

# The Quality of Time in Nature: How Fascination Explains and Enhances the Relationship Between Nature Experiences and Daily Affect

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## Abstract

*Research shows that the quantity of time in nature is associated with improved emotional well-being: The more time people spend in nature, the more positive they feel. However, less is known about the quality of experience in nature and how it may influence the nature-well-being relationship. In this study, we examined the role of fascination as an important quality of one's experience in nature. According to Attention Restoration Theory, heightened fascination within natural environments may help restore attentional capabilities and account for the beneficial effects of nature on well-being. In this 13-day daily diary study of 319 young adults, multilevel analyses were used to investigate whether perceived fascination in nature accounted for and potentially enhanced the day-to-day relationship between time spent in nature each day and daily positive/negative affect. As hypothesized, fascination accounted for some of the relationship between nature and higher positive affect. Fascination also enhanced the relationship between nature and higher positive affect. Time spent in nature was also associated with reduced negative affect for women only, and this association was fully accounted for by the degree of fascination in nature. This latter finding suggests that fascination as an attentional quality may play a key role in the process between exposure to nature and reduced negative affect among women. The importance of quality, not just quantity of daily nature experiences, and future directions will be discussed.*

There is a growing interest in the relationship between contact with nature and well-being. An increasing number of studies have shown that greater proximity to or more time spent in nature is associated with lower depression (Maas et al., 2009), greater life satisfaction (White et al., 2013), self-esteem (Barton et al., 2012), and reports of higher positive affect (Hartig et al., 2003). For the most part, studies have been cross-sectional in their designs, showing that people who have greater exposure to natural environments also report greater well-being, as measured by a variety of markers [e.g., perceived general health and symptoms (de Vries et al., 2003); perceived mental health (Sugiyama et al., 2008); depression (Maas et al., 2009)]. Fewer studies have examined how exposure to nature in daily life is related to well-being on a day-to-day basis. The goal of this research was to understand the role of nature experiences and well-being on a daily basis, as indicated by greater positive affect (PA) and lower negative affect (NA).

The few studies that have tracked nature and well-being on a day-to-day basis generally show that being in nature corresponds with increased PA. For example, a recent study of nearly 22,000 UK residents showed that people reported greater momentary happiness when they were near nature versus not (MacKerron & Mourato, 2013). Happiness was tracked over a period of time using the Mapiness iPhone application, which was analyzed with GPS location features to show covariation between happiness and natural environments. Similarly, Ryan and colleagues investigated the effects of being in nature on "subjective vitality" using a 14-day daily diary procedure (Ryan et al., 2010b). At the end of each day, 138 university students answered questions about their time spent in nature, other daily activities (e.g., outdoor activities, social interactions), and

vitality. Analysis of within-person patterns showed that time in nature predicted greater increases in daily vitality even after controlling for outdoor activities, social interactions, and weekday/weekend effects. Another study of 25 American adults also found that daily nature experiences in a national forest were associated with excitement and satisfaction (Hull & Stewart, 1995). Relatively less is known about links between nature and daily NA. One study examined daily stress levels in a sample of 100 older adults and found no associations with daily stress and the frequency of park visits measured retrospectively across the year (Orsega-Smith et al., 2004). However, that study did not measure the covariation between nature and negativity on a day-to-day basis. Therefore, a goal of the current study is to examine the relationship between nature and both positive and negative daily affect.

