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Exploring the Relationships Among Experiences in Nature, Wellbeing, and Stewardship During the COVID-19 Pandemic

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The COVID-19 pandemic brought sudden and dramatic changes to our daily lives. From shifting to remote work, to following shelter-in-place orders, to increased concerns about the health and wellbeing of one's self and family, individuals were required to make changes to their daily habits and to find new methods of coping with stress and maintaining wellbeing. In the present study, we surveyed participants in the United States ($N = 192$) with open-ended questions and individual difference measures to capture how changes to daily life due to the COVID-19 pandemic affected individuals' engagement with the outdoors. Specifically, using descriptive and inferential statistics, we (1) describe how people experienced the outdoors during the beginning stages of the COVID-19 pandemic; (2) evaluate how individuals' experiences outdoors relate to individual differences; and (3) report whether environmental experiences and COVID-19 concern relate to whether individuals chose to donate their participation payment to The Trust for Public Land, to the Center for Disease Control's COVID-19 fund, or to keep the payment for themselves in the form of a gift card. This work enhances our understanding of how the pandemic affected the relationship between people and the outdoors and contributes to knowledge about how nature can be used to help individuals and communities during times of crisis.

Keywords: green space, wellbeing, human-environment relationships, mental health, physical health, nature spaces

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INTRODUCTION

On March 11, 2020, the World Health Organization declared COVID-19 a global pandemic (WHO, 2020). By April 7th, 2020, 39 U.S. states had mandated that citizens "shelter-in-place" to reduce the spread of the contagious virus (Feyman et al., 2020), requiring individuals to remain home except in the case of permitted activities. Even individuals not under mandated shelter-in-place orders were likely to engage in some level of self-quarantine (Nelson et al., 2020). These mandates and recommendations, along with the pandemic itself, caused sudden and dramatic shifts in the lives of Americans. From changes to employment status and structure (Brynjolfsson et al., 2020), to adjustments to health behaviors (Arora and Grey, 2020; Meyer et al., 2020), to declines in mental health (Meyer et al., 2020; Nelson et al., 2020), individuals faced significant challenges in the early phase of the COVID-19 pandemic. While researchers have recently begun to assess the psychological impacts of COVID-19, there has yet to be an investigation into how changes to physical environments during the early stages of the pandemic—specifically changes to time spent outdoors—might relate to psychological wellbeing.

Regardless of individual state policies, the early weeks of the COVID-19 pandemic was a time of drastic change in which individuals could no longer rely on routine indoor activity and thus provides a unique opportunity to explore how individuals reported changing their outdoor behaviors. The present study aims to capture how changes to daily life due to the COVID-19 pandemic affected individuals' engagement with the outdoors. Specifically, we explore how people spent time outdoors in the early weeks of the COVID-19 pandemic (i.e., March 25th through April 3rd, 2020) in the United States and assess how time spent outdoors related to individuals' relationship to natural environments and to a healthy adaptation to stay-at-home orders.

The changes and adaptations required in the early phase of the COVID-19 pandemic may have altered how people engage with the outdoors. For example, with fitness centers closed, individuals may have turned to the outdoors for exercise and recreation. Some people may have chosen to socialize outdoors, viewing it as a safer alternative to indoor gatherings. Other individuals may have sought refuge in the outdoors as a means to cope with the new emotional challenges and stressors. Regardless of the reason, people who increased their time spent in nature during the pandemic may have benefitted from these experiences. Correlational studies converge with experimental research to suggest that nature promotes psychological wellbeing (e.g., improved mood and life satisfaction; Bratman et al., 2015; Mcmahan and Estes, 2015; Biedenweg et al., 2017; Cox et al., 2017); decreases stress (Hartig et al., 2003; van den Berg and Custers, 2011); and improves physiological markers of health (Ulrich et al., 1991; Lee et al., 2011; Tsunetsugu et al., 2011). Several literature reviews and meta-analyses on the relationship of nature experiences with health, wellbeing, and psychological flourishing also underscore the importance of nature in promoting mental and physical health (Hartig et al., 2011a,b; Capaldi et al., 2014, 2015; Oh et al., 2017).

Supportive of the idea that outdoor experiences may have buffered the stress of the COVID-19 pandemic, one recent study on the emotional correlates of how a nationally representative sample of individuals in Ireland spent their time early in the pandemic (surveys were completed on March 25th, 2020), found that the outdoors was the location most strongly associated with positive affect, while the behaviors most strongly associated with positive affect were exercising, going for a walk, and gardening (Lades et al., 2020). The present study builds upon this work by exploring how, where, and why Americans spent time outdoors in the early weeks of the COVID-19 pandemic and how these experiences related to individual differences and wellbeing.

Finally, the present study explores whether outdoor experiences in the early weeks of the COVID-19 pandemic relate to prosocial behavior. Past work has found that nature experiences predict prosocial behavior (Weinstein et al., 2009; Zhang et al., 2014; Joye and Bolderdijk, 2015; Castelo et al., 2021; Pirchio et al., 2021), in particular, environmentally protective prosocial behavior (Lawrence, 2012; Klein and Hilbig, 2018; Rosa et al., 2018). As such, we explored whether changes to outdoor experiences (e.g., increased time in the outdoors) related to two possible types of prosocial behavior: prosocial behavior directed toward other humans, and prosocial behavior directed at the environment. To do this, we used donations (to a COVID-19 relief fund or to an environmentally focused non-profit) as a proxy for prosocial behavior.

In summary, the present work is organized around three research questions.

1. How, where, and why do individuals spend time outdoors during the early weeks of the COVID-19 pandemic?
2. How do outdoor experiences relate to various individual differences (e.g., wellbeing, concern for COVID-19)?
3. Do outdoor experiences and environmentally relevant individual differences relate to prosocial behavior?

The current study describes the changing relationship between humans and their outdoor environment during the COVID-19 pandemic, offering insight into how dramatic upheavals to daily life may shift the way in which individuals experience, engage with, and appreciate the outdoors. In describing the shifting landscape, we also begin to distill how the changes in nature experiences relate to individual differences. In particular, we highlight the importance of outdoor experiences during a unique time of stress. Thus, this work focuses on the important role nature plays during times of change and contributes to knowledge around how nature can be used to help individuals and communities during times of crisis.

METHODS

Participants in this study completed an online survey and were compensated $5.00 for completing the full survey. The study was preregistered (https://osf.io/fnbuc/) and approved by the principal investigator's Institution's Human Subjects Institutional Review Board before data collection. The complete dataset, analysis script, preregistration (including power analyses), and additional **Supplementary Materials** can be found at https://bit.ly/31m533T.

