

Article

Does Spending Time in Nature Help Students Cope with the COVID-19 Pandemic?

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Abstract: The COVID-19 pandemic has disrupted our economy, social lives, and mental health, and it therefore provides a unique chance for researchers to examine how people cope with changes to their everyday activities. Research suggests that people may be spending more time in nature than they did pre-pandemic. The current study sheds light on how nature is being used to cope with the stresses of the global health crisis and lockdowns. Canadian undergraduate students ($N = 559$) filled out a questionnaire during the fall of 2020 about their pandemic experience, including their affects, life satisfaction, and feelings of flourishing and vitality, in addition to a wide variety of nature variables. The weekly exposures, the perceived increases or decreases in the exposure to nature during the pandemic, and the feelings of connectedness (nature relatedness) were assessed. Those who felt like they were spending more time in nature than they did pre-pandemic experienced more subjective well-being. Nature-related individuals were more likely to access nature and to appreciate it more during the pandemic than others, but all people (even those less connected) experienced well-being benefits from spending more time in nature. Going into nature appears to be an increasingly popular and effective coping strategy to boost or maintain subjective well-being during the pandemic.

Keywords: nature; nature relatedness; subjective well-being; COVID-19; pandemic



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1. Introduction

On the 11 March 2020, the World Health Organization declared the international outbreak of the novel coronavirus (COVID-19) a “pandemic” [1]. Countries around the world closed their doors to international travelers, people were told to stay at home, and restrictions were imposed on daily activities. An analysis of previous pandemics reveals that quarantining has many negative psychological impacts that can last long after quarantine orders are lifted [2]; thus, some call this a mental health “ripple rather than tsunami” [3]. These consequences for well-being highlight the importance of understanding how people are coping with the pressures of the pandemic. For example, if quarantine is mandatory, actions are needed to combat the negative impacts of boredom [2]. Spending time in nature could be a way to cope with the psychological effects of a pandemic, given that the existing literature has established the benefits of contact with nature. Recent work indicates that people have been flocking to natural areas during the COVID-19 pandemic. The goal of the current study is to explore how spending time in nature during the pandemic might be related to higher levels of subjective well-being, and whether this is dependent on having a strong connection with nature. To test this, undergraduate students reported their experiences during the second wave of the COVID-19 pandemic in Ontario, Canada (fall 2020). During this time, the lives of most students were disrupted with the shift to remote learning, the changes in daily routines because of lockdowns, and the extensive restrictions and limitations on social activities (i.e., numerous stressors). Learning how young people may be using nature to cope with the pandemic allows us to better understand the benefits of nature during these novel and extreme circumstances.

1.1. Nature and Well-Being

“Nature contact” refers to the interactions people have with the natural world, which include not only elements of nature, such as plants and wildlife, but also depictions of nature, such as photographs and videos. This exposure to nature is generally related to higher subjective well-being (see review [4]). Healthy natural environments are inherently appraised positively, which is likely due to our evolutionary predisposition to associate with life and lifelike processes, which is known as the “biophilia hypothesis” [5]. Natural environments also possess qualities that have the potential to improve well-being (e.g., by reducing anxiety and stress [6,7]).

Exposure to nature is related to hedonic well-being, which is characterized by feelings of pleasure and joy [8]. For example, people who spend time outdoors in green spaces, near trees, and engaging in nature-related activities, such as hiking, gardening, and nature/bird watching, are more likely to report higher momentary happiness [9]. A meta-analysis of 32 studies from seven different countries [10] indicates that being exposed to nature produces significant increases in positive moods and decreases in negative moods. These effects are similar for both managed nature (e.g., urban parks) and wild nature (e.g., forested areas). Life satisfaction is also higher in people who spend 120 min in nature each week [11]. Less research has examined the relationship between nature exposure and eudaimonic well-being, which includes the positive indicators of mental health, such as feeling authentic, having meaning in life, and flourishing in the important aspects of one’s life [8,12]. However, daily activity in nature appears to be related to a greater sense of meaning [13].

In addition to contact with nature, people also have varying levels of identifications with, and subjective connections to, nature [14,15]. In terms of the individual differences, the terms “nature relatedness” and “nature connection” refer to having a sense of self that includes the natural world, which includes both knowledge of human–nature interdependence, as well as a personal emotional relationship with the natural world [16]. Nature connectedness (relatedness) is associated with higher levels of both hedonic and eudaimonic well-being, as is seen in two meta-analyses. Across 30 studies, nature connectedness was significantly related to overall happiness, a positive mood, life satisfaction, and vitality [17]. In a recent 25-study meta-analysis by Pritchard et al. [18], nature connectedness was related to both hedonic well-being and eudaimonic well-being (especially personal growth). In addition, research indicates that nature connectedness may be more important for well-being (examined through the single item, “how worthwhile does your life feel”) than nature visits [18]. Moreover, individuals who identify as highly nature-related are more likely to spend time in nature [19,20].

The well-being benefits of spending time in nature and connecting with nature suggest that this may be a helpful and healthy activity during the COVID-19 pandemic. However, less is known about how individual differences in nature connectedness may affect people’s behavior in these challenging circumstances.

1.2. Nature and COVID-19

Since the beginning of the pandemic, many people have been spending more time in nature. The Google trend data in 20 European countries showed a large increase in searches for nature-related topics, such as forests, birds, nature, biodiversity, gardening, and vegetable pots, after the 14 March 2020 [21]. There were also increases in global Google searches for English and German translations of “go for a walk” after the 15 March 2020, but no such increases in searches related to other activities, such as shopping or eating out [22]. Moreover, there were also increases in the actual exposures to nature. A German case study compared park use from early spring 2019 to 2020 and found that there was a 140% increase in visits to forested areas, mainly by new visitors [23]. In Oslo, Norway, both pedestrian and cycling recreational activities increased 291% during the lockdown period in March 2020 compared to the same dates in the previous three years [24]. Oslo residents were also more likely to engage in pedestrian recreational activities in greenspaces, such as

forests and city parks, rather than in urban city areas, such as residential zones. In Hong Kong, the people living in greener places were more likely to engage in physical activity during the pandemic than those in less green areas [25]. Almost 70% of Burlington Vermont (United States) residents increased their visits to nature areas, and 80% reported that they valued the importance of nature more [26]. Even the people who were not accustomed to being in nature felt that access to these areas was very important. People around the world seem to have been more inclined to seek out nature during the pandemic.