Although contact with or simply spending time in nature (*quantity* of nature experiences) may benefit daily well-being, it might be helpful to understand what *quality* of nature experiences may actualize or potentially maximize the benefit of nature to well-being. According to Attention Restoration Theory (ART; Kaplan, 1995; Kaplan & Kaplan, 1989), nature affords certain qualities that help restore attentional resources and relieve mental fatigue. One field experimental study tested ART using mobile electroencephalography (EEG) to record and analyze the restorative experience of walkers in a green-space setting (Aspinall et al., 2013). They found EEG signals were consistent with attentional restoration when participants were walking in the green space. One important quality that may mediate attentional restoration is the degree of “fascination” present in natural scenery (Kaplan & Kaplan, 1989). Fascination is the quality of a stimulus being highly appealing and visually interesting. Because of this visual interest, the stimulus draws attention to itself effortlessly which, in turn, allows restoration of diminished psychological resources. According to ART, fascinating qualities found in nature (*vis-à-vis* trees, rocks, landscapes, flowing rivers, etc.) allow people to rest their mental focus and process their surroundings in more involuntary ways (which uses fewer cognitive resources). Although built environments like museums can be fascinating and restorative (Packer, 2008), natural environments seem to evoke this quality particularly well (Purcell et al., 2001; Ulrich et al., 1991). Moreover, laboratory studies have shown that attentional restoration can be achieved in less than 10 minutes and that exposure to high perceived fascination within natural environments can actually improve memory performance and restore the ability to focus attention as tested in the lab (Berto et al., 2010). Therefore, this study will investigate not only how contact with nature may be associated with daily well-being (i.e., higher PA and lower NA) but also whether perceived fascination in nature mediates the link between contact

with nature and well-being and possibly moderates (i.e., enhances) the beneficial effects of nature on well-being.

The study also examined gender differences in the effects of daily nature experiences on well-being. Although previous research found no evidence for gender differences in the link between nature and PA (vitality) (Ryan et al., 2010b), research has not yet tested whether gender moderates the link between nature and NA. Evolutionary theories suggest that men and women may direct their attention differently within nature. Some theorists have proposed that in Paleolithic times, women (gatherers) tended to focus more on proximal features, whereas men (hunters) tended to focus more on distal objects and horizons (Orians & Heerwagen, 1992). Therefore, it is possible that women, by focusing more on nearby features in nature, could extract more benefit from nature. However, a study about how men and women attend to natural features suggests that men and women may direct attention in nature fairly similarly (Hull & Stewart, 1995). Using a photoelicitation approach, in which people took pictures of what they were focusing on during a nature hike, there were more gender commonalities than differences. The main gender difference was that men paid more attention to the ground and other “topographical” features than women. Therefore, our study tested but made no predictions about the role of gender in the nature and well-being relationship.

### Overview

The goal of the study was to examine whether time in nature and the quality of nature experiences (e.g., the degree of fascination in nature) were associated with within-person changes in PA and NA across a 13-day period. An Internet-based daily diary procedure was used in which participants reported their daily experiences of PA and NA along with the amount of time spent in nature and fascination with nature each day. We hypothesized that daily nature experiences would be associated with increased PA and, to a lesser extent, decreased NA. We also hypothesized that higher levels of fascination in nature would mediate and possibly moderate the link between contact with nature and daily affective experiences. We examined gender differences in these pathways as well.

We also controlled for weekday/weekend effects in most statistical analyses (except for descriptive statistics and between-person correlations). Weekends are strongly related with higher PA and lower NA (e.g., Ryan et al., 2010a; Stone et al., 2012). Weekends also typically afford more opportunities to engage in nature compared to weekdays (Scopelliti & Giuliani, 2004). This difference can be a confounding factor—if people feel better on weekends and are in nature on weekends, the relationship between feelings and nature may simply be spurious. Thus, following Ryan and colleagues (2010b), we controlled for weekday/weekend effects.

## Method

### Participants

The sample consisted of 319 young adults (122 males and 197 females) with a mean age of 19 ( $SD=1.486$ ; range 17–25). Participants were part- or full-time students at the University of Otago, New Zealand. Their self-identified ethnicity was mostly European ( $n=261$ ; 81.8%), followed by Asian ( $n=27$ ; 8.4%), Indian ( $n=10$ ; 3.1%), Māori or Pacific Islander ( $n=8$ ; 2.5%), Middle Eastern ( $n=4$ ; 1.2%), mixed ethnicity ( $n=4$ ; 1.2%), or other ethnicity ( $n=5$ ; 1.5%). An additional six participants started the study but were not included in the 319 analyses (two were withdrawn due to technical difficulties; four did not complete the minimum 7 of 13 daily dairies). Participants were recruited for a study of the “daily experiences of university students” as part of the larger Daily Life Study conducted in 2012.