Participants

Participants ($N = 191$) were mostly female (82%), and White (97%). The average age of participants was 32.33 years ($SD = 12.87$; range = 18–69). Participants came from 27 unique states in the United States (**Table 1**) and roughly a third (35%) of participants identified as essential workers who had to continue working during the shutdowns. Thirty-six participants dropped out before full completion, so only partial data is available for these individuals, and demographic data is missing for all of these participants. Participants with partial data are included in analyses with variables for which they provided data. For a two tailed correlation, with an alpha of 0.05, power of 0.80, and effect size of 0.25, the total required sample size is 120.

Procedures

Participants were primarily recruited using Facebook *via* a post on the first author's personal Facebook page, which was shared through her social network. An email was also sent to the first author's campus community, and 10% ($n = 20$) of the sample was from the local community. The survey remained open from March 25th through April 3rd, 2020. After completing the informed consent, participants answered several

TABLE 1 | Participant Demographics.

Demographics	
Gender	82% female
Ethnicity	97% white
Age	*M* = 32.33 *SD* = 12.87 *Range* = 18–69
Identified as essential workers	35%
States	27
Zip codes	127

Participants were located in Pennsylvania (83 participants from 45 zip codes), New Jersey (16 participants from 15 zip codes), Minnesota (13 participants from 11 zip codes), California (10 participants from 10 zip codes), Massachusetts (5 participants from 5 zip codes), New York (4 participants from 4 zip codes), Maryland, Oregon, Virginia, and Washington (each with 3 participants form 3 different zip codes), Connecticut, Florida, Illinois, Missouri, Montana, Tennessee, Texas, and Wisconsin (each with 2 participants form 2 different zip codes), Hawaii (2 participants from 1 zip code), and 1 participant each from Colorado, Delaware, Indiana, Louisiana, Michigan, North Carolina, New Hampshire, and Utah. N = 191. Most participants from any 1 county were PA 18018: 11 and PA 18017: 9.

open-ended questions regarding their recent experiences spent outdoors followed by several individual difference measures. The final page of the online survey asked participants how they would like to receive their $5.00 compensation for participation. Participants had a choice among a gift card to an online store, a donation to the Trust for Public Land, and a donation to the Center for Disease Control's (CDC) COVID-19 Relief Fund. Within a week of survey completion, participants received their gift card or a confirmation of a donation to their selected organization.

Materials

Open-Ended Questions

Participants first responded to several open-ended questions assessing their experiences outdoors. Specifically, participants reported whether their time outdoors increased, decreased, or stayed the same during the pandemic; the activities and location of their time spent outdoors; and whether COVID-19 has changed their appreciation in the outdoors. Participants also reported whether they anticipate spending more time outdoors after the pandemic-related restrictions are lifted. Please see our online **Supplementary Materials** for the list of open-ended questions (https://osf.io/fnbuc/). See below for a detailed description of coding procedures for these open-ended questions.

Quantitative Measures

After completing the qualitative portion of the survey, participants completed a series of quantitative measures. We use the measures reported here as past work has demonstrated that these measures are sensitive to outdoor experiences (Mayer et al., 2008; Passmore and Holder, 2017; Heilmayr and Miller, 2021). Participants completed the Single-Item Connectedness to Nature Scale, which measures how connected to nature participants are (Mayer and Frantz, 2004). For this measure, participants respond to the statement "My connectedness to nature is" on a 1 (*very low*) to 7 (*very high*) Likert scale.

Participants also completed 5 items from an environmental identity scale (Clayton, 2003; $\alpha = 0.78$). For this scale, participants respond on a 1 (*strongly disagree*) to 5 (*strongly agree*) to statements such as "When I am upset or stressed, I can feel better by spending some time outdoors 'communing with nature."

The Elevating Experiences Scale (Ryan et al., 2008) consists of 13 items ($\alpha = 0.93$) and measures constructs such as transcendence, awe, inspiration, and deep appreciation that make up an "elevated experience." Participants respond to how they typically felt during the past 2 weeks on a 1 (*not at all*) to 7 (*extremely*) Likert scale. Feelings on this scale include "inspired;" "in awe," and "part of something greater than myself."

Participants also completed the 54-item Comprehensive Inventory of Thriving (CIT; Su et al., 2014), which measures a broad range of psychological wellbeing constructs relevant to positive functioning and health. The dimensions measured by this scale are Relationships, or the degree to which an individual has enriching relationships; Mastery, the degree to which an individual has a sense of accomplishment; Subjective Wellbeing, including life satisfaction and positive emotion; Engagement, which assesses the degree of engagement in daily activities; Control, or feelings of autonomy; Meaning, or purpose in life; and Optimism (Su et al., 2014; αs = 0.65–0.93). Three of these dimensions can be further broken down into several facets: Relationships is made up of support, community, trust, respect, loneliness, and belonging; Mastery is made up of skills, learning, accomplishment, self-efficacy, and self-worth; and Subjective-Wellbeing is made up of life satisfaction, positive feelings, and negative feelings. For all CIT dimensions, participants respond to a series of statements (e.g., "There are people I can depend on to help me"; "I get fully absorbed in activities I do") on a 1 (*strongly disagree*) to 5 (*strongly agree*) Likert scale.

Two items were included from the SF-36 to assess self-reported health (Ware and Sherbourne, 1992; McHorney et al., 1993). To measure Subjective Health, participants respond to the question "In general, would you say your health is," on a 1 (*excellent*) to 5 (*poor*) scale. To measure Change in Health, participants respond to the question "Compared to one year ago, how would you rate your health in general now?" on a scale of 1 (*much better now*) to 5 (*much worse now*).

We developed two additional single-item measures to assess change in time spent outdoors and concern about COVID-19. To measure individuals' change in time spent outdoors, we asked participants to respond to the item "Have you spent more time than usual outdoors due to COVID-19?" rated on a 1 (*No, much less time than usual*) to 5 (*Yes, much more time than usual*) scale. To measure concern about COVID-19, participants responded to four items (e.g., "During the past week, how often have you worried about COVID-19?") on a 1 (*Never*) to 4 (*All of the time*) scale ($\alpha = 0.69$).

