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New Ecological Paradigm, Leisure Motivation, and Wellbeing Satisfaction: A Comparative Analysis of Recreational Use of Urban Parks before and after the COVID-19 Outbreak

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Abstract: The COVID-19 pandemic has created an opportunity for us to rethink the relationship between humans and the environment. However, few studies have examined the association between environmental attitudes, motivations, wellbeing, and quality of life in the context of urban green areas before and after the outbreak of COVID-19. This paper investigated the interrelationships among these variables based on data collected in 2019 (before COVID-19) and 2021 (after COVID-19). The results show that the 2021 sample differed significantly from the 2019 sample in environmental attitudes. Respondents after the outbreak with the belief in "humans with nature" were more likely to use urban green areas for being "close to nature" than pre-pandemic respondents. In addition, stronger belief in "humans over nature" led to stronger desire for "social interactions" in 2021 than in 2019, implying a close relationship between people's perception of humankind's ability to control nature during the pandemic and their desire to interact with people in urban green areas. The study also found that there may be a pent-up satisfaction among urban dwellers after the COVID-19 outbreak.

Keywords: COVID-19; NEP; motivation; urban green areas; SEM

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1. Introduction

The impacts of urban green areas on urban residents' wellbeing and health have been extensively examined in the literature. It is widely recognized that an individual's wellbeing and satisfaction are affected by factors such as accessibility, motivation, frequency of visits, duration of use, and quality and quantity of urban green areas (among others). Adding to this list is the COVID-19 pandemic, which has spread globally since it initially emerged in January 2020 in China. The pandemic has stimulated a pent-up demand not only for nature-based outdoor recreation and tourism, but also for recreational use of urban green areas. While there is a plethora of studies that have examined the association between the pandemic and residents' use and health related to urban green areas, very few studies have examined the association from the perspective of environmental attitudes in a comparative manner. Thus, this paper seeks to fill this research gap.

Humans have a biological need to be close to nature. This biophilic nature of human beings has significant implications not only for the planning and management of urban green areas, but also for the enhancement and promotion of public health and wellbeing, given that contact with nature in many communities is largely limited to local trees, parks, and green areas nearby. This is particularly true during the COVID-19 pandemic, wherein

most countries/regions have imposed lockdowns and travel restrictions, which have significantly impacted people's recreational behaviors. For example, a study found that more people in the USA stayed closer to home for leisure and recreation, with 49.9% travelling within two miles as opposed to 10.8% prior to 11 March 2020 [1]. In Belgium, people tended to use urban green areas more frequently during the lockdown than pre-pandemic [2]. Another study involving five countries also found that people tended to use urban green areas quite often during the COVID-19 pandemic [3].

While the COVID-19 pandemic has unprecedentedly affected every aspect of our societies and people's daily lives, it has also created an opportunity for us to rethink the relationship between humans and nature and revisit models developed and used to examine human behaviors before the pandemic [4]. On the one hand, people may be more aware of the importance of urban green areas for public health and more motivated to recreate in urban green areas, which, in turn, may reinforce their attitudes toward the environment. On the other hand, reduced economic activities, less energy consumption, and less human movements and commuting following lockdowns and travel restrictions during the pandemic may "have a positive impact on the environment" [5] (p. 2) due to greenhouse gas emissions, air pollution, wastes, and noises being significantly reduced [6–9]. This "incidental" positive impact due to the pandemic may have significant implications for the long-term sustainability as it may trigger a transformative change of people's attitudes and behaviors toward nature and the environment. However, there is a lack of "detailed understanding of how large scale social-ecological upheaval impacts the values and benefits associated with human-nature relationships" [10] (p. 2). Thus, more research is needed to understand the association between these underlying values and benefits and increased nature-based activities [10].

Urban green areas can serve as an ideal platform by which the association between attitudes, motivations, benefits, and recreational use can be examined before and after the COVID-19 outbreak. This assumption follows the value-attitude-behavior model, which implies that "the influence should theoretically flow from abstract values to mid-range attitudes to specific behavior" [11] (p. 638). However, few studies, if any, have been conducted to comparatively examine the interrelationships among these variables based on samples surveyed before and after the outbreak. To this end, this study examined how environmental attitudes measured by the New Ecological Paradigm (NEP) [12] would influence leisure motivations, and how leisure motivations would influence wellbeing satisfaction measured by the Personal Wellbeing Index-Adult (PWI-A) [13], and how the latter would further influence quality of life in the context of urban green areas. Specifically, this study is guided by following questions:

(1) Did residents' recreational use of urban parks differ significantly before and after the outbreak?
(2) Did residents' environmental attitudes, leisure motivations, and PWI-A differ significantly before and after the outbreak?
(3) Did environmental attitudes influence leisure motivations, which, in turn, predicted wellbeing satisfaction measured by PWI-A?
(4) Did PWI-A further influence quality of life?
(5) Did the relationship strengths between two variables for the 2019 sample and 2021 sample differ significantly?

To answer the five questions above, Haihou, the capital city of Hainan Province, China, was chosen as the study area for this research for two reasons. First, the city has a tropical climate with four seasons being not distinct as those in many parts of China. Thus, the recreational use of urban green areas in the city is less affected by seasons. Second, as with many other cities in the country, lockdown was enforced from 24 January 2020 to 26 February 2020 in the city to control the spread of COVID-19. During this period, a total of 39 cases were confirmed. Only two cases were reported after the lockdown (one in June 2021 and one in August 2021). As of 31 December 2021, a total of 41 cases were reported with 0 deaths. Since the second survey was completed in July 2021 (where 0 cases were

reported), the 2021 sample can be considered post- pandemic while the sample surveyed in 2019 can be considered pre- pandemic for the study area.

The rest of the paper is organized in a way that a review of the relevant literature is presented first (which sets the basis for the development of four hypotheses), followed by a description of the methods used and presentation of the results along with a discussion of findings. Finally, the paper is wrapped up with main conclusions along with research implications (theoretical, methodological, and managerial) as well as research limitations and future research needs. Figure 1 displays the flowchart that shows the overall structure of the remaining paper (Figure 1).

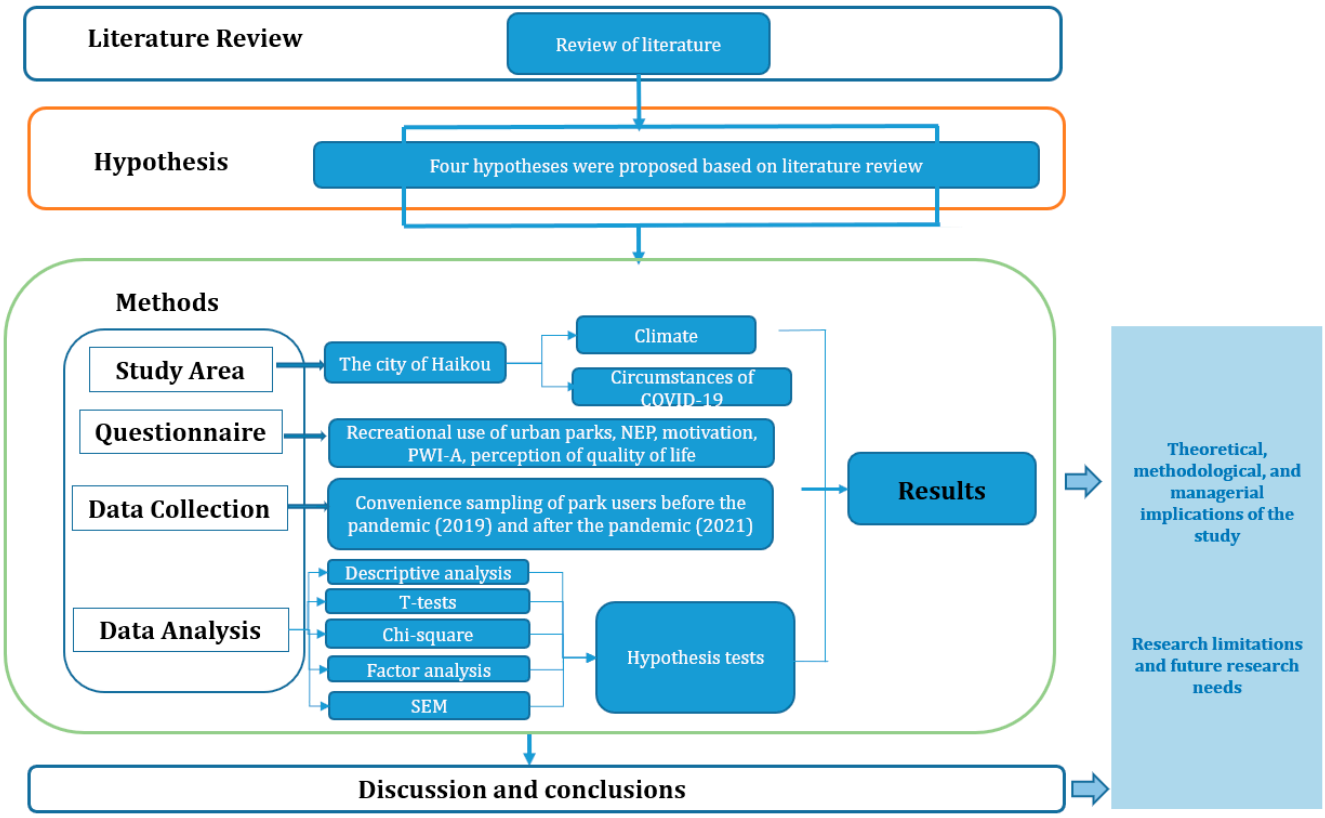

Figure 1. A schematic flowchart of the study.

2. Literature Review

2.1. COVID-19 Pandemic and Environmental Attitudes/Awareness

Several studies have examined people's environmental awareness and attitudes related to the pandemic, albeit not in the study field of urban green areas nor in the context of China. For example, one study [9] investigated public awareness of nature and the environment in 20 European countries based on online search behaviors retrieved from the Google Trends. This study found that online searches of nature-related topics (forest, birds, nature, biodiversity, gardening, and vegetable plot) increased significantly due to the COVID-19 outbreak. A second study [7] also reported a positive change of perceptions of the natural environment due to the pandemic-related lockdown in three European countries (England, Ireland, and Spain). Additionally, a third study [5] reported an increased awareness in air pollution, environmental impact, recycling, water consumption, and natural resources in Brazil and Portugal as a result of the pandemic.