### Setting

Dunedin is the second-largest city in the South Island of New Zealand. Dunedin’s population is approximately 120,000 people. There are botanical gardens, beaches, and local hiking trails close to the university. The urban settings have several shopping malls and business areas that are concentrated in the downtown district as well as in the student quarter. The climate of Dunedin is cool and temperate. Data were collected during the fall season and early winter season (April to early June 2012) in which temperatures ranged from 0°C to 21°C (32°F to 69.8°F).

### Measures

The following measures were included in a larger 90-item daily diary survey that took approximately 10 minutes to complete. The other measures in the diary assessed a range of common daily experiences including enjoyment, physical activity, and health.

**Daily time spent in nature.** Each day, participants were asked to report how long they spent in various green spaces (e.g., parks, gardens) that day. The wording of the item was “If you spent time in green spaces today, please indicate how long the visit was. Duration of the visit: *\_hours \_minutes\_*.” The hours were multiplied by 60 and added to the minutes for a measure of daily time in nature (in minutes). To better understand the context of the visit, participants were asked what type(s) of green spaces they visited, using an open-ended format.

**Fascination.** To measure the fascination with nature, we used two items from the Perceived Restorativeness Scale (Hartig et al., 1997). The full Perceived Restorativeness Scale consists of 16 items de-

signed to measure being away, fascination, coherence, and compatibility. To reduce participant burden, we selected the two fascination items out of seven that loaded most highly on the fascination index (“That place had fascinating qualities” and “My attention was drawn to many interesting things”). Participants used a 7-point scale to indicate the extent to which the given statement described their experience in nature that day (0 = *not at all*, 6 = *completely*). Each participant’s responses to the fascination items were averaged for a measure of daily fascination. If they did not spend time in nature that day, responses to the fascination items were coded as 0.

**Daily positive and negative affect.** Participant’s daily emotional experiences were measured using an 18-item checklist that captured daily PA and NA (Barrett & Russell, 1998). The items for PA were *excited, energetic, enthusiastic, happy, cheerful, pleased, calm, content, relaxed*. The items for NA were *irritable, hostile, angry, nervous, anxious, tense, dejected, sad, unhappy*. These items captured a range of high to low intensities of affect. Participants were asked to rate how they felt “that day” on each of the 18 items using a 5-point Likert scale (1 = *not at all*, 5 = *extremely*). Responses to the nine PA and the nine NA items were averaged separately each day for a measure of daily PA ( $\alpha=0.818$ ) and daily NA ( $\alpha=0.783$ ); multilevel reliability procedures were based on Nezlek (2012).

### Procedure

Participants attended an initial briefing session in groups of two to five where they were briefed on the study aims and procedures, including the daily diary portion of the study. After the initial briefing, participants completed an initial survey on the computer that included demographic information as well as other questionnaires not relevant to the present study. The next day, participants began the daily diary procedure (Gunthert & Wenzel, 2012). For 13 days, participants completed a daily survey between 3 and 8 p.m. each evening by accessing a secure password-protected Web site. Participants were sent nightly e-mail reminders at 5 p.m. and nightly reminder texts at 7 p.m. The survey took 5–10 minutes to complete. On average, participants completed 11 out of 13 dairies (91% completion rate). On the 14th day, participants attended a debriefing session and were reimbursed for their participation.