Finally, participants were given the choice to keep the $5.00 compensation as a gift card to an online store, to donate it to the Trust for Public Land, or to donate it to the CDC coronavirus emergency response fund. For studies using donation behavior or intended donations as a proxy for prosocial

TABLE 2 | Qualitative coding categories and example responses.

Category	Examples responses
Change in direction of time spent outdoors (κ = 0.83)	
Increased	"I've spent more time outdoors because I've gotten laid off from work and I live in a remote area with a small population of people."
Decreased	"Reduce outdoor activities and my family won't allow me to go out"
Stayed the same	"I'm not an outdoors person so I haven't gone outside more or less since covid hit."
Motivation for change (κ = 0.43)	
Exercise/physical activity	"Spending time outdoors is the only place i can really go to leave my house and it's a way to get exercise rather than sitting at home on the computer or watching tv all day"
Improvements to wellbeing	"I've been enjoying siting outside during the day to clear my head and get some fresh air."
COVID risk concern	"My time outdoors has decreased majorly because from what I have heard, the virus can be spread by someone who doesn't have symptoms but is a carrier very easily."
Lifestyle change due to shelter in place mandate	"My time outdoors has decreased as my college workload has increased"
Content of activities κ = 0.73)	
Yardwork/gardening	"Gardening and backyard play with kids."
Walking	"long walks/hikes throughout my neighborhood and nearby parks"
Biking	"Cycling—only within the county and during lower bike-traffic times of the day."
Sports	"We have a golf net hitting golf balls, dribbling a basketball."
Sitting outside	"Just sitting outside while I do my work."
Other type of activity	"Outdoor construction work."
Type of activity (κ =0.81)	
Leisure activity	"Cycling—only within the county and during lower bike-traffic times of the day."
Non-leisure activity	"we took a couple of days as a family to clean up our yard and make some improvements."
Level of activity (κ = 0.64)	
Completely stationary	"I have also gone on a few car rides around town with my mom, but we never got out of the car."
Little activity	"I have gone for a few walks on the beach."
Moderate amount of activity	"Walks around the neighborhood [I never go on walks!] And hikes and runs."
Quite a bit of activity	"Bike rides, online workouts on my own at the park, walking the dog, playing with a soccer ball or tennis ball with my roommate."
Outdoor location (κ = 0.76)	
Backyard	"Only in the backyard"
Parks/forest	"City parks and nature preserves"
Neighborhood	"Close to my neighborhood"
At their job	"I work in a garden center, so I have been outside"
Other outdoor location	"Less populated towns"
Level of nature immersion (κ =0.76)	
No immersion at all	"I drove around in my car with my mom"
Minimal immersion	"Around y suburban neighborhood"
Moderate immersion	"Trails, our yard, and neighborhood."
Complete immersion	"Trails and forested areas that I know that will not be heavily populated."
Content of change in appreciation for the outdoors[a] (κ =0.51)	
Physical health	"Yes, I noticed my physical health is affected. I breath better when I spend more time outdoors."
Mental health	"It's nice to be able to be out and feel grounded, but as soon as I get back inside everything comes rushing back"
Community involvement/ socializing	"Being stuck inside and realizing how long its been since I had been outside made me feel stuck and disconnected from the outside world, so I have been trying to go outside more."
Appreciation for nature	"It has changed my appreciation slightly, because I have always loved being outdoors, but now that I have more time to spend outside, I have grown closer to nature and try to integrate outdoor activity into my everyday routine"
Complexity of meaning for outdoor experience (κ =0.55)	
What the event was without including any lesson or meaning	"Nothing in particular, just enjoying the sun, fresh air, and alone time while running"
Vague meaning associated with experience, but is not deep or complex	"I went on my favorite hiking trail and noticed that there were a lot of people on it when usually it is very secluded. I also noticed more litter/dog feces. It's probably not going to influence my future behaviors, but it makes me feel better to know other people are outside because they also have nothing to do."
Events with insights to transformations in one's understanding of oneself or the world	"It was a very serene experience and there was nothing but quietness. It reminds me that there in an entire universe full of amazing sights that sometimes I forget about, and it really puts my problems and feelings in perspective. It is easy for me to get wrapped up in my own life and material items, but taking a step back and reminding myself of the beauty and simplicity of the world calms be down."
Source of appreciation for the outdoors[a] (κ = 0.68)	
Opportunities for introspection or personal growth	"Going on long runs makes me feel like I've accomplished something and builds my confidence."
Time spent with others	"I walked through a reservation with my friend. We found it very pleasing and I think it helped us out a lot to just walk around and talk about what is going on."
Nature/outdoors in general	"One of the biggest difference is, I am not taking a closer look at things I have been by a ton of times and just never noticed. Example, I noticed that there seem to be a lot more squirrels in our neighbor than I realized."

TABLE 2 | Continued

Category	Examples responses
Bigger picture or society in general	"I tend to just go for a walk around my neighborhood and see the places where it used to be busy which is the one road and barley see any cars so how much you appreciate things in your life."

[a] *"Content of change in appreciation for the outdoors" was coded from the question "Has the COVID-19 pandemic changed your appreciation for the outdoors?" These responses reflect change in appreciation for the outdoors. "Source of appreciation for the outdoors" was coded from the question asking participants to report a specific experience during the pandemic in which they took refuge in the outdoors. These responses reflect a more static source of appreciation for the outdoors.*

behavior, see Exline et al. (2012), Park and Shin (2017), and Guan et al. (2019).

Coding of Open-Ended Questions

To quantify participants' responses to the open-ended questions, we developed a coding framework that enabled the assessment of the objective (e.g., location, activity) and subjective (e.g., source of appreciation for the outdoors) qualities of participants' experiences outdoors. This inductive, content coding analysis (Schwab and Syed, 2015) was developed in three stages. In Stage 1, the first and second authors reviewed 10% of the responses and developed an initial set of coding categories. In Stage 2, two undergraduate research assistants coded another 10% of responses using the framework developed in Stage 1. In the final stage of development, we revised the initial coding framework based on feedback from Stage 2.

For all six open-ended questions, two research assistants used this final coding framework to independently code all responses along a total of 12 non-mutually exclusive categories. The initial agreement across all categories was sufficient and ranged from $\kappa = 0.43–0.83$ (see **Table 2** for examples and reliabilities for each category). The first and second authors resolved all discrepancies among research assistants to determine the final coded dataset.