There are two other studies that are specifically related to NEP. The first one [14] examined COVID-19 risk management behavior as it relates to pro-environmental attitudes measured by NEP, finding that pro-environmental behaviors are positively related to the moral obligation of protecting others from COVID-19 risks. The second study [15] found that while people's attitudes in Germany toward the environment measured by NEP

tended to be more positive during the pandemic than before, there were no significant differences in subscales such as "limits of growth" and "anti-anthropocentrism". The increase in environmental concerns were mainly driven by three other subscales: "balance of nature", "anti-exemptionalism", and "eco-crisis". Thus, people's attitudes toward the environment may differ before and after the pandemic, leading to Hypothesis 1 being proposed as follows:

Hypothesis 1: *People's environmental attitudes measured by NEP would differ significantly before and after the outbreak of the pandemic.*

2.2. Environmental Attitudes and Leisure/Recreation Motivations

Attitude can be defined as "a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object" [16] (p. 10). Attitude is positioned in the theory of planned behavior (TPB) model as an antecedent to intention or motivation. That is, behavioral intention (motivation to act) is determined by attitude toward the behavior. Prior to the TPB model, attitude as a source of motivation was also discussed in previous studies [17–19]. It is argued that "another way to look at psychological needs is to think of them as motives rooted in systems or complexes of attitudes or values" [17] (p. 80). A study involving 372 students in the southeastern United States explored the impacts of cognitive and affective aspects of attitude on motivations and behaviors [20]. Previous studies also measured environmental attitudes in terms of three latent subscales (conservation and development, conservation priority, and leisure rights), which were found to be "significantly associated with visitors' motivations" [21] (p. 35), suggesting "nature-based visitors' environmental attitudes were related to their motivations for travelling" [21] (p. 35).

Contrary to attitude as a factor that predicts motivation as discussed above, there are studies that treated motivation as a predictor of attitude [19,22,23]. For example, one study [19], after a review of relevant literature, concluded that "attitude toward an act is determined by an individual's motivation to perform the act" (p. 285). Thus, it seems that a consensus on attitude preceding motivation or vice versa has not been reached among researchers. It seems that which one should be treated as a driving factor of the other depends on the research context and questions to be examined as the two concepts are closely related. For example, as for gambling, if one dislikes gambling (negative attitude toward gambling), they will be less likely to gamble in a casino (motivation). In this case, attitude determines motivation. That said, even basic human values which are stable and universally considered as the driving factors of attitudes can be put under the rubric of motivational continuum [24,25], thus supporting the argument of motivation determining attitude made by some researchers [19].

Nonetheless, NEP as a measure of environmental attitudes has been consistently used as a variable that predicts motivation when the relationship between attitudes, motivations and behaviors are examined. This is true in the context of environmental studies and tourism studies as well. For example, a study examined the relationships between environmental attitudes (measured by NEP), non-use values of endangered species, and underlying motivations for willingness to pay (WTP), finding that environmental attitudes significantly influenced respondents' rating of the importance of non-use motivations [26]. A significant relationship between NEP and non-use motivations was also reported in another study [27].

In the context of tourism, NEP has been examined along with motivations in several studies. NEP was found to be significantly associated with a festival motivation towards environment-related films and issues, implying that festival attendees with higher level of pro-environmental attitudes were more likely to attend the festival due to its environmental themes [28]. Another study [29] examined NEP as it relates to nature-based tourism motivations, finding that visitors who scored higher on the subscale "humans over nature" were also more motivated by seeking "novelty/self-development", suggesting that people, particularly the young with active and adventurous tourism pursuits of tourism experience,

tended to emphasize the power of humans in conquering nature. In contrast, visitors who were more supportive of "limits to growth" and more concerned about "eco-crisis" were more motivated by passive and appreciative tourism pursuits with a higher desire to return to nature, to learn about nature, and to escape from routines. This suggests "a high level of environmental concern could form a high level of tourism motivation for being close to nature" [29] (p. 399). Extended from these findings, residents' environmental attitudes measured by NEP would also be closely related to their motivations to use urban parks. Thus, the second hypothesis is proposed:

Hypothesis 2: *Peoples' environmental attitudes would significantly influence their motivations to visit urban green areas.*

2.3. Motivations, Satisfaction and Quality of Life

Travel motivation is among the most researched themes in the field of tourism research [30]. It refers to factors that drive a person to participate in a recreation or tourist activity [31]. These factors can be broadly categorized into two dimensions: push and pull [32] with the former referring to internal or intrinsic motives or forces (e.g., facilitation of social interactions, desire to escape daily lives, and rest and relaxation) that cause a person to travel and the latter relating to external or extrinsic motives such as destination attributes and services [33].

Just as motivation and attitude are closely related, so are motivation and satisfaction [34]. Motivation determines people's behaviors and their expectations of products/services [35]. From the perspective of the push dimension that initiates an individual's travel desire, motivation can be defined as "state of need, a condition that exerts a push on the individual towards certain types of action that are seen as likely to bring satisfaction" [36] (p. 16). In this sense, people will feel satisfied if their needs or motives are met [37].

Motivation as an antecedent to satisfaction has been examined in the field of tourism studies [38–43]. Although a positive relationship between motivation and satisfaction was reported in most studies, there are also discrepancies. For example, no significant relationship was found between the two variables in two studies [39,42]. Another study [43] found that the pull and push motivators performed differently in a way that pull travel motivations were not significantly related to satisfaction while push motivations were. In contrast, one study [40] found that both pull and push motivations significantly influence satisfaction. A study in the context of urban parks found that experiencing nature and seeking relaxation positively affected satisfaction while other motivators on educational and cultural activities did not [27]. Thus, "findings on the relationship between motivation and satisfaction are sample specific" [44]. Given that a significant relationship exists between motivation and satisfaction in most studies, it is assumed that leisure motivations would also be significantly related to wellbeing satisfaction measured by PWI-A. In addition, previous studies conducted in both western societies and China consistently found that satisfaction significantly and positively affects quality of life [45,46]. Therefore, two additional hypotheses are proposed:

Hypothesis 3: *Leisure motivations would significantly influence PWI-A.*

Hypothesis 4: *Satisfaction of wellbeing measured by PWI-A would significantly influence quality of life.*

3. Materials and Methods

3.1. Study Area

Haikou, the capital city of China's island province Hainan (often called the "Hawaii" of China), is situated at the north coast of the Hainan island (19°31′32″ N~20°04′52″ N, 110°07′22″ E~110°42′32″ E) with a tropical maritime climate (Figure 2).

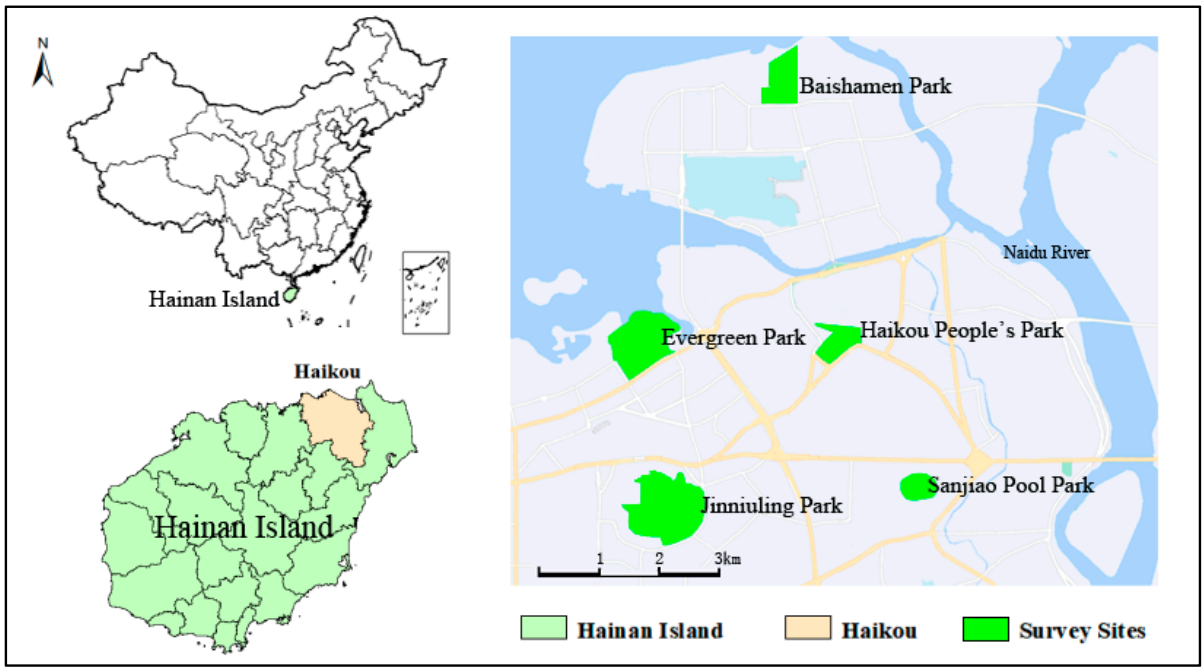

Figure 2. Location of the study area.

Haikou covers 3127 square kilometers with a population of 2.87 million. The city is ranked top in terms of its air quality among 168 major cities nationwide. It is also listed as the "national environmental protection exemplary city", "national garden city", and "international wetland city" with 38.38% of the land area being covered by tree canopy [47]. As with many other cities in the country, all of the city's urban parks and green areas are open to the public for free. Among those most popular urban parks are Evergreen Park, Haikou People's Park, Sanjiao Pool Park, Baishamen Park, and Jinniuling Park, which were selected as the survey sites for this study (Figure 2).

3.2. Questionnaire and Measures

A questionnaire was developed by drawing upon findings from the literature. This questionnaire measures participants' socio-demographics, recreational use of urban green areas, motivations for using urban green areas, attitudes toward the environment, satisfaction of wellbeing, and perceived quality of life. Motivations were measured by eight items which were adopted from a previous study [44]. Environmental attitudes were measured by the widely used and tested NEP [15,48] which consists of 15 items, whereas "agreement with the eight odd-numbered items and disagreement with the seven even-numbered items indicate pro-NEP responses" [12] (p. 433). The seven even numbered items are associated with the Dominant Social Paradigm with a focus on humans over nature, while the eight odd items reflect endorsement of the New Environmental Paradigm that emphasizes humans with nature [48,49]. Satisfaction of wellbeing was measured by seven items, five of which were adopted from the PWI-A [13]. Examples of items include "How satisfied are you with your standard of living?" and "How satisfied are you with your health?" Finally, one item "How would you rate your quality of life?" was used to measure participants' overall quality of life [50]. All of these items were measured on a 5-point Likert scale (1 = strongly disagree or extremely dissatisfied, 5 = strongly agree or extremely satisfied).