## Results

### Descriptive statistics

Table 1 shows the average time spent in nature (in minutes), as well as scores on the fascination index, and daily PA and NA scales. On

**Table 1. Descriptive Statistics Among Day-Level (Aggregate) Variables**

DAILY MEASURES	M	SD	MIN	MAX
Time spent in nature	14.74	21.13	0.00	170.60
Fascination	2.61	1.67	0.00	6.00
Positive affect (PA)	2.98	0.50	1.53	4.74
Negative affect (NA)	1.69	0.47	1.03	3.71

Note. *N* = 319. Time spent in nature = Minutes spent in green spaces. Fascination = Fascinating experiences in green spaces.

average, participants spent approximately 15 minutes per day in nature, with some participants spending no time in nature and others spending on average three hours in nature (due to weekend visits to parks and gardens). Regarding the types of nature visits, 29% of visits were to gardens (302 visits of total 1057), 22% were to parks (302 visits), 6% were water-related (e.g., beaches, lakes; 302 visits), 2% were to forests (16 visits), 39% were classified as “other” (e.g., football field, 442 visits; 41.8%), and 3% did not say. Of all the places visited, the majority of visits were to green-space-related nature (52%), followed by blue-space-related nature (6%). Also shown in Table 1, when participants were in nature, they reported on average low to moderate levels of fascination, with some participants reporting no fascination and others reporting very high fascination. Positive affect was greater than negative affect, which is typical (Fredrickson & Losada, 2005).

There were some gender differences. Men spent on average 18 minutes per day in nature, compared to 13 minutes per day for women, although this difference was only a trend,  $t(317) = 1.690$ ,  $p = .093$  (unequal variances). Men also reported greater daily PA ( $M = 2.88$ ) than women ( $M = 2.72$ ),  $t(317) = 2.565$ ,  $p = .011$  (unequal variances). Men and women reported similar levels of fascination (men  $M = 2.76$ ; women  $M = 2.51$ ),  $t(268) = 1.269$ ,  $p = .206$  (unequal variances) and NA (men  $M = 1.65$ ; women  $M = 1.71$ ),  $t(317) = 1.065$ ,  $p = .288$  (unequal variances).

Table 2 shows the correlations among the aggregated daily measures across all participants for the 2 weeks (between-person correlations). Average daily time spent in nature was positively associated with all three other variables—fascination, PA, and NA. Participants who spent more time in nature across those 13 days reported experiencing more fascination in nature, and they also reported higher average PA compared to participants who spent less time in nature.

**Table 2. Correlations Among Day-Level (Aggregate) Variables**

	FASCINATION	POSITIVE AFFECT	NEGATIVE AFFECT
Average daily time in nature	.120*	.149**	.126*
Average fascination	—	.187**	-.051
Average daily positive affect		—	-.344**
Average daily negative affect			—

Note: \* $p < .05$ ; \*\* $p < .001$ .

Interestingly, participants who spent more time in nature also reported higher levels of NA. However, when testing men and women separately, only men showed these relationships between average time in nature and average PA and NA. For men, average time in nature was correlated significantly with higher average PA ( $r = 0.181$ ,  $p = 0.046$ ) and higher average NA ( $r = 0.193$ ,  $p = 0.033$ ). Thus it appears that men who spent more in nature had, on average, greater emotional intensity, both positive and negative. For women, time in nature did not correlate with either PA ( $r = 0.086$ ,  $p = .227$ ) or NA ( $r = 0.060$ ,  $p = .404$ ). However, these analyses reflect aggregated variables across all 13 days and do not reveal how nature and affect were related to each other on a day-to-day basis. For that, we turn to the within-person analyses.

*Within-person analyses*

The Hierarchical Linear Modeling (HLM) software program version 6.08 (Raudenbush et al., 2009) was used to model within-person associations between daily time in nature and PA and NA. HLM is a software program for running multilevel random coefficient modeling, which accommodates the specialized data structure with repeated daily observations nested within individuals.