Each question required research assistants to code responses into several categories. Categories relating to changes to outdoor experiences included the direction of change for time spent outdoors (i.e., increased, decreased, or stayed the same) and the motivation for increasing or decreasing time spent outdoors (i.e., lifestyle changes due to shelter in place mandate/recommendation, COVID concern, wellbeing/general enjoyment). Categories quantifying more objective qualities of participants' time spent outdoors included the content of the activity (e.g., biking, yard work), location of participants' outdoor experiences (e.g., neighborhood, park), and the level immersion of nature experience and activity associated with their time spent outdoors. More subjective coding categories included whether participants reported a change in appreciation for the outdoors and the source of that appreciation (e.g., physical health, mental health, community engagement, appreciation for nature), as well as the complexity of meaning of participants' outdoor experiences.

For example, for the question "Has the COVID-19 pandemic changed your appreciation for the outdoors? Please explain.", research assistants coded responses along binary categories representing participants' who reported increased appreciation or no change in appreciation (no participants reported a decrease). Then, for participants who reported an increase in appreciation, research assistants coded whether the appreciation change related to physical health, mental health, community engagement, appreciation for nature itself, or something else (i.e., "other"). Similarly, for the question "Where have you been spending time outdoors since you started taking precautions due to the COVID-19 pandemic?", responses were coded into content categories to capture where participants were spending their time (e.g., in the backyard, parks/forest, neighborhood), and also the level of nature immersion of these outdoor experiences (i.e., no immersion, minimal immersion, a moderate amount of immersion, and complete immersion). See **Table 2** for the full list of categories with examples. The full coding manual was preregistered at https://osf.io/fnbuc/.

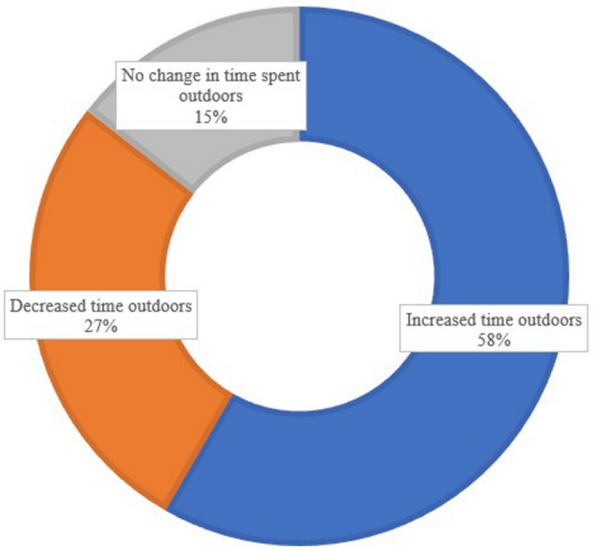

FIGURE 1 | Percentages of participants who reported increased time outdoors, decreased time outdoors or no change spent outdoors since the start of the COVID-19 outbreak.

RESULTS

Research Question 1: How, Where, and Why Do Individuals Spend Time Outdoors During the Early Weeks of the COVID-19 Pandemic?

How: Descriptions of Outdoor Activities

When participants were asked to describe how their time in outdoor spaces had changed since the start of the COVID-19 outbreak, the majority of participants (58.3%) reported increasing the amount of time spent outdoors, while 27.3% described spending less time outdoors, and 14.4% reported no change in the amount of time they spent outdoors (**Figure 1**).

TABLE 3 | Motivations described by change in time outdoors.

	Change in time outdoors		
	Decrease (*N* = 47) (%)	**No change (*N* = 19) (%)**	**Increase (*N* = 107) (%)**
Exercise	0	47	38
Wellbeing	2	16	51
COVID risk	47	16	3
Shelter in place	68	68	64

N = 173; participants could report more than one motivation for their change in behavior; percentages are based on the N associated with each "Change in time outdoors" category.

Most participants described engaging in only leisurely outdoor activities (80.4%), while 1.1% described engaging in only non-leisure activities, and 18.5% described engaging in both leisure and non-leisure activities. On average, participants describe engaging in 2.2 (*SD* = 1.06; *Range:* 1–7) different outdoor activities. The majority of participants spent time outdoors walking (85%), running (34%), biking (24%), doing yard work/gardening (21%), sitting on their porch (18%), and playing sports (7%). Activities based on whether participants increased, decreased, or did not change their time outdoors can be viewed in **Supplementary Table 1** on our Open Science Framework (OSF) page (https://osf.io/t37dq/). Participants reported outdoor activities were moderately high in activity level with an average activity of 1.71 (*SD* = 0.64) on a scale of 0 *(completely stationary)*—3 *(quite a bit of activity)*.

Where: Descriptions of Outdoor Locations

On average, people described spending their time in 1.8 different locations (*SD* = 0.71, *range:* 0–3). The majority of participants (81%) reported spending time in their neighborhood or in their own backyard, while 46% of people reported spending time in a park, wooded, or forested area. On average, participants spent time in moderately nature-dense locations with an average density score of 1.6 (*SD* = 0.69) on a scale of 0 *(no nature immersion at all)* to 3 *(complete nature immersion).*

Why: Motivation for Spending Time Outdoors

When discussing their motivation for spending time outdoors, most participants (66%) described the change as a response to shelter in place mandates. Among those who reported increasing their time outdoors, most reported doing so because of the shelter in place rules where they lived and to improve their wellbeing, while 38% reported increasing their time outdoors to exercise (**Table 3** and **Figure 2**). Among those who reported decreasing their time outdoors, most reported doing so because of the shelter in place rules where they lived, and 47% out of concern for the risk of COVID-19 (**Table 3** and **Figure 2**). We discuss the interesting finding that some participants reported increasing their time outdoors due to restrictions while others reported a decrease for the same reasons further in the Discussion Section.

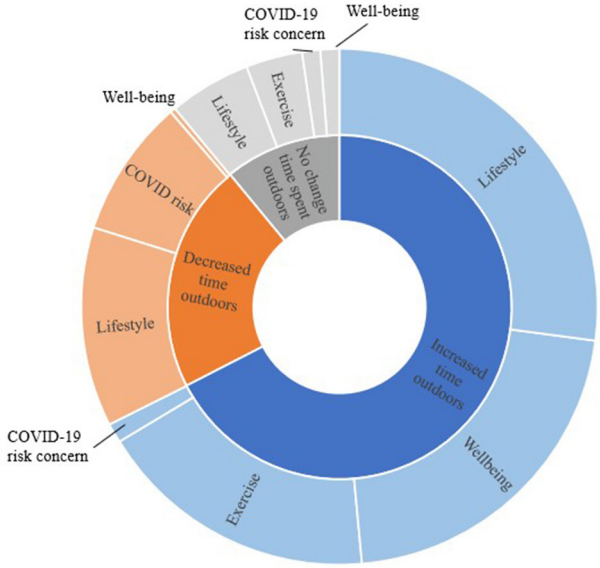

FIGURE 2 | What motivation did participants report for changing their time spent outdoors? Percentage of the motivation participants reported for increased time outdoors, decreased time outdoors, or no change spent outdoors from March 25 to April 3rd, 2020.