3.3. Data Collection

The survey was conducted twice (once before the COVID-19 pandemic in 2019 and once during the pandemic in 2021) using the convenience sampling method by undergraduates and graduates majoring in tourism management from Hainan Normal University under the supervision of the lead author of this paper. Both surveys were carried out during

a similar time period (29 June–21 July for 2019 vs. 3 July to 20 July for 2021) and at the same sites: Evergreen Park, East Lake Park, Sanjiao Pool Park, Baishamen Park, and Jinniuling Park as aforementioned. Only local residents were surveyed while outside visitors were excluded. Specifically, prospective respondents were approached by the survey team who introduced themselves and explained the study purpose to individuals who may be willing to help out with the survey. If an individual was unwilling to participate, the survey team then approached the next individual available. If an individual showed willingness, the questionnaire was then presented for on-site completion. Once one survey was completed, the next individual was approached [51].

During the 2019 survey period, a total of 700 individuals 18 years of age or older were approached. Of this number, 635 returned their questionnaires, resulting in a return rate of 90.7%. Of the 635 returned questionnaires, 30 were removed due to systematic incomplete responses and skeptical response patterns (i.e., same rating for variables in a section of the questionnaire), resulting in 605 usable questionnaires for analysis.

For the 2021 survey period, both the hardcopy questionnaire and its digital version built in the Questionnaire Star with a QR code were offered to prospective participants. It should be noted that some residents were still concerned about the risk of being contracted with the virus even after the end of the lockdown as evidenced in other survey projects administered by the lead author of this paper. Thus, during the survey period in 2021, participants who chose to do a digital survey were asked to scan the QR code and fill the digital survey onsite. A total of 350 individuals preferred the digital survey and 321 of them submitted their filled questionnaires. In addition, a total of 350 hardcopy questionnaires were handed out to participants with 302 of them being returned. Thus, the return rate for the 2021 survey period was 89.0%. As with the 2019 survey, 28 questionnaires for the 2021 sample were removed due to the same reasons, resulting in 595 usable questionnaires for further analysis.

3.4. Data Analysis

With the removal of those questionnaires with incomplete and skeptical responses, the pattern of missing data is random, and the missing rate is quite low (between 0.2% and 0.9%). Thus, no imputation was used to replace missing data. All analyses were made based on usable questionnaires with missing data omitted using casewise deletion.

Data analyses were conducted using SPSS 28 and AMOS 28, including descriptive analysis, chi-square analysis, factor analysis, *t*-test analysis, and SEM. First, socio-demographics and the recreational use of urban green areas pre- and during the pandemic were described. Second, chi-square tests were conducted to see if group types, frequency of visits, and use duration are significantly different between the two samples.

Third, the principal components analysis with varimax rotation and an eigenvalue of 1.00 or more was used to derive latent variables for the 2019 sample, 2021 sample, and the aggregated data (both samples combined). A cut-off point of 0.45 was used to determine items for a factor [52], and a loading difference of 0.15 was used to separate items with cross loadings [53,54].

Fourth, t-tests were conducted to compare the similarities and differences in NEP, motivations, and PWI-A between the two samples. Fifth, a measurement model for the three datasets (the 2019 sample, 2021 sample, and the two samples combined) was tested, respectively. Three parameters such as composite reliability (CR), average variance extracted (AVE), and maximum shared variance (MSV) were used to determine internal consistency (CR > 0.70), the convergent validity (AVE > 0.50) and discriminant validity (AVE > MSV) of a construct, respectively [55]. Sixth, three individual SEMs were tested with the three datasets, respectively. The ratio of χ^2 value over the degree of freedom was used to assess the goodness of fit, with a ratio of 5 being considered acceptable and below 3 as a better fit [56].

Finally, a multiple group analysis was conducted to statistically compare the relationship strengths between two variables in the SEM for the 2019 sample and 2021 sample. The

critical ratio was used to test the significant level of a regression weight, with the ratio >1.96 or <−1.96 indicating the difference between two regression weights being significant at or lower than the 0.05 level [22].

4. Results

4.1. Descriptive Analysis

4.1.1. Socio-Demographics

Participants' socio-demographic characteristics are quite comparable between the two samples. Specifically, females outnumbered males for both survey periods (48.3% males and 51.7% females in 2019 vs. 41.2% males and 58.8% females in 2021). In addition, survey participants were young (71.4% were between 21–49 years of age in 2019 vs. 75.3% in 2021) and well educated (38.2% had an undergraduate degree or above in 2019 vs. 39.3% in 2021). Finally, the majority of participants were married for both samples (51.7% in 2019 vs. 52.8% in 2021).

4.1.2. Recreational Use of Urban Parks

The majority of respondents reported visiting urban parks with family and relatives (46.1% in 2019 vs. 57.1% in 2021), followed by with friends (35.4% in 2019 vs. 23.9% in 2021), while the percentages for people who visited urban parks alone are almost the same (14.2% in 2019 vs. 14.55 in 2021). In addition, a small percentage of respondents visited parks with others (neighbors and colleagues) with 4.3% for 2019 and 4.5% for 2021, respectively. However, in terms of frequency of visits and use duration per visit, participants in 2019 were more often to use urban parks than their counterparts in 2021. For example, 11.1%, 42.7%, 28.8%, and 17.5% of respondents reported having used urban parks every day, 1–3 times per week, 1–3 times per month, and less than 11 times per year in 2019 compared to 7.2%, 35.3%, 35.8%, and 21.5% in 2021, respectively. In addition, respondents in 2019 tended to stay longer in urban parks than respondents in 2021 with 8.9%, 32.1%, 41.8%, 13.7%, and 3.5% of them reporting a use duration of ≤30 min, 30 min to 1 h, 1 to 2 h, 2 to 4 h and >4 h in 2019, respectively (vs. 14.3%, 27.5%, 39.6%, 16.9%, and 1.7%, respectively in 2021).

4.2. Chi-Square Analysis of Recreational Use of Urban Parks

Chi-square tests of group types, frequency of visits, and use duration per visit before and after the outbreak are presented in Tables 1–3, respectively. As shown, the trip characteristics were significantly different before and after the outbreak. Specifically, compared to pre-pandemic in 2019, people surveyed in 2021 were more likely to go to urban parks with family and relatives, less likely with friends (Table 1), and less often to use parks (Table 2) with a shorter stay (Table 3).

Table 1. Chi-square analysis of group types (2019 vs. 2021).

Group Types		2019	2021	Total	χ^2	Φ
Myself	Count	86	86	172	20.31 *	0.130
	% within year	14.2%	14.5%	14.3%		
	Adjusted residual	−0.1	0.1			
Family and relatives	Count	279	339	618		
	% within year	46.1%	57.1%	51.5%		
	Adjusted residual	−3.8 **	3.8 **			
Friends	Count	214	142	356		
	% within year	35.4%	23.9%	29.7%		
	Adjusted residual	4.3 **	−4.3 **			

Table 1. *Cont.*

Group Types		2019	2021	Total	χ^2	Φ
Others (neighbors and colleagues)	Count % within year Adjusted residual	26 4.3% −0.2	27 4.5% 0.2	53 4.4%	20.31 *	0.130
Total	Count % within year	605 100.0%	594 100.0%	1199 100.0%		

* $p < 0.001$, ** Absolute value of adjusted residual > 2.0.

Table 2. Chi-square analysis of frequency of visits (2019 vs. 2021).

Frequency of Visits		2019	2021	Total	χ^2	Φ
Everyday	Count % within year Adjusted residual	67 11.1% 3.5 **	33 5.5% −3.5 **	100 8.3%	25.94 *	0.147
1–6 times/week	Count % within year Adjusted residual	258 42.6% 2.8 **	207 34.8% −2.8 **	465 38.8%		
1–3 times/month	Count % within year Adjusted residual	174 28.8% −3.0	219 36.8% 3.0	393 32.8%		
<11 times/per year	Count % within year Adjusted residual	106 17.5% −2.3 **	136 22.9% 2.3 **	242 20.2%		
Total	Count % within year	605 100.0%	595 100.0%	1200 100.0%		

* $p < 0.001$, ** Absolute value of adjusted residual > 2.0.

Table 3. Chi-square analysis of length of visits (2019 vs. 2021).

Use Duration		2019	2021	Total	χ^2	Φ
≤30 min	Count % within year Adjusted residual	54 8.9% −2.9 **	85 14.3% 2.9 **	139 11.6%	15.63 *	0.114
30 min–1 h	Count % within year Adjusted residual	194 32.1% 1.7	163 27.5% −1.7	357 29.8%		
1–2 h	Count % within year Adjusted residual	253 41.8% 0.8	235 39.6% 0.8	488 40.7%		
2–4 h	Count % within year Adjusted residual	83 13.7% −1.5	100 16.9% 1.5	183 15.3%		
>4 h	Count % within year Adjusted residual	21 3.5% 1.9	10 1.7% −1.9	31 2.6%		
Total	Count % within year	605 100.0%	593 100.0%	1198 100.0%		

* $p < 0.01$, ** Absolute value of adjusted residual > 2.0.

4.3. Factor Analysis

As previously mentioned, leisure motivations, NEP, and PWI-A were factor analyzed for each sample and the two samples combined. Interestingly, each dataset shares exactly the same subscale patterns for each measure. To save the paper length, only the factor analysis results for the aggregated data (Tables 4 and 5) are presented while results for

each single sample are included as an Appendix (see Appendix A). Two factors—"close to nature" (pull motivations) and "social interactions" (push motivations)—were obtained from the eight items measuring leisure motivations. These two latent variables explained 59.57% of the total variance, with a Cronbach's alpha value for "close to nature" being 0.87 and "social interactions" being 0.55, respectively (Table 4). While the Cronbach's alpha value of 0.70 [57] has been typically used as the threshold to determine a factor's reliability, the alpha value less than the threshold was also considered acceptable for a factor with fewer items [58,59] since the value is sensitive to the number of items. For example, a reliability of 0.454 was reported in one study examining visitors' environmental attitudes measured by NEP [60].

Table 4. Summary results of exploratory factor analysis for motivation (aggregated data).