Some research has also examined the well-being impacts of spending time in nature during the pandemic. For example, having access to urban parks was important for the happiness of Chinese residents during the pandemic, but the amount of greenness in urban parks was particularly linked with happiness [27]. Irish participants, in a March 2020 daily diary study, reported the most positive and least negative moods when spending time outdoors or in nature, and particularly when engaged in nature-related activities, such as walking, gardening, or bird watching [28]. Austrians who reported being outdoors during a two-week study in April 2020 reported higher levels of state happiness than when they were indoors [29]. In addition, those who felt lonely were not as unhappy when they were outdoors versus when they were indoors. Altogether, this suggests that people seem to be spending more time in nature during the pandemic than previously, and that doing so makes them feel better.

1.3. Current Study

The current study explores the relationships between nature contact and subjective well-being in a student sample that was evaluated during the second wave of the COVID-19 pandemic in Ontario, Canada. With the rises in cases and deaths, the restrictions were tightened. Students' classes were moved online, and stay-at-home orders limited activities to only essential trips outside the home. This context allowed for a study on how the students coped during these unusual times, and on the nature-based strategies used by some of the participants during the pandemic.

Intuitively, a global health crisis would seem likely to result in severe mental health consequences; however, a recent review on mental health and the COVID-19 pandemic suggests that the results are mixed in terms of how the pandemic has affected subjective well-being [30]. In repeated cross-sectional research, studies show that people's moods differed during the early stages of the pandemic, when people were feeling more unpleasant emotions, compared to pre-pandemic. However, the research also suggests that these levels returned to normal a few months into the pandemic. For example, in November 2020, more Canadians reported having better mental health than earlier on in the pandemic, with similar levels to those reported in 2019 (pre-pandemic [31]). Life satisfaction seems to be relatively unchanged (in some people), according to both longitudinal and repeated cross-sectional research [30]. Thus, we expected that the pandemic might have impacted the students' subjective well-being and contacts with nature, but we viewed this study as largely exploratory. We identified the following key research questions (pre-registered on AsPredicted: <https://aspredicted.org/j7za4.pdf> (created on the 26th of October 2020):

1. Are those who are spending more time in nature coping better with COVID-19 (i.e., feeling less fear, feeling that COVID-19 has affected their lives less, experiencing greater subjective well-being and less overall stress)? Previous research on nature contact indicates that spending time in natural environments is beneficial to subjective well-being. The current study explores this relationship over the course of the COVID-19 pandemic to examine if this is still the case. Prior work on the benefits of nature suggests that those spending more time in nature may cope better with the demands of the pandemic. For example, spending time outdoors was related to higher levels of happiness in a Chinese sample [27], an Irish sample [28], and an Austrian sample [29]. Taking into account the pandemic research on nature, recent narrative reviews suggest that nature contact is beneficial for stress reduction, for reducing feelings of loneliness, and for increasing positive emotions and life satisfaction [32,33].

Unlike these studies, our work distinguishes between contacts with different types of environmental landscapes: green spaces, blue spaces, and countryside areas. This allowed for a more nuanced understanding of how subjective well-being is related to various types of nature;

2. Do participants feel like they are spending more time in nature than before the pandemic? The research suggests that our student sample will report spending more time in nature, which is consistent with the pandemic trend of seeking out natural environments [21–26]. Additionally, a preprint review of studies on nature contact during the pandemic found that the majority of the studies reviewed reported increases in time spent in nature, but that one out of every three studies reported a decrease in time spent in nature [32]. Pre-pandemic data were not available in our sample, but the participants reported on their own perceptions, and whether there were changes in their nature contact because of the pandemic. By examining these experiences, we were able to explore how subjective well-being differed for those spending more time in nature (compared to other people), and how this compared to the perceptions of their pre-pandemic behavior;
3. Do the participants feel that they appreciate nature more as a result of the pandemic? The participants were asked about the changes in their perceptions of nature, such as their appreciation. This allowed us to explore whether people were relying on natural environments to cope, and whether they were noticing nature's benefits;
4. Is trait-level nature relatedness associated with spending more time in nature? Engaging with nature tends to increase individuals' feelings of nature connectedness [34]. However, people who feel connected are more likely to go outdoors and spend time in nature [14,19]. This has also been seen during the pandemic. For example, Robison and colleagues [35] report small but significant relationships between nature relatedness and nature-exposure frequencies ($r = 0.12$) and durations ($r = 0.17$). Additionally, in a large-scale study in Australia, those higher in nature relatedness were more likely to feel they were spending more time in green and/or blue spaces during the pandemic than previously, and they also felt more solace or respite in these environments during the pandemic, and reported spending more hours, on average, in green and/or blue spaces [36]. Moreover, nature relatedness has previously been associated with time spent in nature and well-being. Richardson and Hamlin [37] found that, during the pandemic, long-term nature connection and exposure (in the previous year) were more important for ratings of subjective well-being than short-term nature exposure (i.e., the last two weeks). In addition to the bivariate correlations, we also simultaneously evaluated nature relatedness and nature exposure to see if they uniquely predicted well-being.

We also used these data to explore a question not explicitly included in the pre-registration: do any of the links between nature experience and well-being depend on the levels of nature relatedness? In other words, we assessed the interactions between trait nature relatedness and nature exposure. Martin et al. [38] report some complex patterns of interaction, which include the suggestion that the links between nature connectedness and well-being were stronger for those who reported spending more time in nature over the prior year, though the interaction findings are mixed across the literature (e.g., compare with [39]). Taken together, this research suggests that there is value in further examining how nature relatedness associates and interacts with nature exposure in conjunction with subjective well-being.