Change in Appreciation

When discussing how the pandemic had changed their appreciation for the outdoors, 30% did not report a change in their appreciation, and 70% described an increase in their appreciation. No participants reported a decrease in nature appreciation.

Research Question 2: How Do Outdoor Experiences Relate to Individual Differences?

We next sought to assess the extent to which individual differences relate to participants' outdoor experiences. To ensure we did not capitalize on Type I error, we used randomization tests when appropriate, as described in Smith (2000) and Sherman and Serfass (2015). These tests evaluate whether a set of variables are more related to an outcome than we should expect by chance. Randomization tests were used when a variable (i.e., the individual difference variables) could be represented by a set of subscales. For example, randomization tests were used to evaluate the relationships between the Relationships dimension of the CIT (represented by the set of subscales Community, Trust, Respect, Belonging, and Loneliness) and outdoor experiences (i.e., change in time outdoors, motivation for outdoors, complexity of meaning of an outdoor experience, source of outdoor appreciation and degree of nature immersion). If these randomization tests found that the strength of the relationship between the Relationships dimension and outdoor experiences was statistically significantly greater than could be expected by chance, we assessed these relationships on the subscale level.

TABLE 4 | Randomization test results for correlations of outdoor experiences with comprehensive inventory of thriving.

Predictor	Outdoor experience	*N*	Average absolute *r*	*r* expected by chance	SE	*p*-value
Relationships (CIT)	Change in time outdoors	166	.23	.06	.024	<.001**
	Motivation for outdoors	155	.09	.06	.013	.02*
	Complexity of meaning	161	.09	.06	.024	.15
	Source of appreciation	157	.05	.06	.013	.94
	Nature immersion	165	.05	.06	.024	.71
Mastery (CIT)	Change in time outdoors	166	.10	.06	.029	.11
	Motivation for outdoors	155	.07	.06	.015	.41
	Complexity of meaning	161	.04	.06	.030	.81
	Source of appreciation	157	.04	.06	.017	.93
	Nature immersion	165	.08	.06	.029	.21
Subjective well-being (CIT)	Change in time outdoors	166	.18	.06	.038	.001**
	Motivation for outdoors	155	.07	.06	.020	.32
	Complexity of meaning	161	.07	.06	.038	.38
	Source of appreciation	157	.04	.06	.021	.87
	Nature immersion	165	.02	.06	.038	.93
Engagement (CIT)	Motivation for outdoors	155	.09	.06	.026	.21
	Source of appreciation	157	.05	.06	.026	.68
Control (CIT)	Motivation for outdoors	155	.04	.06	.025	.85
	Source of appreciation	157	.06	.06	.026	.58
Meaning (CIT)	Motivation for outdoors	155	.12	.06	.026	.03*
	Source of appreciation	157	.06	.06	.026	.53
Optimism (CIT)	Motivation for outdoors	155	.04	.06	.026	.82
	Source of appreciation	157	.03	.06	.026	.95
Subjective health	Motivation for outdoors	155	.04	.06	.026	.78
	Source of appreciation	157	.08	.06	.026	.23
Change in health	Motivation for outdoors	155	.06	.06	.026	.45
	Source of appreciation	157	.04	.06	.027	.78
Connectedness to nature	Motivation for outdoors	161	.07	.06	.025	.35
	Source of appreciation	163	.09	.06	.026	.18
Environmental identity	Motivation for outdoors	162	.07	.06	.025	.42
	Source of appreciation	164	.10	.06	.026	.08
Concern about COVID-19	Motivation for outdoors	155	.06	.06	.026	.53
	Source of appreciation	156	.08	.06	.027	.22

Note. *$p < .05$; **$p < .01$.

The results of all randomization tests are reported in **Table 4**, but only sets with relationships stronger than we would expect by chance are reported in text.

Relationships Between Outdoor Experiences and the Comprehensive Inventory of Thriving

As described in the Materials Section, the dimensions of the Comprehensive Inventory of Thriving (CIT; Su et al.,

TABLE 5 | Correlations between change in time outdoors and individual differences, as warranted by randomization tests.

		Increased time spent outdoors	Motivation for time spent outdoors			
CIT Dimension	**CIT Subscale**		**Exercise**	**Wellbeing**	**COVID-19 risk**	**Shelter in place**
Relationships	Support	0.13	0.05	0.17*	−0.05	−0.07
	Community	0.34***	0.20*	0.10	−0.08	−0.09
	Trust	0.21**	0.10	0.04	−0.07	0.10
	Respect	0.18*	0.20*	0.09	−0.15	−0.02
	Loneliness	−0.26***	−0.11	−0.08	0.03	0.08
	Belonging	0.27***	0.12	0.09	−0.12	−0.06
Subjective wellbeing	Life satisfaction	0.22**	–	–	–	–
	Positive feelings	0.16*	–	–	–	–
	Negative feelings	−0.15	–	–	–	–
Meaning	Meaning	–	0.09	−0.19*	−0.01	0.19*

*N for relationships and subjective wellbeing = 166; N for meaning = 155; *p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001.*

2014) includes measures of Relationships, Mastery, Subjective Wellbeing, Engagement, Control, Meaning, and Optimism. The Relationships, Mastery, and Subjective Wellbeing dimensions are further made up of 6, 5, and 3 subscales, respectively, that were explored by the randomization tests.

The Relationships dimension of the CIT was related to whether individuals increased or decreased their time spent outdoors *via* randomization tests (**Table 4**). The Relationships subscales of Community, Trust, Respect, and Belonging relate positively to change in time outdoors, such that participants high in these facets increased their time outdoors, whereas Loneliness related negatively to change in time outdoors, such that participants high in this facet decreased their time spent outdoors (**Table 5**). Randomization tests further revealed that the Relationships dimension related to why individuals were motivated to spend time outdoors (**Table 5**). Specifically, individuals high in Support and Positivity tended to report spending time outdoors during the pandemic to increase their wellbeing, whereas individuals high in sense of Community and Respect were motivated to spend time outdoors to exercise.