Code	Factor (Proportion): Scale Name and Items	*M*	*SD*	Factor	
				1	2
Factor 1	**Close to nature**	**4.18**	**0.66**		
L1	Experience nature	4.17	0.81	**0.785**	0.165
L3	Relaxation	4.30	0.78	**0.855**	0.084
L4	Enjoy the natural tranquility	4.25	0.84	**0.854**	0.156
L5	Enjoy the fresh air of open space	4.19	0.86	**0.829**	0.117
Factor 2	**Social interactions**	**3.25**	**0.90**		
L6	With friends	3.44	1.10	0.103	**0.746**
L7	With kids	3.35	1.37	0.144	**0.643**
L8	Picnics	2.96	1.23	0.050	**0.728**
	Eigenvalues			3.41	1.35
	% of variance			42.71	16.86
	Cumulative %			-	59.57
	Standardized Cronbach's *a*			0.87	0.55

KMO = 0.82, $p < 0.001$. Note. Item L2 "fitness and jogging" was removed from further analysis due to it being cross loaded on two factors.

Table 5. Summary results of exploratory factor analysis for New Ecological Paradigm (aggregated data).

Code	Factor (Proportion): Scale Name and Items	*M*	*SD*	Factor	
				1	2
Factor 1	**Humans with nature**	**3.82**	**0.64**		
NEP1	We are approaching the limit of the number of people the earth can support	3.72	0.95	−0.074	**0.520**
NEP3	When humans interfere with nature it often produces disastrous consequences	3.85	0.97	−0.017	**0.651**
NEP5	Humans are severely abusing the environment	3.62	1.02	−0.033	**0.634**
NEP7	Plants and animals have as much right as humans to exist	4.10	0.91	0.152	**0.655**
NEP9	Despite our special abilities humans are still subject to the laws of nature	3.81	0.90	−0.018	**0.633**
NEP11	The earth is like a spaceship with very limited room and Resources	3.97	0.92	0.109	**0.704**
NEP13	The balance of nature is very delicate and easily upset	3.82	0.99	−0.016	**0.682**
NEP15	If things continue on their present course, we will soon experience a major ecological catastrophe	3.64	0.94	−0.108	**0.667**

Table 5. *Cont.*

Code	Factor (Proportion): Scale Name and Items	*M*	*SD*	Factor	
				1	2
Factor 2	**Humans over nature**	**2.84**	**0.85**		
NEP2	Humans have the right to modify the natural environment to suit their needs	3.18	1.17	**0.605**	-0.077
NEP4	Human ingenuity will ensure that we do NOT make the earth unlivable	3.21	1.08	**0.652**	−0.155
NEP6	The earth has plenty of natural resources if we just learn how to develop them	2.88	1.22	**0.729**	−0.053
NEP8	The balance of nature is strong enough cope with the impacts of modern industrial nations	2.77	1.23	**0.779**	0.042
NEP10	The so-called "ecological crisis" facing humankind has been greatly exaggerated	2.86	1.11	**0.711**	0.028
NEP12	Humans were meant to rule over the rest of nature	2.48	1.23	**0.764**	0.118
NEP14	Humans will eventually learn enough about how nature works to be able to control it	2.54	1.22	**0.788**	0.076
	Eigenvalues			3.70	3.39
	% of variance			24.63	22.57
	Cumulative %			-	47.20
	Standardized Cronbach's *a*			0.80	0.84

KMO = 0.87, $p < 0.001$.

Two factors were extracted from the 15 NEP items with all eight odd-numbered items loaded on one factor–"humans with nature" (with a Cronbach's *a* of 0.87) and all seven even-numbered items on another factor—"humans over nature" (with a Cronbach's *a* of 0.84). A total of 47.20% of variance was explained by the two factors (Table 5). Factor analysis results for PWI-A are not tabulated as all seven items were loaded on one single factor.

4.4. T-Tests

t-tests were conducted to examine the similarities and differences in leisure motivations, NEP, and PWI-A between the two samples. Results are presented in Table 6. As shown, both groups were not significantly different in their leisure motivations ($p > 0.05$). However, they differed significantly in NEP and PWI-A with the 2021 sample being more positive toward "humans with nature", while also more supportive of "humans over nature", and more satisfied with their wellbeing than the 2019 sample counterparts. Thus, hypothesis 1 (people's environmental attitudes measured by NEP would differ significantly before and after the outbreak of the pandemic) is fully supported.

Table 6. T-tests of subscales of the three measures (2019 vs. 2021).

Subscales		Mean		Mean Difference	*t*	*p*	95% Confidence Interval of the Difference	
		2019	2021					
Leisure motivations	Close to nature	4.29	4.22	0.07	1.73	0.085	−0.01	0.15
	Social interactions	3.27	3.23	0.04	0.72	0.470	−0.06	0.14
NEP	Humans with nature	3.76	3.87	−0.11	−2.97 *	0.003	−0.17	−0.04
	Humans over nature	2.74	2.96	0.23	−4.58 **	0.000	−0.32	−0.13
PWI-A	Satisfaction of wellbeing	3.35	3.52	−0.17	−4.84 **	0.000	−0.24	−0.10

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

4.5. Structural Equation Modeling

4.5.1. Measurement Model

Data skewness and kurtosis for observed variables for the three datasets were examined prior to the test of the measurement model. A sample is considered not to deviate too much from the normal distribution if absolute values of univariate skewness and univariate kurtosis are less than 2 and 3, respectively [61]. The normality assessment indicated that the absolute values of all observed variables met the criteria (Appendix B), suggesting the appropriateness of the datasets for SEM analyses.

Table 7 presents CR, AVE, and MSV for the three datasets. CR is consistently above 0.70 for the two NEP subscales, PWI-A and one leisure motivation subscale "close to nature" for the three datasets. While CR is less than 0.70 for another leisure motivation subscale "social interactions", it is close or equal to 0.60. In terms of AVE, the value for "close to nature" is above 0.50 for all three datasets, while between 0.30 and 0.50 for the rest. An AVE close to 0.50 is still adequate if CR is greater than 0.70 [55]. It is worth noting that all AVE values are close to or higher than MSV, except the pair "humans over nature" and "social interactions" which has a MSV of 0.37. AVE values of between 0.30 and 0.50 and CR around 0.6 were also reported in other studies [62]. Thus, the three measures for each analysis group have a moderate to good composite reliability, convergent validity, and discriminant validity.

Table 7. Composite reliability, average variance extracted, and maximum shared variance.

	2019	2021	Aggregated
Composite reliability (CR)			
Leisure motivations			
Close to nature	0.84	0.87	0.87
Social interactions	0.60	0.56	0.56
NEP			
Harmony with nature	0.76	0.83	0.80
Humans over nature	0.81	0.87	0.85
PWI-A	0.80	0.86	0.84
Average variance extracted (AVE)			
Leisure motivations			
Close to nature	0.58	0.67	0.62
Social interactions	0.33	0.31	0.30
NEP			
Harmony with nature	0.30	0.38	0.34
Humans over nature	0.38	0.50	0.44
PWI-A	0.37	0.49	0.43
Maximum Shared Variance (MSV)			
Humans with nature↔Humans over nature	0.122	0.028	0.001
Humans with nature↔Close to nature	0.037	0.310	0.147
Humans with nature↔Social interactions	0.015	0.081	0.051
Satisfaction of wellbeing↔Humans with nature	0.057	0.047	0.055
Humans over nature↔Close to nature	0.002	0.003	0.000
Humans over nature↔Social interactions	0.044	0.372	0.192
Satisfaction of wellbeing↔Humans over nature	0.011	0.108	0.063
Close to nature↔Humans over nature	0.177	0.144	0.183
Satisfaction of wellbeing↔Close to nature	0.019	0.046	0.031
Satisfaction of wellbeing↔Social interactions	0.039	0.239	0.130

While CR and AVE can be improved by deleting items with low loadings, this study did not choose to do so for three reasons. First, the purpose of this study is not to develop and test a measure, but to obtain latent variables for the sake of simplicity of analysis. Second, keeping all items allows for comparison analysis being consistent with the same configurations between the two samples. Third, the measurement model for each dataset has a χ^2/df less than 3, RMSEA less than 0.05 and IFI and CFI greater than 0.90, indicating a good model fit of data (Appendix C).

4.5.2. Structural Model

Overall Structural Model

For the structural model, two variables—duration of recreational use of urban parks and frequency of visits were added. Figures 3–5 present the structural models for the 2019 sample, 2021 sample, and two samples combined, respectively. The model fit parameters are presented in Table 8. The ratio χ^2/df less than or slightly over 3, RMSEA close to or slightly over 0.05, IFI and CFI close to or equal to 0.90 indicate each dataset fits the model well.

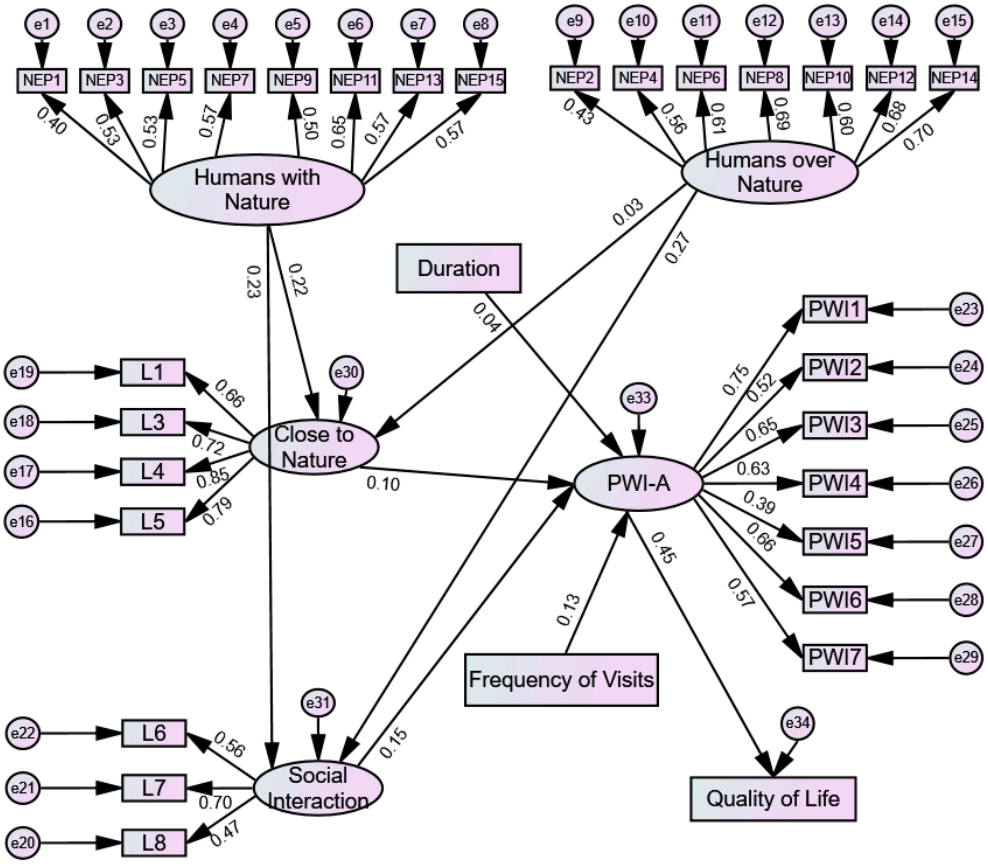

Figure 3. Structural equation model for the 2019 sample.