2. Materials and Methods

The materials, raw data, and syntax can be found on Open Science Framework (see Data Availability Statement).

2.1. Participants

Because of the exploratory nature of the current study, a power analysis based on previous effect sizes could not be performed. However, correlations tend to stabilize with approximately 250 participants [40]. Thus, an informed sensitivity analysis was run in G*Power Version 3.1.9.4 to identify the required effect sizes with a given sample size, power, and alpha. With 80% power and an alpha set at 0.05, a sample of 300 participants can identify an effect size as small as 0.113, regardless of the direction. Therefore, we aimed to recruit 300 participants at each of the two Canadian universities for the study.

Undergraduate students were recruited for an online survey at two Canadian universities in Ontario between the 28 October and the 13 November 2020. Carleton University (approximately 27,829 undergrads [41]) is located in Ottawa (population of approximately 1,032,910 people [42]), and Trent University (approximately 9460 undergraduates [43]) is located in Peterborough (population of approximately 82,094 people [44]). The raw data included 753 potential responses, and the duplicates and unidentified participants were removed. An attention check item was included to ensure that the participants were reading and understanding the questionnaire, and those who failed the attention check were also removed. The final sample consisted of 559 participants. The majority identified as female (83%), with a smaller percentage of male (16%), and gender-fluid, non-binary, or two-spirited participants (1%). The average age was 20.43 years ($SD = 4.80$; range: 18–58). A large percentage of participants were Caucasian (58.7%), and a smaller percentage of participants identified as Black (9.8%), South Asian (7.9%), multiple ethnicity (6.1%), or other ethnicities (<5%) (Aboriginal, Arab, Chinese, Filipino, Latin American, Southeast Asian, West Asian, and other). A total of 37% of the participants were psychology students, whereas the majority (63%) were from other majors. A total of 64% of the participants lived in urban environments (cities, suburbs, ex-urban areas, campus residences), whereas approximately 36% lived in rural environments (small towns, rural areas, farms).

2.2. Materials

The students were recruited through each of the universities' undergraduate research participation systems for course credit. All of the procedures were approved by both universities' ethics boards. The cross-sectional online survey asked participants about demographic information, and it included the measures described in the following sections.

2.2.1. COVID-19 Experience

Restrictions

The pandemic restrictions varied across regions and provinces. Learning was virtual (remote), so not all of the students were in the cities where their universities were located. Thus, we asked the participants to report about the current COVID-19 restrictions in their immediate area. The participants reported on whether indoor retail shopping was allowed, if wearing masks was mandatory, if indoor dining was permitted, and if gatherings were limited to 10 people (using a "yes", "no", or "unsure" response format in order to reduce guessing). Each item was analyzed individually.

Impact

The participants were asked how the COVID-19 pandemic had impacted seven different aspects of their lives: living situation, work/school, social life, physical activity, getting outside, health, and mental health. The students responded using a five-point scale ranging from 1 (no impact at all) to 5 (impacted my life a great deal). These items were examined individually and were aggregated (by averaging all 7 items) to create an overall impact score ($\alpha = 0.75$).

Stress

The Perceived Stress Scale [45] assessed the degree to which the participants felt their lives had been unpredictable, uncontrollable, and overloaded in the prior four weeks, which are all important factors in the experience of stress. We used a modified version of this scale, with 10 items instead of the original 14. The participants rated their perceptions of stress using a five-point Likert scale ranging from 1 (never) to 5 (very often). The items were averaged and the higher scores indicated higher levels of perceived stress, with good internal consistency ($\alpha = 0.87$).

COVID-19 Fear

The Fear of COVID-19 Scale [46] measured the distress levels related to the COVID-19 pandemic with six items. The participants reported how much they disagreed or agreed with statements about the fear of losing their life, having serious health complications, forced hospitalization, isolation, losing employment, and losing someone they love, using a five-point scale from 1 (definitely disagree) to 5 (completely agree). The six items were averaged to create an aggregated variable ($\alpha = 0.83$).

Loneliness

A single-item loneliness measure was used. This loneliness item asked the participants how lonely they felt during the past week (7 days) on a scale from 1 (never) to 5 (very often).

2.2.2. Nature Variables

Nature Contact

The participants reported how much time they spent, on average, in places such as green spaces (local parks, woodlands, nature areas), blue spaces (beaches, coasts, canals, lakefronts), and countryside spaces (farmlands, hills) during a typical week of the pandemic (the assessment of places was adapted from [11]). The participants rated the frequencies of their nature contact on a five-point scale: 1 (I have not spent time here); 2 (once a week); 3 (2–3 times a week); 4 (4–5 times a week); and 5 (6–7 times a week). These three natural environments were assessed as single items, but they were also aggregated (averaged across all three nature environments) to explore the overall natural contact ($\alpha = 0.64$). Because of the COVID-19 restrictions, we also assessed how the pandemic may have impacted the frequencies of the visits to these places. The participants used a seven-point scale to indicate the extent to which their visits were “less” (1) or “more” (7) frequent than they were pre-pandemic. Given the potential differences in the access to nature, we also asked the participants to report how easily they could access both green and blue spaces on a five-point scale from 1 (very difficult) to 5 (very easily).

Nature Perceptions

We wanted to gather the individuals’ self-reported changes in their perceptions towards nature during the pandemic. To assess these perceptions of nature, the participants were asked to report if they valued nature more, feared nature more, thought of nature differently, and whether they noticed more wildlife during the pandemic than previously. These items were rated on a five-point Likert-type scale from 1 (strongly disagree) to 5 (strongly agree). Each item was examined separately.

Nature Connectedness

The nature connection was assessed with the Nature Relatedness (NR) Scale [14]. The scale assesses the affective, cognitive, and experiential aspects of an individual’s subjective connection with nature. Twenty-one items are rated on a five-point Likert scale ranging from 1 (disagree strongly) to 5 (agree strongly). An overall average across all items was created ($\alpha = 0.87$).