The randomization tests also revealed that the Subjective Wellbeing dimension of the CIT was related to whether individuals increased or decreased time spent outdoors in response to the pandemic (**Table 4**). Further analyses revealed that the subscales of Life Satisfaction and Positive Feelings were positively related to change in time outdoors (**Table 5**), such that individuals high in these facets reported increasing their time outdoors early in the pandemic.

The Engagement dimension of the CIT was related to the degree to which individuals felt immersed in nature such that those higher in Engagement tended to be less immersed in nature, $r_{(163)} = -0.16$, $p = 0.04$. Interestingly, Engagement was not related to whether individuals increased or decreased in their time outdoors, $r_{(164)} = 0.12$, $p = 0.12$, nor the complexity of meaning individuals attributed to their experiences outdoors, $r_{(159)} = 0.11, p = 0.17$. The Control dimension of the CIT was not related to whether individuals increased or decreased their time spent outdoors, $r_{(164)} = -0.15, p = 0.054$, complexity of meaning attributed to time spent outdoors, $r_{(159)} = -0.03$, $p = 0.67$, nor nature immersion, $r_{(163)} = -0.12, p = 0.13$.

Randomization tests revealed that the Meaning dimension of the CIT was statistically significantly related to the motivation participants reported for changing their outdoor behavior (**Table 5**). Specifically, individuals high in Meaning reported being motivated to change their time spent outdoors for COVID-19 related lifestyle changes due to shelter in place mandate or restrictions (e.g., inability to go to restaurants or friend's houses, working from home), whereas those low in Meaning reported being motivated to change their time spent outdoors to increase their wellbeing (**Table 5**). Meaning was not related to whether individuals spend more or less time outdoors in response to the pandemic, $r_{(164)} = -0.14$, $p = 0.08$, the complexity of meaning attributed to time spent outdoors, $r_{(159)} = 0.07, p = 0.37$, nor their degree of nature immersion, $r_{(163)} = 0.11, p = 0.16$.

The CIT dimension of Optimism was not related to change in time spent outdoors, $r_{(164)} = 0.09$, $p = 0.26$, the complexity of meaning attributed to an outdoor experience, $r_{(159)} = -0.01$, $p = 0.85$, or individuals' level of nature immersion, $r_{(163)} = -0.02, p = 0.78$.

In summary, we found that experiences outdoors in the early days of the COVID-19 pandemic related to various dimensions of the Comprehensive Inventory of Thriving, which measures a range of dimensions related to psychological wellbeing.

Relationships Between Outdoor Experiences and Health

We next sought to assess the extent to which outdoor experiences during the COVID-19 shelter in place orders were related to self-reported health. Results indicate that Subjective Health (i.e., "In general, would you say your health is") was not related to whether individuals increased or decreased their time outdoors, $r_{(164)} = 0.04$, $p = 0.64$, the complexity of meaning for their time spent outdoors, $r_{(159)} = 0.08$, $p = 0.32$, nor level of nature immersion, $r_{(163)} = 0.13, p = 0.09$.

Individuals who reported improved health as compared to last year reported that their time spent outdoors increased since shelter in place orders, $r_{(164)} = 0.16$, $p = 0.04$. Change in Health

(i.e., health compared to last year) also related positively with the complexity in meaning of outdoor experience, $r_{(159)} = 0.18$, $p = 0.03$, such that participants who reported better health also tended to report more meaning in their outdoor experience. However, Change in Health was not related to individuals' level of nature immersion, $r_{(163)} = 0.10$, $p = 0.19$.

Relationship Between Outdoor Experiences and Nature Identity

We next tested whether individuals' nature identity was related to their experiences outdoors since COVID-19 stay-at-home orders. Connectedness to Nature was related to the complexity of meaning attributed to an outdoor experience, $r_{(165)} = 0.19$, $p = 0.01$, and the degree of nature immersion experienced, $r_{(170)} = 0.33$, $p < 0.001$, such that individuals high in Connectedness to Nature enjoyed more meaningful and immersive experiences outdoors. Interestingly, Connectedness to Nature was not related to change in time spent outdoors, $r_{(171)} = 0.05$, $p = 0.51$.

Those relatively higher in Environmental Identity had more complexity of meaning, $r_{(166)} = 0.19$, $p = 0.01$ and higher nature immersion, $r_{(171)} = 0.18$, $p = 0.02$, in regard to their reported outdoor experience, but Environmental Identity did not relate to change in time spent outdoors, $r_{(172)} = -0.03$, $p = 0.72$.

Relationship Between Outdoor Experiences and Concern About COVID-19

Concern about COVID-19 related positively to the complexity of meaning attributed to and outdoor experience, $r_{(158)} = 0.18$, $p = 0.02$, but was not related to whether individuals increased or decreased their time spent outdoors, $r_{(163)} = -0.02$, $p = 0.81$, nor their level of nature immersion: $r_{(162)} = -0.04$, $p = 0.61$.

Research Question 3: Do Outdoor Experiences and Environmentally Relevant Individual Differences Relate to Prosocial Behavior?

Our last research question was concerned with whether participants' experiences outdoors impacted donation behavior. Specifically, we tested whether participants' experiences outdoors (e.g., increased or decreased time spent outdoors; motivation for time spent outdoors) related to whether they donated their participant compensation to a charity, and if yes, if these experiences inspired them to donate to a charity focused on COVID-19 relief or environmental conservation. Importantly, donation was not a measure of prosociality in general, but rather a behavioral measure used as a proxy for prosocial behavior in the moment, and we tested whether outdoor experiences related to this measure. The most common compensation allocation choice was to receive an Amazon gift card (44%), with 36% of participants choosing to donate to the CDC's COVID Relief Fund and 20% opting to donate to the Trust for Public Lands.

To identify if individuals who choose to donate differed from individuals who did not donate in terms of their degree of environmental identity, elevated experiences, and/or concern over COVID-19, we ran a series of independent samples *t*-tests between those who donated (to either the Trust for Public Land, or to the CDC's COVID Relief Fund) and those who choose to receive an Amazon gift card. There were no statistically significant differences between those who donated and those who did not donate in Environmental Identity [$M_{donation} = 5.49$, $SD_{donation} = 1.18$, $M_{Amazon} = 5.25$, $SD_{Amazon} = 1.16$, $t_{(154)} = 1.315$, $p = 0.19$, $r = 0.11$], the Elevating Experiences Scale [$M_{donation} = 3.87$, $SD_{donation} = 1.24$, $M_{Amazon} = 3.88$, $SD_{Amazon} = 1.24$, $t_{(155)} = 0.039$, $p = 0.97$, $r = 0.003$], nor COVID-19 Concern [$M_{donation} = 3.65$, $SD_{donation} = 0.59$, $M_{Amazon} = 3.48$, $SD_{Amazon} = 0.72$, $t_{(155)} = 1.67$, $p = 0.10$, $r = 0.13$].