First, HLM was used to determine the within-person relationship between daily time in nature as the level-1 predictor and daily PA (or NA) as the level-1 outcome. This model enabled us to determine how daily time in nature and PA or NA covaried within a given individual over time. The equations were as follows:

Level 1 (Day-level):

$$\text{Positive affect}_{ij} = \beta_{0j} + \beta_{1j}(\text{Time in nature}) + \beta_{2j}(\text{Weekend effect}) + r_{ij}$$

Level 2 (Person-level):

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + u_{2j}$$

At level 1, time in nature was used to predict change in daily PA as the outcome variable. Time in nature was person centered (i.e., group mean centered) to model changes around each person's own average time in nature (i.e., to test whether participants felt better when they spent more time in nature than they usually did). A weekend effect variable was entered as a control variable (0 for weekdays Mon–Fri; 1 for weekend Sat–Sun). No predictors were included at level 2 in these initial analyses. A significant  $\gamma_{10}$  would indicate that there was a significant relationship between time in nature and daily PA. A separate analysis was run with NA as the level-1 outcome variable.

Results from these analyses showed that daily time spent in nature significantly predicted higher daily PA,  $\gamma = 0.002$ ,  $t(318) = 8.256$ ,  $p < 0.01$ , but not less NA,  $\gamma = -0.0004$ ,  $t(318) = -1.628$ ,  $p = 0.104$ . On days in which participants spent more time in nature, they felt more positive than they normally did. However, time spent in nature was not related to how negative participants felt on a day-to-day basis.

Next, gender (0 = men, 1 = women) was added as a level-2 predictor to test whether men and women varied in their relationships between daily nature experiences and PA and NA. Gender did not moderate the relationship between nature and PA,  $\gamma = -0.000988$ ,  $t(317) = -1.920$ ,  $p = 0.055$ . Thus, for both men and women, daily time spent in nature significantly predicted higher daily PA. However, gender moderated the relationship between nature and NA,  $\gamma = 0.001098$ ,  $t(317) = 2.267$ ,  $p = 0.024$ . Women felt less negative on days when they spent more time in nature,  $\gamma = -0.000965$ ,  $t(317) = -2.615$ ,  $p = 0.01$ , whereas men showed no relationship between NA and nature experiences,  $\gamma = 0.000132$ ,  $t(317) = 0.422$ ,  $p = 0.673$ . In summary, while time in nature significantly predicted higher PA for both men and women, it only predicted lower NA among women.

*Mediation analyses—does fascination account for the relationship between nature experiences and daily affect?*

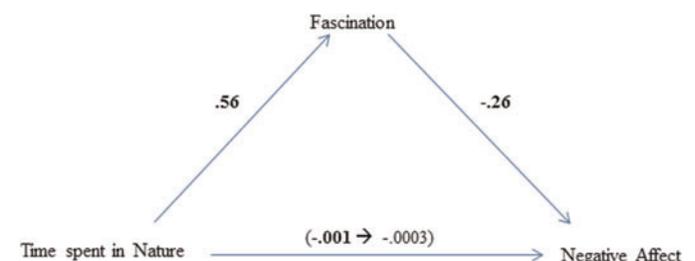
In this next set of analyses, we tested whether fascination mediated the within-person relationships between daily nature experiences and daily affect. We followed three steps using the procedure recommended by Card (2012): Step 1—use time in nature to predict affect; Step 2—use time in nature to predict fascination; Step 3—use fascination to predict affect while controlling for time in nature. The equations for all steps are presented in the Supplementary Materials

(available online at [www.liebertonline.com/eco](http://www.liebertonline.com/eco)). Results showed that fascination partially mediated the relationship between daily nature experiences and PA for the sample as a whole (Sobel test = 6.289) (Sobel, 1982). Step 1 path was significant ( $\gamma = 0.002$ ). Step 2 path was significant ( $\gamma = 0.055949$ ). And Step 3 path was significant ( $\gamma = 0.017938$ ); however, there still remained significant variance ( $\gamma = 0.00115$ ). These patterns of partial mediation were similar when testing women and men separately (see Supplementary Materials). Thus, for both men and women, their experiences of fascination in nature partially explained the associations between nature and PA.