2.2.3. Well-Being

Affect

The Scale of Positive and Negative Experience (SPANE [47]) was used to assess the positive and negative feelings experienced by the participants. Six positive emotions (SPANE-P) and six negative emotions (SPANE-N) were rated on a five-point scale, ranging from 1 (very rarely or never) to 5 (very often or always), in terms of how often the emotion was experienced during the past four weeks. Both the SPANE-P ($\alpha = 0.87$) and SPANE-N ($\alpha = 0.83$) scores were averaged. An affect balance score (SPANE-B) was computed by subtracting the negative affect from the positive affect, with a positive score indicating that the participants feel more positive moods, and a negative score indicating more negative moods. In addition to the six original positive emotions (positive, good, pleasant, happy, joyful, contented), three additional words were added (curious, in awe, fascinated) to assess the emotions often experienced during contact with nature. This ad hoc emotion facet was averaged across the three items and was named “fascination” ($\alpha = 0.79$).

Flourishing

The Flourishing Scale [47] was used to assess the participants’ perceived success in their relationships, self-esteem, purpose, and optimism. Each of the eight items were rated on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The scores were averaged ($\alpha = 0.89$).

Vitality

The Subjective Vitality Scale [48] measures the participant’s self-reported levels of aliveness and energy. This seven-item questionnaire is rated on a seven-point Likert scale ranging from 1 (not at all true) to 7 (very true). A score is calculated by averaging the seven items ($\alpha = 0.91$). A high average indicates high subjective vitality.

Satisfaction with Life

The Satisfaction with Life Scale (SWLS [49]) was used to assess the participants’ satisfaction with life. This is often viewed as a cognitive judgement of subjective well-being that complements the emotional experience indicators. The five items are rated on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The scores were averaged across all five items, with a higher score indicating that a participant felt more satisfied with their life ($\alpha = 0.89$).

2.3. Procedure

The participants were recruited on the SONA online systems at each of the universities. The questionnaire included some measures beyond the scope of this report, and it began with demographic information, such as sex, age, ethnicity, type of student (part-time versus full-time), major of study, employment status, ownership of pets, political ideology, and living situation. The participants were also asked to report on the availability of environmental behavior services (such as curbside composting and recycling, which is part of a separate study and outside the scope of the current manuscript) and their access to natural spaces. The participants were asked about the current COVID-19 restrictions in their areas, how the pandemic had impacted different aspects of their lives, as well as the single-item loneliness measure. Next, three nature connectedness scales were included: the Nature Relatedness Scale [14], the Inclusion of Nature in Self Scale [15], and the Nature Self Size Scale [50]. We focused on the Nature Relatedness Scale in this study to avoid collinearity in analyses. The nature variables, such as the nature perception, time spent in nature, and the perceived time difference from pre-pandemic levels, were examined. The well-being measures, such as the SPANE [47], flourishing [47], vitality [48], and the Life Satisfaction Scale [47], were evaluated. To examine the participants’ unpleasant experiences during the COVID-19 pandemic, the Perceived Stress Scale [45] and the Fear of COVID-19 Scale [46] were included. The last section of the questionnaire consisted

of pro-environmental behavior items (outside the scope of the current manuscript). We declare that we reported how we determined our sample size, all the data exclusions (if any), all the manipulations, and all the measures in the study.

2.4. Statistical Methods

First, descriptive statistics were used to examine the students' experiences during the pandemic. Therefore, the frequencies and the descriptives, such as the means and standard deviations, were explored for the COVID-19 restrictions, how the pandemic was impacting their lives, and their reported well-being (loneliness, COVID-19 fear, stress, affect, flourishing, vitality, and life satisfaction). Second, the descriptives were explored for the nature variables to determine how much time the students were spending in nature environments (green spaces, blue spaces, and the countryside), and whether they perceived this time spent in nature as more or less than the time spent pre-pandemic. Pearson correlations were conducted to examine whether the nature-related individuals were more likely to be spending time in nature during the pandemic.

To examine the concurrent predictive power of the nature relatedness and the nature exposure, and how they might interact, hierarchical linear regressions (i.e., with cross-product interaction terms added in separate blocks) were run for each of the subjective well-being measures. However, we used bivariate Pearson correlations to guide which sets of variables were best suited to regression by examining the correlations between the nature variables and the positive and negative markers of well-being. To focus and streamline the analyses, the three nature exposure items (green space, blue space, countryside) were aggregated into a single composite nature-exposure variable. In the first step of each model, the aggregated nature-exposure variable and the natural relatedness were entered as unique predictors for each individual subjective well-being marker. In the second step of each model, the interaction term between the nature exposure and the nature relatedness was entered. To create the interaction terms, the aggregated nature exposure and the nature relatedness were both mean centered before creating the cross-product term.

3. Results

3.1. Students' Experiences during the Pandemic

The participants were asked to describe the current COVID-19 restrictions in their areas. The frequencies of the responses can be seen in Table 1. Overall, the participants reported that the COVID-19 pandemic had impacted their lives. When examining individual items, it can be seen that the participants reported that the pandemic affected their work/school, social life, physical activity, and mental health the most, but that impacts were also felt with regard to their living situations, getting outside, and their health. On average, the participants reported feeling lonely and in a negative mood sometimes, but they also experienced some positive moods and reported feeling somewhat vital and flourishing. The average scores were also near the scale midpoints for the life satisfaction and the fear of COVID-19.

Table 1. Frequency table of the current COVID-19 restrictions in the participants' areas (percentage of sample).

	Yes	No	Unsure	Total
Can you shop indoors at retail stores?	535 (95.7%)	7 (1.3%)	17 (3%)	559
Are masks mandatory?	367 (65.7%)	165 (29.5%)	27 (4.8%)	559
Is indoor dining (cafes, restaurants) permitted?	492 (88%)	33 (5.9%)	34 (6.1%)	559
Are indoor gatherings limited to 10 people?	438 (78.4%)	29 (5.2%)	92 (16.5%)	559

The participants reported that green spaces were very easily accessible, and more so than blue spaces ($t = 19.02, p < 0.001, d = 1.21$). Most of the participants spent time in green spaces about once a week, but they visited blue spaces or the countryside less than once a week. This time spent in natural environments was reported, on average, as being about the same amount of time spent prior to the pandemic in green spaces, and a little less for blue and countryside spaces. When asked about their perceptions of the changes related to nature during the pandemic, the participants indicated that they appreciated nature more and feared it less. Most people did not report thinking differently about nature or noticing more wildlife, compared to pre-pandemic. Table 2 contains the descriptive statistics for all the variables.