Finally, we assessed whether participants' experiences outdoors impacted donation behavior; that is, we investigated not if there were differences in whether participants donated, but rather if there were differences in *where* participants donated. Chi-square tests of independence showed that neither change in time spent outdoors [$\chi^2_{(4)} = 1.10$, $p = 0.894$, $\Phi = 0.08$], the source of participants' appreciation of the outdoors [$\chi^2_{(8)} = 4.82$, $p = 0.777$, $\Phi = 0.18$], the complexity of the meaning participants found in refuge outdoors [$\chi^2_{(6)} = 2.43$, $p = 0.877$, $\Phi = 0.13$], nor level of nature immersion [$\chi^2_{(4)} = 5.64$, $p = 0.227$, $\Phi = 0.19$; those who scored a zero on nature immersion were removed from this analysis due to extremely low base rates] were associated with where participants allocated money.

Finally, there was no statistically significant difference between men and women in donation behavior, $\chi^2_{(4)} = 2.36$, $p = 0.307$, $\Phi = 0.12$ (the participant who had a gender of "3" was removed from this analysis due to extremely low base rates). There was also no statistically significant age difference between those who kept the money (gift card) and those who donated, $t_{(153)} = 1.260$, $p = 0.210$, $r = 0.10$.

In sum, individual differences in environmental identity, COVID concern, and experiences outdoors did not predict donation behavior.

DISCUSSION

The mandated and recommended restrictions put in place in response to the COVID-19 pandemic impacted all aspects of individuals' lives. The current project explored how individuals' outdoor experiences changed during the early weeks of the pandemic when stay-at-home restrictions were largely in place. To accomplish these goals, we asked participants a series of open-ended questions to assess the objective and subjective qualities of their time spent outdoors. We also asked participants to complete several quantitative individual difference measures. We then used these data to describe how, where, and why individuals spent time outdoors, and to examine how outdoor experiences early in the pandemic relate to individual differences. Finally, we captured how these measures relate to prosocial behavior by providing participants the opportunity to keep their $5 participant compensation as an Amazon gift card, or to donate it to a COVID-19 Relief Fund or an environmentally focused non-profit.

In regard to how, where, and why individuals spent time outdoors, the majority of participants' reported spending time

near their house (e.g., in their yard or neighborhood), or at a park or forest. Their activities included those with a moderate amount of activity including walking, running, and yardwork. For participants who reported decreasing activity outdoors, the majority explained the change as a result of their state's advisory to stay at home to stop the spread of COVID-19 or general concern about contracting the virus. When participants reported increasing their time outdoors, most attributed the change being due to shelter-in-place recommendations or mandates, as a means to increase their wellbeing, and/or to facilitate exercise. That some participants reported increasing their time outdoors due to restrictions while others reported a decrease for the same reason highlights the variability in response to the COVID-19 pandemic. It is possible, for example, that individuals living in more densely populated areas were less likely to go outdoors due to not being able to maintain distance, while those living in more rural locations were more likely to go outdoors because they were able to follow distancing advisories in their area. Though the present study cannot answer why some individuals increased time outdoors due to advisories and some decreased time outdoors for the same reason, these results make sense given the wide range of participants' ages, locations, and other unmeasured variables such as risk tolerance.

Next, we sought to understand variation in participants' experiences outdoors by relating the six dimensions of the Comprehensive Inventory of Health (CIT), health, environmental identity, and to attributes of individuals' outdoors experiences. Results indicate that those high in the Relationships and the Subjective Wellbeing dimensions of the CIT tended to report spending more time outdoors. In other words, participants in this study with enriching relationships and high subjective wellbeing reported spending more time outdoors. While it may be that outdoor experiences promoted positive relationships (e.g., by providing a safe space to commune) and wellbeing, it may also be that enriching relationships and wellbeing causes individuals to spend more time outside, or that these relationships exist due to some third variable. Though past research provides support for nature-based experiences promoting social connections (Passmore and Holder, 2017), no causal conclusions can be drawn from the present study. We also found that individuals high on the Engagement dimension of the CIT tended to report less immersion in nature while they were outdoors, perhaps because they had less of a need to be immersed in nature to feel energized and engaged. (Example items from the Engagement scale include "In most activities I do, I feel energized;" and "I get fully absorbed in the activities I do.")

In terms of self-reported health, participants who spent more time outdoors in the early weeks of the pandemic also reported increased health over the last year (in response to the question "Compared to one year ago, how would you rate your health in general now?"). However, this relationship was not observed for overall health (i.e., "In general, would you say your health is[…]"). Though more research is required to understand the causal mechanisms, it may be that individuals who improved in health in the past year wanted to maintain their health and wellbeing as various outlets to achieve these goals were being closed (e.g., gyms and community spaces), and thus turned to the outdoors for to exercise and positive affect. That is, individuals may have had extra motivation to maintain positive changes in health that they had achieved in the past year and may have worked to achieve this goal by spending time outdoors.

Unsurprisingly, those who felt highly connected to nature report experiences outdoors that are highly meaningful and immersive. These results, taken together with those discussed above, indicate that individuals who already feel connected to nature may have felt an added benefit to spending time outdoors during early weeks of the COVID-19 pandemic. However, results should be interpreted with caution as the sample is not generalizable to all populations and some reported effects are small.

Finally, we explored whether experiences outdoors was related to donation behavior. We expected that individuals who benefited from time spent outdoors during the pandemic to be motived to donate to a nature conservation fund in lieu of an Amazon gift card or a COVID-19 Relief Fund. We expected this because past work has found that experiences in nature promote prosocial behavior (Weinstein et al., 2009; Zhang et al., 2014; Joye and Bolderdijk, 2015; Castelo et al., 2021; Pirchio et al., 2021), especially prosocial behavior directed toward the environment (Lawrence, 2012; Klein and Hilbig, 2018; Rosa et al., 2018). Contrary to our expectations, individuals' experiences outdoors did not relate to how they chose to allocate their study compensation. These results indicate that while spending time outdoors early in the COVID-19 pandemic was associated with psychological benefits, these positive associations do not motivate discrete prosocial behaviors, which may be more influenced by financial security or general philanthropic tendencies. As such, future studies should aim to measure possible variables that may have had a confounding effect in the present study, such as socioeconomic status, to disentangle when and why donation behavior may relate to experiences outdoors.