The results show that the relationship patterns among the five latent variables, frequency of visits, duration, and quality of life are amazingly consistent across all three models. Specifically, "human with nature" is significantly and positively related to the two leisure motivation subscales: "close to nature" ($p < 0.001$) and "social interactions" ($p < 0.001$), which, in turn, are significantly and positively related to wellbeing satisfaction ($p < .05$ for the former and $p < 0.01$ for the latter), PWI-A ($p < 0.05$ for the former and $p < 0.01$ for the latter), which further significantly influences quality of life ($p < 0.001$). While frequency of visits significantly and positively predicts PWI-A ($p < 0.05$) which further significantly contributes to quality of life ($p < 0.001$), duration does not. Finally, "humans over nature" significantly and positively predicts social interactions ($p < 0.001$). However, its relationship with "close to nature" is not significant ($p > 0.05$). Thus, Hypothesis 2 (residents' environmental attitudes would significantly influence their motivations to visit urban parks) and hypothesis 4 (satisfaction of wellbeing measured by PWI-A would significantly influence quality of life) are fully supported, while hypothesis 3 (leisure motivations would significantly influence PWI-A) is partially supported.

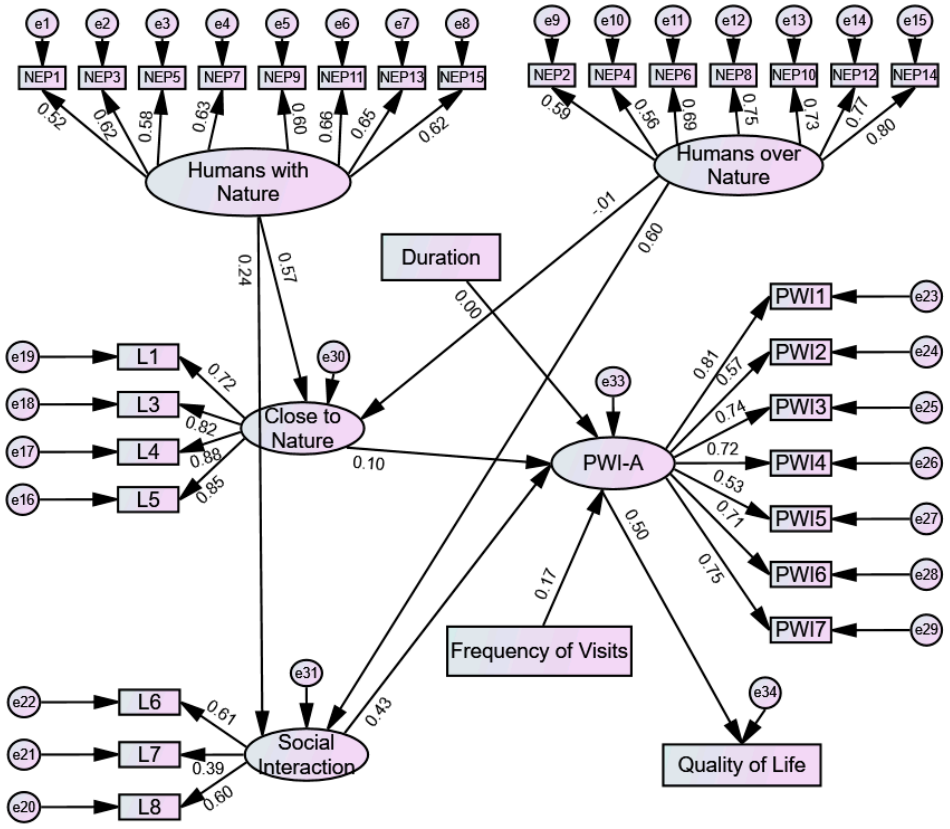

Figure 4. Structural equation model for the 2021 sample.

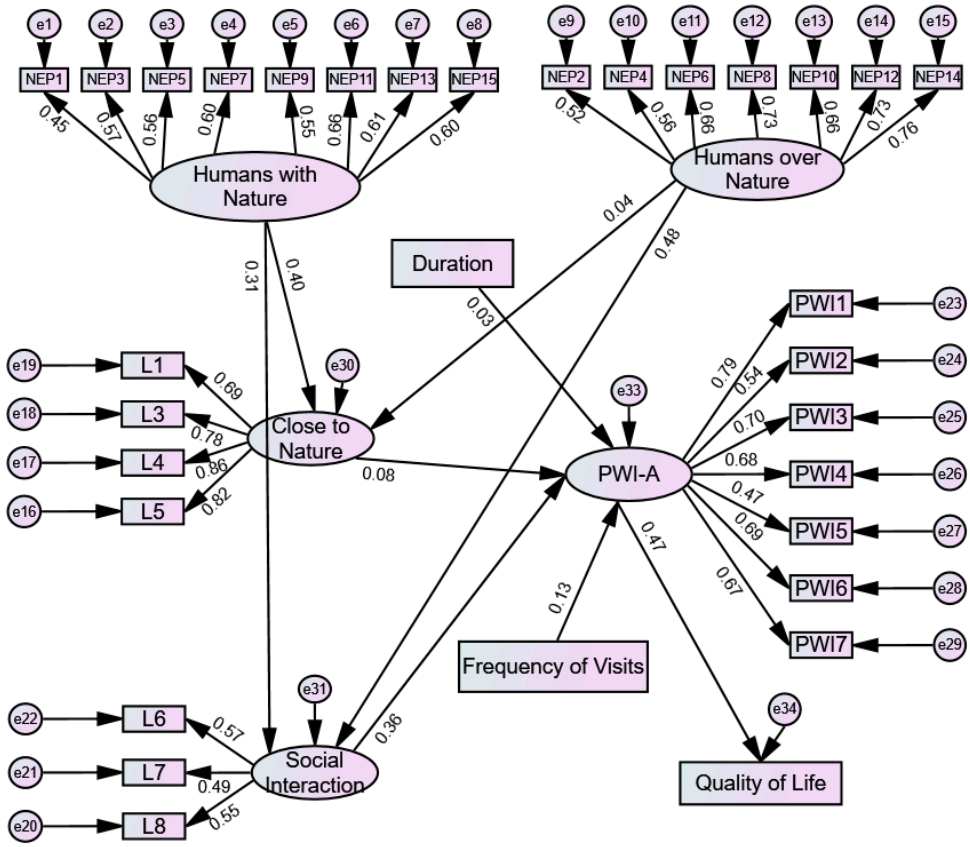

Figure 5. Structural equation model for the aggregated data (two samples combined).

Table 8. Assessment indices.

Model Fit Indices	χ^2	*df*	χ^2/df	RMSEA	IFI	CFI
2019 sample	1077.59	458	2.35	0.047	0.87	0.87
2021 sample	1239.72	458	2.70	0.054	0.89	0.89
Aggregated (two samples combined)	1616.04	458	3.53	0.046	0.90	0.90

Multiple Group Comparison Analysis

Measurement invariance across groups needs to be supported prior to the comparative analysis being carried out between groups [63]. There are four types of measurement invariance commonly reported in the literature, including configural invariance, metric invariance, scalar invariance, and residual invariance [64]. It is argued that "since full measurement invariance in all four steps is often not supported, it is becoming common practice to accept some violations of measurement invariance" [64] (p. 79).

Table 9 presents results of measurement invariance test for the two groups: 2019 sample and 2021 sample. The measurement model test reported earlier in Appendix C exhibits the same measurement pattern with good model fit between the two samples, supporting configural invariance. However, the metric invariance, if judged by the change of χ^2 would not be supported (Table 9) ($p < 0.001$). Since χ^2 is sensitive to sample size, a large sample size may lead to over-rejection of measurement invariance if the change of χ^2 is used as the only criterion to judge model fit [63,64]. Alternatively, change in alternative fit indices (AFIs) which is less sensitive to sample size has been used to evaluate fit [65]. AFIs criteria include a 0.01 change in CFI, 0.015 in RMSEA and 0.030 in SRMR (for metric invariance) or 0.015 (for scalar or residual invariance) [66]. The ΔCFI of 0.007, ΔRMSEA of 0.00 and ΔSRMR of 0.008 (Table 9) support metric, scalar, or residual invariance, suggesting the appropriateness of the data for cross group comparison analysis.

Table 9. Measurement invariance test between the 2019 sample and 2021 sample.

	χ^2	*df*	χ^2/df	RMSEA	SRMR	CFI
Unconstrained measurement model	1618.76	734	2.21	0.032	0.0449	0.924
Constrained measurement model	1728.24	763	2.27	0.032	0.0529	0.917
Difference	109.48 *	29	-	0.00	0.008	0.007

* $p < 0.001$.

The multiple group comparison analysis indicates that the three pairs of regression weights are significantly different between the two samples, including paths linking one NEP subscale "humans with nature" and one leisure motivation subscale "close to nature" (0.57 in 2021 vs. 0.22 in 2019, z = 2.889, $p < 0.001$), another NEP subscale "humans over nature" and another leisure motivation subscale "social interactions" (0.60 in 2021 vs. 0.27 in 2019, z = 3.468, $p < 0.001$), and "social interactions" and PWI-A (0.43 in 2021 vs. 0.15 in 2019, z = 2.283, $p < 0.01$) with the relationships being consistently stronger for the 2021 sample than for the 2019 sample. No significant differences were found for all other path coefficients between the two samples.