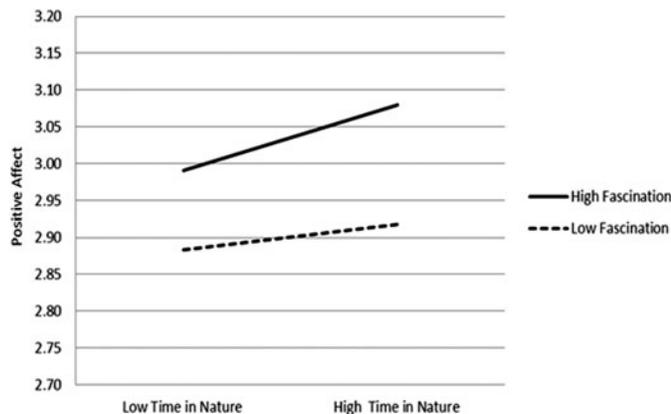
Next, we tested whether fascination mediated the within-person relationship between daily nature experiences and NA found for women only. Here, fascination fully mediated the relationship between time in nature and NA (see Fig. 1). Results for women showed that fascination completely mediated the relationship between daily nature experiences and NA (Sobel test = -2.5099). Step 1 path was significant ( $\gamma = -0.000965$ ). Step 2 path was significant ( $\gamma = 0.055949$ ). And Step 3 path was significant ( $\gamma = -0.025947$ ), with no significant remaining variance ( $\gamma = -0.000319$ ). This pattern for NA suggests that fascination in nature may play a key role in the process between exposure to nature and reduced NA among women.

*Moderation analyses—does fascination enhance the relationship between nature experiences and daily affect?*

Last, we tested whether fascination enhanced the relationship between nature and daily PA and NA. The level-1 equation included the following predictors: time in nature (group centered), fascination (group centered), their cross-product interaction term (computed on group-centered variables), and the weekend effect variable as a control variable. All four variables were used to predict daily PA



**Fig. 1.** The mediational model showing how daily time spent in nature might lead to decreased NA via heightened attentional fascination among women. Bolded coefficients were statistically significant ( $p < .05$ ).



**Fig. 2.** Relationship between time in nature and daily PA as a function of fascination. High and low fascination were defined as one standard deviation from the mean.

(or NA) (see Supplementary Materials; moderation analyses). Results showed that fascination significantly enhanced the relationship between daily spent time in nature and PA,  $\gamma = 0.0003$ ,  $t(318) = 2.381$ ,  $p < 0.05$ , but not NA,  $\gamma = -0.0001$ ,  $t(318) = -1.124$ ,  $p = 0.263$ . This relationship is shown in Fig. 2. As shown by the top line, when individuals reported more fascination in nature, they showed more enhanced PA compared to when they reported less fascination in nature. Unlike the findings for mediation, there were no gender differences in fascination as a moderator. Both men and women showed similar levels of enhancement in PA through fascinating nature experiences.

## Discussion

We found evidence that the *quality* of nature experiences, not just the quantity, played an important role in the relationship between nature and affective experience. Consistent with previous diary and experience sampling studies (Hull & Stewart, 1995; MacKerron & Mourato, 2013; Orsega-Smith et al., 2004; Ryan et al., 2010b), time in nature was associated with significant increases in daily PA among our young adult sample. Moreover, the restorative *quality* of nature experiences (i.e., fascination) both partially accounted for this link between nature and PA and further enhanced the beneficial effects of nature on PA. These findings support the theory that the quality of nature experiences (i.e., fascination) not just the quantity makes an important difference to PA. This link between nature and PA is important given that PA is perhaps the most significant ingredient in well-being—it can broaden attention capability and build resilience

(Fredrickson, 2001) and have beneficial effects on health, perhaps even more so than NA (Pressman & Cohen, 2005).