The Implications of Spending Time Outdoors During a Pandemic

Our results illuminate the ways that spending time outdoors could potentially serve as a low-cost and easy-to-implement intervention to promote wellbeing during times of stress, as we found that participants who reported spending more times outdoors reported better relationships and higher wellbeing. Spending time in nature may be particularly beneficial during the COVID-19 pandemic because spending time outdoors is relatively low-risk compared with indoor activities (Bhagat et al., 2020).

The present study also points to the possibility that the pandemic increased individuals' appreciation for nature and outdoor experiences. When participants in the present study were asked, "Do you anticipate spending more time in the outdoors after the restrictions due to the COVID-19 are lifted?", 76% of participants reported anticipating spending more time outdoors, while 18% anticipated no change, and 6% reported an anticipated decrease. It may be that as the pandemic forced individuals to use the outdoors for leisure and exercise in lieu of indoor options, people found a renewed sense of appreciation

of outdoor experiences and found themselves motivated to spend more time outdoors even when indoor opportunities become available again. In this way, spending time outdoors may turn into a self-reinforcing pattern. This is a ripe area for future research. Interestingly, 80% of individuals who reported decreasing their time outdoors during the pandemic also reported planning to increase their time outdoors after the pandemic restrictions were lifted, highlighting the possibility that not having the opportunity to go outside (e.g., due to safety or increased daily burdens) is associated with the motivation to spend time outdoors. In other words, spending time outdoors seems to increase our appreciation for the outdoors while being prevented from spending time outdoors may also increase our appreciation for the outdoors by reminding us of what we are missing. These results highlight how the pandemic may be shifting the relationship between humans and nature.

Of note, however, self-reported outdoor experiences did not translate to behavior that is protective of the environment (i.e., donation to The Trust for Public Land) nor to prosocial behavior toward others (i.e., donation to the CDC COVID-19 Relief Fund). That is, while the majority of individuals reported appreciating nature and planning to spend more time outdoors, these indicators did not translate into prosocial behavior. It may be that the pandemic caused people to have a more egoistic (self-focused) appreciation of nature rather than a biospheric (concern for living things) or altruistic (concern for other people) appreciation (Schultz, 2001). Importantly, we did not measure socioeconomic status, which may be confounding the lack of relationship between outdoor experiences and donation behavior. We did not measure the structure of participants' environmental concerns in the present study, but future work may look to investigate whether type of appreciation may explain donation behaviors (or the lack thereof). Additionally, it is possible that these trends would change over the course of the pandemic, so these results should be considered in tandem with other studies of donation behavior during various points of the COVID-19 pandemic.

Limitations and Future Directions

While this study provides important insight into how individuals utilize their time outdoors during the early stages COVID-19 pandemic, it is not without its limitations. First, this study relied on self-report assessments of nature experience and health. Future research should assess more objective assessments of these variables. For example, nature immersion could be assessed *via* the amount of green space individuals live near. Inclusion of non-self-report data would limit common method bias and help generalize the current findings in assessing causes and consequences of time spent outdoors.

Additionally, the sample included in this study in limited in its generalizability. Though we included participants from 27 unique states who reflected a wide range of ages, the participants are not reflective of the U.S. population. Additionally, we cannot test the effect of different COVID-19 policies or rates on the effects we report here, so it may be that some of the effects are only relevant to specific populations during specific times.

Importantly, the results of this study are cross-sectional and correlational, meaning that we cannot draw causal conclusions about the relationship between outdoor experiences and mental and physical health. Though the present study provides evidence that outdoor experiences are related to wellbeing and health, future research should employ experimental approaches to establish temporal precedence and to rule out potential third variables. Recently published findings indicate that the relationship between spending time outside during the pandemic and wellbeing may depend on who is spending time outdoors and the period within the pandemic that they are outdoors. Specifically, Büssing et al. found that individuals high in wellbeing may benefit more from time outdoors than individuals low in wellbeing, and that the benefits of outdoor experiences may have declined over the course of the pandemic (Büssing et al., 2021). Thus, more research is necessary to understand the full landscape of this relationship. Moreover, while the present work points to promising relationships to capitalize upon for intervention work, we first must identify the causal mechanisms through which outdoor experiences may promote health and wellbeing.

CONCLUSIONS

Taken together, the results reported here suggest that we may see a shift in how people engage with the outdoors as we emerge from the COVID-19 pandemic. As indoor spaces closed, people turned to the outdoors for safer socialization and exercise opportunities, which was associated with a plan to increase time outdoors after the pandemic restrictions were lifted. Even the majority of individuals who decreased their time outdoors due to safety concerns or increased daily burdens reported wanting to increase time outdoors after the pandemic restrictions were lifted. In short, the majority of individuals in this study expressed an appreciation for the outdoors during the COVID-19 pandemic, and a plan to increase time outdoors when the pandemic restrictions were lifted.

The shifting relationship between humans and outdoor experiences may ultimately promote human thriving. In the present work, we found that spending more time outdoors was associated with attributes of thriving. While not new (for reviews of the relationship between connectedness with nature and wellbeing see Hartig et al., 2011a,b; Capaldi et al., 2014, 2015; Oh et al., 2017), this relationship has yet to be deeply explored in regard to the COVID-19 pandemic. Though these results are not conclusive, it points to the possibility that if individuals follow through with their plans to spend more time outdoors, they may experience boosts to health and wellbeing.

In sum, it seems that the pandemic may shift the relationship between humans and their environment, and that nature experiences were associated with healthy adaptations to stay-at-home orders. Future work should continue assessing these trends to understand how these relationships change alongside the severity of the pandemic.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/**Supplementary Material**, https://osf.io/fnbuc/.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Human Subjects Institutional Review Board at Moravian College. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

DH developed and ran the study and also did the majority of the writing of the manuscript. EB assisted in the development of the coding manual and in coding qualitative responses, in addition to assisting with manuscript writing. TM was primarily responsible for statistical analyses and created the tables in addition to assisting with manuscript writing. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/frsc.2022.694054/full#supplementary-material

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