5. Discussion

Human beings are increasingly facing uncertainties that may have severe impacts on our health. The COVID-19 outbreak that has inflicted China and many other countries is such an example. The scope of restriction measures enforced by a country or region has largely affected the level of recreational use of urban green areas during the pandemic. More recreational uses of urban green areas were reported in countries/regions where people were still allowed to use urban green areas during the pandemic. For example, residents in the city of Freiburg visited the city's urban forests more often during the lockdown (4.2 visits per week) than before the pandemic (2.7 visits per week) [67]. A global study on the impacts of COVID-19 pandemic on urban park visitation using data recorded

from the Google Community Mobility Report found that as of 26 May 2020, the number of park visits increased in all 48 countries selected with some countries experiencing more visits than others [68].

It seems that more visits experienced in other cities outside China as a result of the pandemic did not happen in Haikou as the city's residents visited urban parks less often and with shorter duration during the pandemic than before the pandemic. Less use of urban parks during the pandemic in the city seems to endorse another study in Hong Kong [69] where lockdown was not practiced during the pandemic and where people tended to participate outdoor activities less often than before the pandemic. Thus, people in China or at least in Haikou and Hong Kong maybe more cautious and preventive than people in the western societies in dealing with the pandemic. This can also be reflected by the finding that respondents surveyed in 2021 were more likely to visit urban parks with family/relatives and less likely with friends than their counterparts surveyed in 2019. Decreased visits to urban forests and parks were also reported in Cambodia, Indonesia, and Myanmar during the pandemic [70].

Interestingly, it is the frequency of visits and not their duration that contributes to wellbeing satisfaction. This is true for each individual sample and the two samples combined. This finding endorses a study which found that frequency of visits, not amount of time spent in urban green areas, significantly and positively predicts life satisfaction for residents in Daejeon City, South Korea [71]. Thus, frequent visits to urban green areas mean more than duration in increasing positive emotions, "leading to a feeling of happiness in daily life" [71] (p. 2). Previous studies involving tourism and destination satisfaction also found that frequency of visits is positively and significantly related to satisfaction [72–76].

In terms of the two NEP factors "humans with nature" and "humans over nature", the 2021 sample was more likely than the 2019 sample to emphasize the importance of "humans with nature" as well as "humans over nature", which seems to be paradoxical as items in "humans with nature" represent pro-environmental attitudes while the opposite is true for the items measuring "humans over nature". People may think it is more important than before for humans to maintain a harmonious relationship with nature due to the pandemic, while in the meantime, they may also believe that humans can eventually learn how to control nature with the advance of science and technology and human wisdoms. The effective control of the spread of COVID-19 in China in 2021 as a whole and in the city specifically may have reinforced this line of thoughts. Thus, two mindsets (i.e., "humans with nature" and "humans over nature") may coexist simultaneously, though the former still weighed more than the latter as indicated by the average factor score being higher for the former than for the latter ($M = 3.77$ for "humans with nature" vs. $M = 2.74$ for "humans over nature" in 2019 and $M = 3.87$ for "humans with nature" vs. $M = 2.96$ for "humans over nature" in 2021). A further t-test analysis of the seven Dominant Social Paradigm items shows that the most significant differences came from three items: "the earth has plenty of natural resources if we just learn how to develop them" (NEP4), "the balance of nature is strong enough cope with the impacts of modern industrial nations" (NEP6), and "humans will eventually learn enough about how nature works to be able to control it" (NEP14).

It should be noted that a consensus about the dimensionality of the NEP construct has not been achieved among researchers. Although the 15 items of the NEP were initially used to represent five aspects of the environmental attitudes (balance of nature, eco-crisis, limits to growth, anti-exemptionalism, anti-anthropocentrism, each with three items) [12], the developers of the scale also argue that NEP can be treated as a one-dimension measure. However, they further emphasized that "future research will be needed to address the issue of the revised NEP Scale's dimensionality, and on some samples a clearer pattern of multidimensionality will no doubt emerge and warrant creation of two or more subscales measuring distinct dimensions of the NEP" [12] (p. 439). Indeed, many following studies conducted in varying socio-cultural contexts have reported two or more subscales out of either the earlier 12-item measure or the revised measure with 15 items [48,77]. However, few, if any, have obtained five subscales through exploratory factor analysis that match

exactly the five aspects of the 15 items. This led some researchers to speculate that the NEP subscales are sample specific [29]. Nevertheless, the two subscales from this study are, to a large extent, resemble a previous study on a national park in China [29], whereas all even-numbered items were loaded on one factor-"humans over nature", and all odd-numbered items were loaded on two other subscales termed "limits to growth" and "eco-crisis", which, if combined, correspond to "humans with nature" in this study.

The fact that NEP subscales vary with samples makes it difficult to compare findings of this study with those from previous studies involving NEP. For example, a study [15] found that not all NEP subscales are significantly more positive during the pandemic than pre-pandemic in the context of Germany, with respondents being more concerned about three of them—"balance of nature", "anti-exemptionalism", and "eco-crisis" while less concerned about two other subscales—"limits of growth" and "anti-anthropocentrism". Given that the four items in the subscale "humans over nature" (i.e., NEP1, NEP2, NEP11, NEP12) and other four items in the subscale "humans with nature" (i.e., NEP4, NEP8, NEP10, and NEP14) of this study are the same as reported in the study involving Germany [15], findings of this study partially endorse the study in Germany [15]. That is, people may hold views of the Dominant Social Paradigm that emphasizes "humans over nature" and views of the New Environmental Paradigm that endorses "humans with nature" during the pandemic in both countries.

While the two NEP factors differed significantly pre- and during-pandemic, the two leisure motivation factors were not significantly different from each other. However, when the relationships between NEP and leisure motivations were examined using SEM, some interesting patterns emerged. That is, the impact patterns of NEP on leisure motivations are consistent across all three datasets as shown in Figures 3–5, with the relationships between one NEP subscale "humans with nature" and the two motivation subscales "close to nature" and "social interactions" being significant, so is the relationship between another NEP subscale "humans over nature" and one motivation subscale "social interactions". The significant relationship between "humans with nature" represented by all seven odd-numbered items and "close to nature" endorses a previous study [29] which reported that all those odd-numbered items significantly influence nature-based tourism motivations to return to nature, to learn about nature, and to escape from routines. Interestingly, similar to "humans over nature" being closely related to active and adventurous tourism pursuits of nature-based tourism reported in that study [29], respondents in this study who scored higher on "humans over nature" expressed a higher motivation on social interactions. This is true for the 2019 sample, 2021 sample, and the two samples combined.

Both motivation subscales positively and significantly predicted satisfaction of wellbeing, which is consistent with previous studies on tourism motivations and destination satisfaction [38,41]. It should be noted that the push aspect of the motivation measure—"social interactions" had a larger effect on wellbeing satisfaction than the pull motivation—"close to nature" which corroborates, to some degree, a study [43] which also found that it is the push motivators, not the pull motivators, that contributed more to satisfaction. It is worth noting that the relationship between "social interactions" and wellbeing satisfaction for the 2021 sample was significantly stronger than that for the 2019 sample, implying that people were more likely to emphasize the importance of being united with family/relatives for mental and physical wellbeing during the pandemic than pre-pandemic. In other words, they felt more satisfied to socialize with family and relatives when recreating in the urban parks than before the pandemic. This is consistent with the t-test results that respondents surveyed during the pandemic scored significantly higher on PWI-A than their counterparts surveyed pre-pandemic. Thus, there may be a pent-up satisfaction among urban dwellers after the COVID-19 outbreak. This finding supports the posttraumatic growth theory that explains positive psychological change as a result of experiencing highly stressful life circumstances (i.e., disasters, crises, or traumas) [78,79].

The stronger relationship between "humans with nature" and "close to nature" for the 2021 sample suggests that respondents during the pandemic with the belief in "humans

with nature" were more likely to utilize urban green areas for being "close to nature" than respondents surveyed before the pandemic in 2019, albeit both samples were not significantly different from each other in their leisure motivations. The multigroup comparison analysis also shows that stronger belief in "humans over nature" led to stronger desire for "social interactions" in 2021 than in 2019, implying a close relationship between people's perception of humankind's ability to control nature during the pandemic and their desire to interact with people in urban green areas.

6. Conclusions

This paper not only addressed the use of urban green areas as affected by the COVID-19 pandemic before and after the outbreak of the COVID-19 pandemic, but also the perception of other variables as they relate to COVID-19 (attitudes, motivation, satisfaction, etc.). The examination of the use and perception of urban green areas based on two samples (one before the pandemic and one after the outbreak of the pandemic) using the same instrument and questionnaire making this study unique among existing studies on COVID-19 and urban green areas, as it allows for a meaningful comparison of use and perception of urban green areas as affected by COVID-19. Moreover, the use and perception were examined not separately, but simultaneously using the structural equation modeling (SEM).

6.1. Research Implications

This study is of significant theoretical, methodological, and managerial implications. Theoretically, this study, for the first time, empirically examined people's environmental attitudes measured by the NEP before and after the outbreak of COVID-19, with respondents after the outbreak being more supportive of "humans with nature" than respondents before the outbreak. This stronger belief in "humans with nature" during-pandemic proves that NEP is useful "in tracking possible increases in endorsement of an ecological worldview, as well as in examining the effect of specific experiences and types of information in generating changes in this worldview" [12] (p. 439). While recognizing the increased belief in "humans with nature" as a result of the pandemic, it is "humans over nature" that contributed more than "humans with nature" to "social interactions", which further led to a higher level of wellbeing satisfaction, resulting in a pent-up satisfaction during the pandemic. This pent-up satisfaction of wellbeing endorses the posttraumatic growth theory and thus deserves more research on the relationships between environmental attitudes, motivations, satisfaction, and quality of life as they relate to the pandemic in the context of urban green areas.

Methodologically, the duality of pro- and anti-environmental attitudes challenges the practice of treating the NEP as one composite measure of environmental attitudes. Doing so would cover the nuances of people's environmental attitudes pre- and post-pandemic. The change of environmental attitudes due to the pandemic also addresses the concern raised by other scholars who state that "it remains an open, empirically unaddressed question whether the pandemic has actually shifted our environmental concerns" [15] (p. 4), thus filling the research hiatus. Additionally, the use of multiple statistical methods (i.e., t-tests, chi-square tests, SEM, and SEM multi-group comparison analysis) allows for a better understanding of findings with cross validations [80]. For instance, the chi-square analysis shows people surveyed in 2021 were more likely to visit urban parks with family and relatives (social interactions) than their counterparts surveyed in 2019 while the t-test shows the 2021 respondents were more supportive of "humans over nature" and more satisfied than the 2019 respondents. Furthermore, "humans over nature" and "social interactions" were significantly related with each other with the relationship strength for the 2021 sample being significantly stronger than that for the 2019 sample. Thus, a clear picture appears when these findings are linked together, that is, the successful control of the COVID 19 pandemic in 2021 in the city of Haikou not only led people to believe in "humans over nature", but also provided much-needed opportunities for social interactions with family and relatives in urban green areas, resulting in a higher level of satisfaction.

