where a wider range of complex factors are likely to be involved. Once again, the need to consider nature connectedness when considering pro-nature conservation behaviours is repeated for a third time in recent research on different large-scale datasets

The longer-term measures of nature connectedness and time in nature were unrelated to loneliness. Social relationships are important for wellbeing, so clearly the social distancing and 'stay at home' measures used in response to the pandemic provide challenge to keeping well. Previous research has found that nearby nature can offer socially isolated people an alternative way of feeling connected, buffering the effect of low social connectedness

(Cartwright et al., 2018). It is possible the single item measure of loneliness in the current study, rather than measure of social connectedness used by Cartwright and colleagues, did not tap into this relationship. Further, it might be that the alternative connections nature can bring are reflected in other measures of wellbeing, for example nature connectedness has been found to predict happiness over and above how generally connected people feel to family and friends (Zelenski & Nisbet, 2014). Therefore, the significant relationship between nature connectedness and happiness in the current study could reflect this. The findings from the shorter-term measures, that is spending more time noticing nature, do show a relatively small, but significant negative relationship to loneliness. Higher levels of noticing were associated with higher levels of loneliness. As a cross-sectional survey the direction of this relationship is unknown, rather than increased noticing of nature increasing loneliness, the findings association could reflect that as loneliness increases people turn to nature and spend more time noticing it, buffering the effect of reduced social connectedness (Cartwright et al., 2018). Given this small insight and wider research in this area, the relationship between engaging in a relationship with nature, social isolation and loneliness is a topic deserving further research.

Continuing with the shorter-term measures of noticing and recent visits to nature, without controlling for longer-term measures in the first instance, the findings are broadly consistent with the results when considering longer term nature connection and time in nature alone. Indeed, the variance in outcomes explained and beta levels are remarkably similar, although recent visits to nature is not a significant predictor of pro-nature behaviours. Considering these short-term measures alone, in the context of people visiting and tuning into nature during the pandemic restrictions, (Baillie, 2020; Büssing et al., 2020; Natural England, 2020a) these findings suggest that this change had a role across wellbeing outcomes.

However, given the similarity in results between timescales, these results could reflect that the longer and shorter-term measures are measuring the same thing. Time outside over twelve months is a very similar measure to visits in the last 14 days, although the correlation between the two is moderate rather than strong. Time noticing nature is conceptually different to nature connectedness, but can be considered as a lived experience of nature connectedness. Further, the correlation between the two is weaker and the question specifies recent increases in noticing at a time of increased engagement with nature (Baillie, 2020; Büssing et al., 2020; Natural England, 2020a; Rousseau and Deschacht, 2020).

The combined regression controls for these potential issues as both the longer and short-term measures are included. Once again, the findings for the longer-term measures are broadly consistent with previous results, with the variance in outcomes explained and beta levels being similar. However, the combined analysis confirms the significance of spending more time noticing nature for reporting a worthwhile life and engaging in pro-nature behaviours. In the context of people's response to pandemic restrictions, these findings suggest that noticing more nature (Baillie, 2020; Büssing et al., 2020) is important for eudemonic, rather than hedonic wellbeing, with those benefits being accompanied by higher levels of pro-nature behaviours. As indicated by the moderate correlation between noticing and nature connectedness, it does not appear that noticing nature is a proxy measure of longer-term nature connectedness, rather an activity understandably related to it. However, for recent nature visits does drop from significance, with longer-term time in nature being significant across all outcome variables, other than loneliness. Finally, once again, the contribution of nature connectedness is higher than time in nature for life satisfaction and a worthwhile life, a difference that is particularly notable for pro-nature conservation behaviours.

While providing unique insights and controlling for several demographic variables the results should be considered within the context of several limitations. First, our analyses were correlational in nature and so the causal connections between the variables cannot be inferred with complete confidence. Although complimentary experimental research exists which more clearly demonstrates the effect of increased time in and engagement with nature on wellbeing (McEwan et al., 2019), additional experimental studies would be welcome. Second, most of the data presented is based on retrospective self-reports that may be subject to recall bias. Third, in our interpretation of the results, we compare the predictive validity of recent increases in time noticing nature with recent time spent in nature. We make such comparisons tentatively though because we recognise that these two variables are not directly comparable: one measures increases over an unspecified time period, the other measures levels over the past 14 days.

In sum, during the restrictions imposed to control the coronavirus pandemic people turned to nature through visiting and noticing it more. The results presented above suggest that the short-term changes in noticing had a role in people's wellbeing; particularly for feeling one's life is worthwhile. More broadly, the importance of nature connectedness and noticing nature in addition to time in nature is confirmed again. It is becoming clear that emotional and psychological access to nature matters, as much and perhaps more so than time in nature for certain outcomes. The current findings together with recent research support a more holistic approach based on increasing access and fostering a close connection with nature, through noticing nature (McEwan et al. 2019) and systematic application of the pathways to nature connectedness (Lumber et al., 2017; Richardson et al, 2020).

Turning to nature for wellbeing during the corona pandemic has been a reminder that human wellbeing depends upon nature. This highlights the relevance of ‘One Health’ models of health that recognise that humans are embedded within the rest of the natural world and that nature is essential for wellbeing. The current results also highlight the reciprocal relationship where a close connection with nature is associated with pro-nature behaviours. The evidence is mounting that political and practical efforts should focus on creating a new human-nature relationship, creating a long-term habit of being out in, and connecting with, nature and an everyday habit of noticing nature.

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