Table 2. Descriptive statistics.

Variable	Min	Max	<i>M</i>	<i>SD</i>
Overall COVID-19 impact on life	1	5	3.48	0.79
Your living situation (affected by COVID-19)	1	5	2.45	1.52
Work/school (affected by COVID-19)	1	5	4.47	0.85
Social life (affected by COVID-19)	1	5	4.19	1.01
Physical activity (affected by COVID-19)	1	5	3.56	1.29
Getting outside (affected by COVID-19)	1	5	3.19	1.40
Health (affected by COVID-19)	1	5	2.74	1.33
Mental health (affected by COVID-19)	1	5	3.76	1.21
Loneliness	1	5	3.32	1.09
Positive affect	1	5	3.31	0.68
Negative affect	1	5	3.05	0.75
Affect balance	−4	4	0.26	1.26
Fascination affect	1	7	2.69	0.95
Flourishing	1.50	7	5.18	1.02
Vitality	1	7	3.84	1.32
Satisfaction with life	1	7	4.19	1.40
COVID-19 fear	1	5	3.05	0.99
Perceived Stress	1.80	5	3.35	0.38
Green space access	1	5	4.60	0.75
Blue space access	1	5	3.63	1.26
Time spent in green spaces	1	5	2.40	1.04
Time spent blue spaces	1	5	1.69	0.90
Time spent in countryside	1	5	1.69	1.11
Perceived difference in time spent in green spaces	1	7	4.19	1.75
Perceived difference in time spent in blue spaces	1	7	3.54	1.67
Perceived difference in time spent in countryside	1	7	3.51	1.51
I value nature more (appreciation)	1	5	3.75	1.01
I fear nature more	1	5	2.17	1.12
I think of nature differently	1	5	3.11	1.07
I notice and see wildlife more	1	5	3.39	1.15

As exploratory analyses, we examined whether those currently living in urban areas versus rural areas differed in their ratings on the nature variables. To test this, independent sample *t*-tests were examined for the nature relatedness, access to nature, and time spent in nature (see Table 3 for *t*-test results). Individuals living in more rural environments had more access to blue spaces, but not green spaces, compared to those living in urban environments. Rural residents spent significantly more time in all three nature spaces (green, blue, and countryside) than urban residents. There was no difference in their level of nature relatedness.

Table 3. Independent *t*-test results and means (standard deviations) of the nature variables for those currently living in urban areas versus rural areas.

Variables	Rural	Urban	<i>t</i> -Test	Cohen's <i>d</i>
NR	3.52 (0.58)	3.52 (0.59)	−0.001	0.00
Green space access	4.65 (0.69)	4.58 (0.78)	1.15	0.10
Blue space access	3.98 (1.16)	3.43 (1.26)	5.15 ***	0.44
Time in green space	2.56 (1.11)	2.32 (1.00)	2.54 *	0.23
Time in blue space	1.83 (1.00)	1.61 (0.83)	2.62 **	0.07
Time in countryside	2.09 (1.38)	1.47 (0.85)	5.77 ***	0.40

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

3.2. Nature Relatedness and Nature Exposure

To examine if higher trait levels of nature relatedness were associated with spending more time in nature, bivariate correlations were run (see Table 4). The nature-related people reported going outdoors more, such as to green spaces, blue spaces, and the countryside. They also reported that these nature exposures were more frequent than their pre-pandemic levels. Higher levels of nature relatedness were also associated with better perceptions of nature, such as a greater appreciation for nature, thinking of nature differently, and noticing more wildlife. There was no relationship between the nature relatedness and the fear of nature. Although all of the correlations were statistically significant except for one, a note about the magnitude of the correlations should be made. Altogether, these moderate and small correlations suggest that those who identified as more nature-related were more likely to access nature during the pandemic, compared to the people who were less nature-related.

Table 4. Bivariate Pearson correlations between nature relatedness and the nature variables.

Nature Items	NR
I value nature more (appreciation)	0.42 ***
I fear nature more	−0.05
I think of nature differently	0.27 ***
I notice and see wildlife more	0.34 ***
Time spent in green spaces (local parks, woodlands, nature areas)	0.37 ***
Time spent in blue spaces (beaches, coasts, canals, lakefronts)	0.20 ***
Time spent in countryside (farmlands, hills)	0.25 ***
Change in time spent in green spaces	0.20 ***
Change in time spent in blue spaces	0.14 ***
Change in time spent in countryside	0.14 **

Note: ** $p < 0.01$, *** $p < 0.001$.

3.3. Nature Exposure and Well-Being

In order to examine if the time spent in nature over a typical week during the pandemic was related to well-being, bivariate Pearson correlations were run. The correlation matrix can be viewed in Table 5. Although many significant associations between nature and well-being appear, it is worth noting that the statistically significant correlations were of a modest size (typically 0.20 or smaller). Those who spent more time in green spaces reported more positively balanced affect, fascination, flourishing, vitality, and satisfaction with life. Those who spent more time in blue spaces had more positively balanced affect and life satisfaction. There was no relationship between the time spent in blue spaces and any of the other variables. Those who spent more time in the countryside had more positively balanced affect, fascination, feelings of flourishing, vitality, and life satisfaction. Additionally, people who spent time in the countryside reported feeling less lonely. The nature experiences were unrelated to either COVID-19 fear or stress.

Table 5. Bivariate Pearson correlations of nature variables, well-being, and COVID-19 experience variables.