This intricacy among these interrelated variables cannot be revealed if a single method was used.

Managerially, one previous study [43] recommended that destination managers pay attention to family togetherness given the positive contribution from push motivators to destination satisfaction, we would like urban park managers to do the same by providing more opportunities for social interactions in the city's urban parks given the significant contribution of social interactions in urban parks to the wellbeing satisfaction of the city dwellers. In addition, urban parks as important and convenient venues for being close to nature should engage locals in the restoration and conservation of urban ecosystems through citizen science projects and activities, which may enhance their attitudes toward nature and the environment, and which, in turn, may facilitate more recreational uses of urban parks with higher levels of satisfaction and quality of life. Consequently, a virtuous circle or feedback loop for the long-term sustainability of urban green areas can be achieved. Finally, given the role of urban green areas in promoting and improving residents' wellbeing and quality of life, it is important to increase the accessibility of urban green areas to meet residents' increasing desire of going to urban green space for leisure after the pandemic. However, the planning of urban green areas lagged behind the social development in the city, in that the quantity of green spaces in neighborhoods is insufficient. Thus, more public green spaces, especially neighborhood green spaces, should be rationally planned and constructed so that residents can access and use green spaces as frequently as they wish. It is worth noting that frequency of visits was closely related to public wellbeing as shown in this study.

6.2. Research Limitations and Future Research Needs

Three research limitations need to be addressed. First, while the two samples, one in 2019 and one in 2021, were used to analyze the similarities and differences before and after the COVID-19 outbreak, these two samples were not from the same group in an experimental design with the use of control group and randomized participants. Thus, the differences between participants surveyed may not 100% result from the impact of COVID-19. That said, the use of a pure experiment design is rare in the field of social science studies in general and human dimensions of urban green areas in particular while a "survey is the most common method of data collection" in "parks, recreation, tourism, sport, and leisure studies" [81] (p.171). Second, the survey period was not spread around each season and may not represent the whole picture of recreational uses of urban green areas in the city. However, this bias may not be a big issue given that seasonality has a little impact on outdoor recreation participation in the city for the reason explained earlier in this paper. Finally, although the convenience sampling method has been commonly used in the literature, survey results using the method in this study may be biased due to participants being not sampled in a random manner. A household survey may need to be conducted in the future whereas a random survey with a larger sample size can be implemented.

While recognizing the change of environmental attitudes measured by NEP before and after the outbreak of the pandemic, no one knows if this change is transformative and permanent without follow-up surveys. Thus, future research needs to focus on the long-term monitoring of residents' use of urban green areas along with their leisure motivations and attitudes toward the environment. Future research should also utilize big data from social media or mobile phone call detail record (CDR) or other big data platforms (e.g., Google, Baidu, Sina Weibo, etc.) to analyze the recreational use of urban green areas spatially and temporally using GIS [82,83] to supplement the traditional way of using pencil-paper questionnaires. Compared with the traditional approach of data collection using questionnaires, field observations, or interviews, geotagged big data provide geographical and contextual information about people's spatial movement and thus are more useful and effective to understand the spatial movements/behaviors of individuals as well as their comments, perceptions, and momentary experience associated with urban green areas during different stages of the COVID-19 pandemic. Information obtained from big data or

social media on where people visit, why they visit, how long they stay, what they experience, and how satisfied they are with urban green areas visited is tremendously useful for better planning and management of urban green areas. In addition, it is recommended that more comparative studies be conducted in other countries/regions where the pandemic still prevails so that the links between environmental attitudes, leisure motivations, wellbeing, and quality of life can be examined and compared internationally and cross-culturally.

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Appendix A. Factor Analysis for the 2019 Sample and 2021 Sample

Table A1. Summary results of exploratory factor analysis for leisure motivations (n = 605, 2019 sample).

Code	Factor (Proportion): Scale Name and Items	*M*	*SD*	Factor	
				1	2
Factor 1	**Close to nature**	**4.28**	**0.66**		
L1	Experience nature	4.25	0.75	**0.750**	0.214
L3	Relaxation	4.35	0.73	**0.825**	0.053
L4	Enjoy the natural tranquility	4.25	0.85	**0.837**	0.167
L5	Enjoy the fresh air of open space	4.30	0.88	**0.817**	0.087
Factor 2	**Social interactions**	**3.27**	**0.85**		
L6	With friends	3.49	1.07	0.121	**0.718**
L7	With kids	3.41	1.22	0.078	**0.790**
L8	Picnics	2.90	1.14	0.113	**0.649**
	Eigenvalues			3.27	1.36
	% of variance			40.88	17.03
	Cumulative %			-	57.91
	Standardized Cronbach's *a*			0.84	0.59

KMO = 0.81, $p < 0.001$. Note. Item L2 "fitness and jogging" was excluded from further analysis due to it being cross loaded on two factors.

Table A2. Summary results of exploratory factor analysis for New Ecological Paradigm (n = 605, 2019 sample).

Code	Factor (Proportion): Scale Name and Items	*M*	*SD*	Factor	
				1	2
Factor 1	**Humans with nature**	**3.77**	**0.58**		
NEP1	We are approaching the limit of the number of people the earth can support	3.81	0.91	−0.022	**0.504**
NEP3	When humans interfere with nature it often produces disastrous consequences	3.81	0.94	0.038	**0.626**

Table A2. *Cont.*

Code	Factor (Proportion): Scale Name and Items	*M*	*SD*	Factor	
				1	2
NEP5	Humans are severely abusing the environment	3.59	1.00	−0.013	**0.635**
NEP7	Plants and animals have as much right as humans to exist	4.06	0.96	0.280	**0.586**
NEP9	Despite our special abilities humans are still subject to the laws of nature	3.72	0.89	0.013	**0.585**
NEP11	The earth is like a spaceship with very limited room and Resources	3.91	0.93	0.209	**0.664**
NEP13	The balance of nature is very delicate and easily upset	3.74	0.99	0.104	**0.636**
NEP15	If things continue on their present course, we will soon experience a major ecological catastrophe	3.52	0.94	0.019	**0.648**
Factor 2	**Humans over nature**	**2.74**	**0.77**		
NEP2	Humans have the right to modify the natural environment to suit their needs	3.08	1.15	**0.537**	−0.027
NEP4	Human ingenuity will ensure that we do NOT make the earth unlivable	2.94	1.05	**0.664**	−0.038
NEP6	The earth has plenty of natural resources if we just learn how to develop them	2.72	1.19	**0.685**	0.055
NEP8	The balance of nature is strong enough cope with the impacts of modern industrial nations	2.68	1.13	**0.738**	0.143
NEP10	The so-called "ecological crisis" facing humankind has been greatly exaggerated	2.87	1.02	**0.666**	0.030
NEP12	Humans were meant to rule over the rest of nature	2.40	1.18	**0.693**	0.219
NEP14	Humans will eventually learn enough about how nature works to be able to control it	2.43	1.15	**0.729**	0.144
	Eigenvalues			4.00	2.43
	% of variance			26.64	16.22
	Cumulative %			-	42.86
	Standardized Cronbach's *a*			0.77	0.81

KMO = 0.85, $p < 0.001$.

Table A3. Summary results of exploratory factor analysis for leisure motivations (n = 595, 2021 sample).

Code	Factor (Proportion): Scale Name and Items	*M*	*SD*	Factor	
				1	2
Factor 1	**Close to nature**	**4.22**	**0.73**		
L1	Experience nature	4.09	0.87	**0.811**	0.132
L3	Relaxation	4.25	0.82	**0.877**	0.115
L4	Enjoy the natural tranquility	4.26	0.83	**0.870**	0.167
L5	Enjoy the fresh air of open space	4.29	0.84	**0.850**	0.150
Factor 2	**Social interactions**	**3.22**	**0.95**		
L6	With friends	3.38	1.13	0.060	**0.804**
L7	With kids	3.30	1.51	0.218	**0.464**
L8	Picnics	3.02	1.31	0.110	**0.783**
	Eigenvalues			3.57	1.39
	% of variance			44.63	17.40
	Cumulative %			-	62.03
	Standardized Cronbach's *a*			0.89	0.52

KMO = 0.80, $p < 0.001$. Note. Item L2 "fitness and jogging" was excluded from further analysis due to it being cross loaded on two factors.

Table A4. Summary results of exploratory factor analysis for New Ecological Paradigm (n = 595, 2021 sample).

Code	Factor (Proportion): Scale name and items	*M*	*SD*	Factor	
				1	2
Factor 1	**Humans with nature**	**3.87**	**0.63**		
NEP1	We are approaching the limit of the number of people the earth can support	3.63	0.98	−0.150	**0.567**
NEP3	When humans interfere with nature it often produces disastrous consequences	3.90	0.99	−0.050	**0.676**
NEP5	Humans are severely abusing the environment	3.65	1.04	−0.054	**0.645**
NEP7	Plants and animals have as much right as humans to exist	4.15	0.85	0.043	**0.697**
NEP9	Despite our special abilities humans are still subject to the laws of nature	3.91	0.91	−0.014	**0.674**
NEP11	The earth is like a spaceship with very limited room and Resources	4.03	0.90	0.036	**0.722**
NEP13	The balance of nature is very delicate and easily upset	3.90	0.98	−0.104	**0.705**
NEP15	If things continue on their present course, we will soon experience a major ecological catastrophe	3.76	0.93	−0.201	**0.666**
Factor 2	**Humans over nature**	**2.96**	**0.92**		
NEP2	Humans have the right to modify the natural environment to suit their needs	3.28	1.19	**0.653**	−0.122
NEP4	Human ingenuity will insure that we do NOT make the earth unlivable	3.48	1.04	**0.630**	−0.266
NEP6	The earth has plenty of natural resources if we just learn how to develop them	3.04	1.23	**0.749**	−0.142
NEP8	The balance of nature is strong enough cope with the impacts of modern industrial nations	2.86	1.31	**0.800**	−0.037
NEP10	The so-called "ecological crisis" facing humankind has been greatly exaggerated	2.85	1.18	**0.767**	0.014
NEP12	Humans were meant to rule over the rest of nature	2.57	1.27	**0.807**	0.034
NEP14	Humans will eventually learn enough about how nature works to be able to control it	2.65	1.28	**0.826**	0.021
	Eigenvalues			4.53	3.20
	% of variance			30.20	21.36
	Cumulative %			-	51.55
	Standardized Cronbach's *a*			0.83	0.87

KMO = 0.88, $p < 0.001$.