We found that fascination not only acted as a partial mediator but also as an enhancer (moderator) of PA. People felt better on days in which they reported experiencing more versus less fascination in nature. This finding is consistent with the interpretation that experiencing fascination within natural environments may lead to greater well-being more than simply experience in nature without fascination. What factors, then, drive the experience of fascination? While fascination is certainly afforded by interesting visual stimuli in the natural environment, fascination also likely depends on the state of the person—whether they are in a frame of mind “to be fascinated.” One possibility is that being in a positive mood may itself foster greater fascination within natural environments. Positive mood states are known to broaden not narrow attention (Fredrickson, 2001). While we favor the interpretation that PA follows from experiencing greater fascination in nature, our study design does not rule out the possibility that fascination follows from PA. It is entirely plausible that people in a happier mood who visit nature are in a better frame of mind to be fascinated. Another possibility is that people are better able to be fascinated when they have the leisure to do so. It may be that our fascination items are not tapping a cognitive state at all but rather reflecting a wider meaning of their time in nature—whether they are “at play” or not. We do not think this is the case. We measured two other items tapping a related construct called “Being Away” from the Perceived Restorativeness Scale (“Being [in nature] was an escape experience” and “Spending time [in nature] gave me a break from my day-to-day routine”). Unlike fascination, these two measures did not enhance the relationship between nature and PA, although they did partially mediate the relationship between nature and PA. And, unlike fascination, there was no mediational effect on NA for women. So while experiencing nature as an escape from the day-to-day routine accounted for some of the relationship between nature and PA, it did not enhance the beneficial effects of nature on PA, nor did it explain the relationship between nature and NA for women. This finding indicates that being away and fascination are different constructs and that fascination may play a more important role in the nature-experience relationship.

Time in nature was also associated with improvements in daily NA for women only. We believe our study is the first to test for and show such gender differences in the links between nature and daily NA. We can only speculate on why this gender difference occurred. It is known that women are more likely to have mild forms of anxiety and depression (Kendler et al., 2007; Nolen-Hoeksema et al., 1999). It may be that nature is particularly beneficial for women with such

vulnerability. However, there are many other factors that covary with gender that could be driving those differences (e.g., socioeconomic factors, or power differences between men and women). Regardless of the cause, our findings suggest that women's negative mood may especially benefit from nature-style interventions. Replication and further study will be needed to clarify this. It would be interesting for future studies to test whether women might particularly benefit from nature-style interventions. For example, this link could be tested experimentally, possibly using nature as a treatment for mild forms of anxiety and depression. Moreover, this relationship between time in nature and reduced NA for women was completely mediated by the degree of fascination in nature. This finding further highlights the importance of experiencing certain qualities in nature—and provides support that fascination may be especially beneficial for reducing NA among women.

There were both strengths and limitations of our study. Strengths included the large sample size of over 300 participants; the micro-longitudinal study design across 13 days that enabled within-person analyses; inclusion of both PA and NA to test their unique links to nature experiences; and testing for gender differences, which showed that gender may play a role in the nature and well-being relationship. Limitations included our strictly young adult sample rather than a sample of wider age ranges and the correlational design which limits establishment of causal relationships between nature, fascination, and daily affect. Our study was also fairly quantitative in nature and did not explore in any qualitative way participants' personal feelings about or cultural connections to nature.

In conclusion, our results extend ecopsychology by showing that the quality of nature experiences (not just the quantity) might play an important role in well-being. While simply spending time in nature may be an important first step to greater well-being, our results suggest how one pays attention in those natural environments may further enhance (or impede) the beneficial effects of nature. This finding might also suggest that people can cultivate their sense of fascination and wonder when they are in natural environments.

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