	Time Spent in Green Spaces	Time Spent in Blue Spaces	Time Spent in Countryside	Perceived Difference in Time Spent in Green Spaces	Perceived Difference in Time Spent in Blue Spaces	Perceived Difference in Time Spent in Countryside	Nature Relatedness
Affect Balance	0.16 ***	0.09 *	0.18 ***	0.11 **	0.10 *	0.10 *	0.07
Fascination affect	0.16 ***	0.07	0.12 **	0.07	0.04	0.01	0.19 ***
Flourishing	0.15 ***	0.08	0.17 ***	0.16 ***	0.13 ***	0.14 ***	0.20 ***
Vitality	0.18 ***	0.07	0.17 ***	0.15 ***	0.09 *	0.06	0.18 ***
Satisfaction with life	0.20 ***	0.12 **	0.18 ***	0.17 ***	0.11 **	0.12 **	0.13 ***
Fear of COVID-19	−0.01	0.02	−0.06	−0.03	−0.05	−0.14 ***	0.01
Stress	0.03	0.02	−0.01	0.02	−0.01	0.01	0.09 *
Loneliness	−0.05	−0.07	−0.11 **	−0.05	−0.10 *	−0.08	0.06

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Moreover, we examined the relationship between the perceived differences in the time spent in natural environments during the pandemic with the well-being and pandemic experience variables. Those who felt like they were spending more time in green places were likely to have better affect balance, to be flourishing, and to feel greater vitality and satisfaction with life. Similarly, the participants who reported spending more time in blue spaces reported experiencing more flourishing, vitality, and life satisfaction, and feeling less lonely. Spending more time in the countryside was also associated with more flourishing and life satisfaction, and less fear of COVID-19. Access to green and blue spaces was also examined in relation to well-being. The only significant association was between the access to green spaces and flourishing ($r = 0.10$, $p = 0.02$). Access was not significantly related to any other well-being variable (all r values below 0.10).

Regression Analyses

As highlighted by the correlations, the positive markers of well-being (balanced affect, vitality, flourishing, and life satisfaction) were more consistently associated with nature exposure across the three natural environments. Therefore, the regression analyses were only run to predict the positive markers of subjective well-being. (Still, we report the regressions with the negative markers of well-being in Supplementary Materials, Table S1.) Four separate models were explored for each of the positive well-being variables (affect, vitality, flourishing, life satisfaction). In addition, in order to reduce the number of regression analyses, and because of the relative similarities of the results across the three different types of nature environments, the three environments were aggregated to a single nature-exposure item that was used in the regression analyses.

The results of the four regression analyses can be viewed in Table 6. The first step of each of the models for all of the four dependent variables were significant: the affect balance ($R^2 = 0.04$, $F(2, 556) = 10.41$, $p < 0.001$); the flourishing ($R^2 = 0.05$, $F(2, 556) = 15.00$, $p < 0.001$); the vitality ($R^2 = 0.05$, $F(2, 556) = 14.20$, $p < 0.001$); and the satisfaction with life ($R^2 = 0.05$, $F(1, 556) = 15.22$, $p < 0.001$). (Note: the strengths of the effect sizes are small. Therefore, the predictor variables explain the small percentage of variance in the well-being DVs.) The nature exposure was a unique predictor for the affect balance, flourishing, vitality, and life satisfaction. The nature relatedness was only a significant unique predictor of the flourishing and vitality measures of well-being. The second models, with the interaction for all four dependent variables, did not add significant explained variance to the regression: affect balance ($R^2_{\text{change}} = 0.000$, $F(1, 555) = 0.02$, $p = 0.90$); flourishing ($R^2_{\text{change}} = 0.000$, $F(1, 555) = 0.05$, $p = 0.82$); vitality ($R^2_{\text{change}} = 0.000$, $F(1, 555) = 0.24$, $p = 0.63$); and life satisfaction ($R^2_{\text{change}} = 0.000$, $F(1, 555) = 0.15$, $p = 0.70$). Moreover, the interaction terms were not significant predictors for any of the positive subjective well-being markers.

Table 6. Regression results for: (i) affect balance; (ii) flourishing; (iii) vitality; and (iv) life satisfaction.

(i) Affect Balance		95% CI					
Step		<i>b</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>	Lower	Upper
1	(Constant)	−0.31	0.32	−0.98	0.33	−0.94	0.31
	Nature exposure	0.31	0.07	4.29	<0.001	0.17	0.45
	NR	−0.01	0.10	−0.09	0.93	−0.20	0.18
2	(Constant)	−0.31	0.32	−0.98	0.33	−0.94	0.31
	Nature exposure	0.31	0.08	4.07	<0.001	0.16	0.46
	NR	−0.01	0.10	−0.08	0.94	−0.20	0.18
	NR X Nat exposure	0.02	0.12	0.13	0.90	−0.22	0.25
(ii) Flourishing		95% CI					
Step		<i>b</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>	Lower	Upper
1	(Constant)	3.95	0.26	15.43	<0.001	3.44	4.45
	Nature exposure	0.16	0.06	2.73	0.01	0.04	0.27
	NR	0.26	0.08	3.44	<0.001	0.11	0.42
2	(Constant)	3.95	0.26	15.42	<0.001	3.44	4.45
	Nature exposure	0.16	0.06	2.55	0.01	0.04	0.27
	NR	0.27	0.08	3.45	<0.001	0.11	0.42
	NR X Nat exposure	0.02	0.10	0.23	0.82	−0.16	0.21
(iii) Vitality		95% CI					
Step		<i>b</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>	Lower	Upper
1	(Constant)	2.40	0.33	7.25	<0.001	1.75	3.05
	Nature exposure	0.24	0.08	3.22	0.001	0.09	0.39
	NR	0.28	0.10	2.80	0.01	0.08	0.47
2	(Constant)	2.40	0.33	7.25	<0.001	1.75	3.05
	Nature exposure	0.25	0.08	3.22	0.001	0.10	0.41
	NR	0.27	0.10	2.76	0.01	0.08	0.47
	NR X Nat exposure	−0.06	0.12	−0.49	0.63	−0.30	0.18
(iv) Life Satisfaction		95% CI					
Step		<i>b</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>	Lower	Upper
1	(Constant)	2.98	0.35	8.48	<0.001	2.29	3.67
	Nature exposure	0.36	0.08	4.47	<0.001	0.20	0.52
	NR	0.15	0.11	1.40	0.16	−0.06	0.36
2	(Constant)	2.98	0.35	8.48	<0.001	2.29	3.67
	Nature exposure	0.37	0.08	4.39	<0.001	0.20	0.53
	NR	0.15	0.11	1.37	0.17	−0.06	0.35
	NR X Nat exposure	−0.05	0.13	−0.39	0.70	−0.31	0.21

In sum, across all the positive well-being indicators, the nature exposure remained an independent predictor, even when controlling for the nature relatedness. The nature relatedness remained a significant unique predictor for some well-being indicators, but not others. Finally, we found no evidence of interactions between the trait nature relatedness and the recent nature exposure in predicting well-being.