Appendix B. Descriptive Analysis for the 2019 Sample, 2021 Sample, and the Two Samples Combined

Table A5. Descriptive analysis of leisure motivations (n = 605, 2019 sample).

Item	*Mean*	*SD*	Skewness	Kurtosis
1. Experience nature	4.25	0.75	−1.07	2.04
2. Fitness and jogging	3.96	0.92	−0.61	−0.13
3. Relaxation	4.35	0.73	−1.19	2.22
4. Enjoy the natural tranquility	4.25	0.85	−1.27	1.92
5. Enjoy the fresh air of open space	4.30	0.88	−1.38	1.92
6. With friends	3.49	1.07	−0.26	−0.56
7. With kids	3.41	1.22	−0.37	−0.76
8. Picnics	2.90	1.14	0.15	−0.68

Table A6. Descriptive analysis of the New Ecological Paradigm (*n* = 605, 2019 sample).

Item	*Mean*	*SD*	Skewness	Kurtosis
1. We are approaching the limit of the number of people the earth can support	3.81	0.91	−0.66	0.31
2. Humans have the right to modify the natural environment to suit their needs	3.08	1.15	0.12	−0.89
3. When humans interfere with nature it often produces disastrous consequences	3.81	0.94	−0.74	0.32
4. Human ingenuity will insure that we do NOT make the earth unlivable	2.94	1.05	0.02	−0.54
5. Humans are severely abusing the environment	3.59	1.00	−0.52	−0.34
6. The earth has plenty of natural resources if we just learn how to develop them	2.72	1.19	−0.28	−0.84
7. Plants and animals have as much right as humans to exist	4.06	0.96	−1.21	1.37
8. The balance of nature is strong enough cope with the impacts of modern industrial nations	2.68	1.13	−0.27	−0.78
9. Despite our special abilities humans are still subject to the laws of nature	3.72	0.89	−0.63	0.29
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated	2.87	1.02	−0.16	−0.48
11. The earth is like a spaceship with very limited room and Resources	3.91	0.93	−1.90	0.56
12. Humans were meant to rule over the rest of nature	2.40	1.18	−0.57	−0.60
13. The balance of nature is very delicate and easily upset	3.74	0.99	−0.85	0.39
14. Humans will eventually learn enough about how nature works to be able to control it	2.43	1.15	-0.50	-0.57
15. If things continue on their present course, we will soon experience a major ecological catastrophe	3.52	0.94	-0.41	0.17

Table A7. Descriptive analysis of wellbeing satisfaction (*n* = 605, 2019 sample).

Item	*Mean*	*SD*	Skewness	Kurtosis
1. How satisfied are you with your standard of living?	3.39	0.84	−0.28	−0.01
2. How satisfied are you with your health?	3.42	0.89	−0.39	0.12
3. How satisfied are you with what you are achieving in life?	3.27	0.84	−0.17	0.08
4. How satisfied are you with your personal relationships?	3.48	0.81	−0.36	0.05
5. How satisfied are you with how safe you feel?	3.14	0.86	−0.14	0.01
6. How satisfied are you with where you live in your community?	3.32	0.84	−0.27	−0.13
7. How satisfied are you with your leisure pursuits?	3.42	0.87	−0.23	0.02

Table A8. Descriptive analysis of leisure motivations (*n* = 595, 2021 sample).

Item	*Mean*	*SD*	Skewness	Kurtosis
1. Experience nature	4.09	0.87	−1.23	2.22
2. Fitness and jogging	3.78	1.02	−0.63	0.02
3. Relaxation	4.25	0.82	−1.40	2.95
4. Enjoy the natural tranquility	4.26	0.83	−1.42	2.91
5. Enjoy the fresh air of open space	4.29	0.84	−1.45	2.76
6. With friends	3.38	1.13	−0.23	−0.58
7. With kids	3.30	1.51	−0.44	−1.25
8. Picnics	3.02	1.31	−0.07	−1.02

Table A9. Descriptive analysis of the New Ecological Paradigm (*n* = 595, 2021 sample).

Item	*Mean*	*SD*	Skewness	Kurtosis
1. We are approaching the limit of the number of people the earth can support	3.63	0.98	−0.54	0.13
2. Humans have the right to modify the natural environment to suit their needs	3.28	1.19	0.41	−0.76
3. When humans interfere with nature it often produces disastrous consequences	3.90	0.99	−0.91	0.62
4. Human ingenuity will insure that we do NOT make the earth unlivable	3.48	1.04	0.32	−0.36
5. Humans are severely abusing the environment	3.65	1.04	−0.72	0.18
6. The earth has plenty of natural resources if we just learn how to develop them	3.04	1.23	0.09	−0.95
7. Plants and animals have as much right as humans to exist	4.15	0.85	−1.11	1.53

Table A9. *Cont.*

Item	*Mean*	*SD*	Skewness	Kurtosis
8. The balance of nature is strong enough cope with the impacts of modern industrial nations	2.86	1.31	−0.09	−1.13
9. Despite our special abilities humans are still subject to the laws of nature	3.91	0.91	−0.78	0.67
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated	2.85	1.18	−0.16	−0.90
11. The earth is like a spaceship with very limited room and Resources	4.03	0.90	−1.16	1.82
12. Humans were meant to rule over the rest of nature	2.57	1.27	−0.42	−0.91
13. The balance of nature is very delicate and easily upset	3.90	0.98	−0.90	0.49
14. Humans will eventually learn enough about how nature works to be able to control it	2.65	1.28	−0.34	-0.96
15. If things continue on their present course, we will soon experience a major ecological catastrophe	3.76	0.93	−0.54	0.30

Table A10. Descriptive analysis of wellbeing satisfaction (n = 595, 2021 sample).

Item	*Mean*	*SD*	Skewness	Kurtosis
1. How satisfied are you with your standard of living?	3.49	0.90	−0.31	0.05
2. How satisfied are you with your health?	3.37	0.90	−0.37	0.00
3. How satisfied are you with what you are achieving in life?	3.50	0.88	−0.12	−0.11
4. How satisfied are you with your personal relationships?	3.54	0.86	−0.14	−0.14
5. How satisfied are you with how safe you feel?	3.66	0.89	−0.24	−0.12
6. How satisfied are you with where you live in your community?	3.53	0.91	−0.31	−0.07
7. How satisfied are you with your leisure pursuits?	3.57	0.89	−0.27	−0.08

Table A11. Descriptive analysis of leisure motivations (n = 1200, two samples combined).

Item	*Mean*	*SD*	Skewness	Kurtosis
1. Experience nature	4.17	0.81	−1.20	2.35
2. Fitness and jogging	3.87	0.97	−0.65	0.03
3. Relaxation	4.30	0.78	−1.33	2.80
4. Enjoy the natural tranquility	4.25	0.84	−1.34	2.38
5. Enjoy the fresh air of open space	4.29	0.86	−1.341	2.29
6. With friends	3.44	1.10	−0.25	−0.56
7. With kids	3.36	1.37	−0.45	−0.98
8. Picnics	2.96	1.23	0.04	−0.87

Table A12. Descriptive analysis of the New Ecological Paradigm (n = 1200, two samples combined).

Item	*Mean*	*SD*	Skewness	Kurtosis
1. We are approaching the limit of the number of people the earth can support	3.72	0.95	−0.60	0.22
2. Humans have the right to modify the natural environment to suit their needs	3.18	1.17	−0.25	−0.86
3. When humans interfere with nature it often produces disastrous consequences	3.85	0.97	−0.82	0.46
4. Human ingenuity will insure that we do NOT make the earth unlivable	3.21	1.08	−0.15	−0.54
5. Humans are severely abusing the environment	3.62	1.02	−0.62	−0.08
6. The earth has plenty of natural resources if we just learn how to develop them	2.88	1.22	0.10	-0.96
7. Plants and animals have as much right as humans to exist	4.10	0.91	−1.19	1.54
8. The balance of nature is strong enough cope with the impacts of modern industrial nations	2.77	1.23	0.20	−0.97
9. Despite our special abilities humans are still subject to the laws of nature	3.81	0.90	-0.69	0.43
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated	2.86	1.11	0.16	−0.70
11. The earth is like a spaceship with very limited room and Resources	3.97	0.92	−1.02	1.10
12. Humans were meant to rule over the rest of nature	2.48	1.23	0.50	−0.76

Table A12. *Cont.*

Item	*Mean*	*SD*	Skewness	Kurtosis
13. The balance of nature is very delicate and easily upset	3.82	0.99	−0.87	0.42
14. Humans will eventually learn enough about how nature works to be able to control it	2.54	1.22	0.43	−0.77
15. If things continue on their present course, we will soon experience a major ecological catastrophe	3.64	0.94	−0.47	0.19

Table A13. Descriptive analysis of wellbeing satisfaction (n = 1200, two samples combined).

Item	*Mean*	*SD*	Skewness	Kurtosis
1. How satisfied are you with your standard of living?	3.44	0.87	−0.28	0.02
2. How satisfied are you with your health?	3.39	0.90	−0.38	0.05
3. How satisfied are you with what you are achieving in life?	3.39	0.87	−0.12	−0.02
4. How satisfied are you with your personal relationships?	3.51	0.83	−0.24	−0.04
5. How satisfied are you with how safe you feel?	3.40	0.91	−0.15	−0.12
6. How satisfied are you with where you live in your community?	3.42	0.88	−0.25	−0.10
7. How satisfied are you with your leisure pursuits?	3.50	0.88	−0.24	−0.05

Appendix C. Measurement Model Assessment Indices

Table A14. Measurement model assessment indices.

Model Fit Indices	χ^2	*df*	χ^2/df	RMSEA	IFI	CFI
2019 sample	718.01	367	1.96	0.040	0.92	0.92
2021 sample	881.41	367	2.40	0.049	0.93	0.93
Aggregated (two samples combined)	1067.42	367	2.91	0.040	0.94	0.94

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