4. Discussion

The current study explored the relationships between spending time in nature, nature relatedness, and well-being during the global COVID-19 pandemic in a Canadian undergraduate student sample. On average, people who spent more time in nature also reported higher well-being; however, this was more so for the positive markers of well-being than the negative. This relationship was also inconsistent across the types of nature. For

example, although the time spent in green spaces and in the countryside were related to all four markers of positive subjective well-being (affect balance, flourishing, vitality, and satisfaction with life), spending time in blue spaces was only significantly related to the hedonic well-being indicators (affect balance and satisfaction with life).

It is not clear why there are differences between the three different nature environments and their associations with well-being. There are three reasonable possibilities: the environments themselves are more conducive to well-being; different kinds of people frequent different kinds of environments; and some environments are more accessible. For example, Mangone et al. [51] found dramatic differences in people's assessments of various narrower environment types (e.g., beaches vs. swamps); however, the most and least preferred biomes did not easily cleave into the green space vs. blue space categories, as one might intuit when considering beaches and swamps. The benefits of particular environments may further vary in ways that are more nuanced than our three categories could discover. Additionally, personality characteristics that are not obviously related to nature experiences, yet that are associated with well-being, may actually predict the preferred places, such as the extraverts' affinity for oceans, and the introverts' affinity for mountains [52]. Happier people may select different kinds of nature.

Finally, in this study, the green spaces were reported as more accessible than the blue spaces, and the participants, in general, reported spending more time in green spaces than in both blue spaces and the countryside. However, there were differences in both the access to (blue spaces only), and the time spent in, the three nature environments for those living in urban versus rural areas. This suggests individual differences in the accessibilities and regular visits to the different types of natural environments. In the supplementary analyses (not presented; see Supplementary Materials, Table S2), there is, however, no difference in the subjective well-being on the basis of where individuals were living, except for satisfaction with life. Of course, much future research will be needed in order to resolve the true explanations for the differential effects of the natural environment types of well-being. This can be performed by exploring natural environments with varying degrees or forms of natural elements. With all this being said, the aggregated measure of nature exposure was related to all the positive markers, and it is possible that the nuanced differences are idiosyncratic to the times, contexts, and places assessed in this particular sample. There was less evidence that nature exposure attenuates the negative markers of subjective well-being, though there were suggestive results for countryside environments that were related to lower levels of loneliness in the correlational analyses. McMahan and Estes [10] highlight the weaker relationship between negative affect and nature exposure, compared to positive affect, across 32 studies, and our results are broadly consistent with theirs.

Unlike several other nature pandemic studies [23,24,26,53], on average, our participants did not report spending significantly more time in nature. They did report spending more time in green spaces, specifically, and they also indicated that they appreciated nature more, feared it less, and noticed wildlife slightly more as a result of the pandemic. Notably, some people were spending more time in nature, while others were visiting nature less often (the median scores for the pandemic changes on each type of nature type were mid-range; scale value = 4). In a recent review [32], even though the majority of studies report increased time spent in nature during the pandemic, a third of the studies report decreases. The authors speculate that the differences may come from the size and type of the data. For example, large datasets, such as those coming from Google trend data, generally show reliable increases, whereas smaller datasets, similar to ours, show more mixed results. Individual differences may also play a role; we found that people higher in nature relatedness have been spending more time in nature during the pandemic, compared to those who are less nature-related. Additionally, the timing of our data collection may explain, in part, the lack of sample-wide increases in the nature contact observed in other studies. For example, much of the reported pandemic research on the increases in nature contact was conducted during the first few months of the pandemic (March to June 2020). During that time, activities were so restricted that nature visits may have been the only option. By the

fall of 2020, when we recruited our participants, nature exposure may have become less of a novelty, or may have perhaps become less appealing because of cooler temperatures. This is consistent with research suggesting that the well-being markers returned to pre-pandemic levels by the fall of 2020 [30]. Moreover, some studies indicate that the participants were not spending more time in nearby greenspaces [54,55]. For example, students from four universities in the United States reported that they were limiting their park use in order to avoid people, to reduce the threat of contracting COVID-19, or because of restrictions beyond their control [54]. Despite this, the people who did report spending more time in greenspaces were more likely to report higher senses of well-being (through life satisfaction and subjective happiness) [55] and lower emotional distress [54], which is similar to our results. With the continuation of the pandemic and our slow move back to “normal”, it is important to sustain this line of research in order to explore whether people are still seeking nature contact, and whether this is beneficial for coping with the ongoing uncertainty of the COVID-19 pandemic.

The nature-related people reported spending more time in all three types of natural environments, which is similar to research by Lin et al. [19]. They also appreciated nature more, thought of nature differently, and noticed more wildlife during the pandemic. More frequent nature contact may help to explain why those high in nature relatedness also tended to report better well-being. However, we found no significant interaction between nature exposure and nature relatedness, and the benefits of nature were not particularly pronounced for the nature-related people. Another interpretation is that nature relatedness is not necessary to benefit from nature contact; everyone seems to benefit from nature if they spend time there. The results of the moderating effect of the nature connection on the nature contact well-being relationship have been mixed. Some previous research indicates that those lower in nature connection benefit more from nature exposure [38,56], whereas McMahan et al. [39] suggest that those high in nature connectedness benefit most from spending time in nature. Similar to our study, Passmore and Holder [57] found no interaction. Across these studies and our own, there are differences in the measures, procedures, and samples used. Therefore, it is unclear if the mixed results are due to differences between the studies, or to a lack of interaction and type II error. Furthermore, our study has much less power for interaction analyses (vs. simple correlations), so these nulls are not high confidence. Overall, the relationship between nature contact and nature relatedness is unclear and requires more attention.

Our nature-related participants reported higher levels of subjective well-being, even when controlling for the nature contact. However, nature relatedness was not more important than nature exposure for predicting well-being. For example, nature exposure independently predicted all four markers of positive well-being, whereas nature relatedness was only significant for eudaimonic well-being (flourishing and vitality) in the regressions. This conflicts with previous studies that found that long-term nature exposure, such as nature connectedness, was more important to predicting well-being than short-term nature exposure [37]. Our single study does not suggest any conclusions about how nature contact and nature connectedness may suppress the effects of the other. For example, it could be that contact is more important than connection; however, the same pattern could also be explained if nature-related people experience more well-being because they spend more time in nature (akin to the ambiguity of a mediation process vs. a control variable). More data and clever designs may help to resolve these ambiguities in future work.

Limitations

This study is not without limitations. First, we used a convenience sample of Canadian students, so our results and conclusions are limited in terms of generalizing to other kinds of people. Narrowing our sample to students, whose learning environments were drastically altered, is useful for exploring the consistency of the findings about nature exposure and well-being during the pandemic. For example, other studies from China [27], Ireland [28], Austria [29], Japan [55], and the United States [54] noted similar relationships between

nature contact and well-being during the pandemic. Thus, even though our results are specific within the context of our sample of Canadian university students, the broad pattern of results matches those of many other pandemic studies about nature and well-being. Our findings contribute more information to these emerging trends. In addition, we were able to explore two samples of students from different universities in different cities within Canada. (The pattern of the results was not different when examining the data separately).

Second, the correlational design inhibits causal or directional claims for any of the results. For example, highly nature-related people may seek out nature; however, spending time in nature may also increase nature relatedness. In addition, the study was cross-sectional, and longitudinal research would help us to better establish how nature contact is changing as a result of the pandemic. The circumstances meant that we relied on the participants to report their subjective perceptions of how their nature contact may have changed. This introduces potential recall bias [58], even though most of our central research questions were focused on experiences during the pandemic. Our results also align with previous findings. For example, we report that those who perceived that they spent more time in nature were more likely to report higher subjective well-being. This is consistent with the existing prior experimental work that shows that more nature contact can cause mood boosts [10]. This strengthens the inference that nature has been conducive to well-being during the pandemic, at levels similar to those of pre-pandemic periods; however, we cannot rule out the alternative causal direction (happiness to nature contact), which is possible at both times (i.e., it could be a bi-directional relationship). Moreover, the results linking nature and well-being are, in general, modest in size. The sizes of the relationships (e.g., the Cohen's d of the t -tests, the correlation coefficients, and the R^2 of the regressions) do not discount the importance of the relationships; however, it is also important not to overstate their sizes. Our significant results indicate that the relationships are greater than 0, but that the effect sizes are small or moderate by the conventional benchmarks. On the one hand, well-being is determined by many factors, so it is perhaps unsurprising that a narrow collection of predictors explains a relatively small proportion of variability. On the other hand, the links here are smaller than the largest predictors (e.g., broad personality traits). Therefore, our results do suggest relationships between nature and well-being, but the modest strength should be understood too.

Third, the current study does not consider the potential confounding effects of other variables, such as physical activity or socialization, that may co-occur with nature exposure. Astell-Burt and Feng [36] report that approximately 30% of their participants perceived that they walked or exercised more in natural spaces during the pandemic than they did previously, and approximately 25% reported that spending time in natural spaces allowed them to connect with their neighbors during the pandemic. These confounding variables have previously been associated with both nature and well-being. For example, physical activity has been associated with well-being [59], and increased greenness has been associated with more physical activity [60]. It is possible that our participants who are spending time in nature may also be doing physical activity within these spaces, which may explain their well-being. Future research should aim to assess these and other confounding factors when exploring nature exposure and well-being. Understanding the causal forces more accurately will likely translate to better personal and policy recommendations. Nonetheless, knowledge of the mere association between the time spent in nature and well-being, especially during the pandemic, may still be useful if natural spaces are generally conducive to physical activity, socializing, or other stress relievers that act as the more proximal causes of the benefits.

5. Conclusions

Many of the studies at the beginning of the pandemic, in early 2020, report that people were spending more time in nature, and that this seemed to be making them feel good (through happiness, affect, and life satisfaction). Our findings suggest that although the students varied in their nature contacts during the fall of 2020, those who spent more time in

nature felt better (measured as affect, vitality, flourishing, and life satisfaction). The results from this period of the pandemic are generally consistent with previous findings. As the world adjusts to the new pandemic reality, it seems useful to continue recommending that people spend time in nature. Despite this overall trend, our results also produced some inconsistent patterns across more specific types of natural environments, and further exploring these nuances will be useful in sharpening future recommendations for nature contact.

At a broader level, our results are consistent with a growing body of work that suggests the benefits for individuals, broader communities, and even the planetary health when people deepen their connections with nature. That is, nature contact seems to foster both well-being and stronger subjective connections with nature over time. In turn, high nature relatedness is strongly associated with sustainable behaviors [38]. Our results extend some of these patterns to life during the pandemic, and with similar associations. Thus, as before the pandemic, there may be a happy path to sustainability that leads through nature. The efforts to foster people's nature contacts may provide benefits to the natural environment as well.

Supplementary Materials: The following are available online at <https://www.mdpi.com/article/10.3390/su14042401/s1>: Table S1. Regression results for the negative markers of well-being: (i) Stress, (ii) COVID-19 Fear, & (iii) Loneliness. Table S2. T-test results and mean (standard deviations) for each subjective well-being variable by rural or urban residents.

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