Inequitable Effects of COVID-19 on Time Spent in Urban Nature Associated with Sense of Belonging: A Case Study of Seattle with Asian, Black, Latino, and White Residents

Audryana Nay

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Committee:

Peter H. Kahn, Jr. (Chair)

Joshua J. Lawler

Gregory N. Bratman

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University of Washington

Abstract

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Audryana Nay

Chair of the Supervisory Committee:

Peter H. Kahn, Jr.

School of Environmental and Forest Sciences, Department of Psychology

The COVID-19 pandemic has impacted basically everyone in urban areas. Some of these impacts in the United States have negatively affected People of Color more than their White counterparts. Using Seattle, Washington as a case study, I investigated whether inequitable effects would appear in residents' interactions with urban nature (such as urban green space), and, if so, why. Using a 48-question instrument developed for this study, 300 residents were surveyed, equally divided across 4 racial/ethnic groups: Asian, Black, Latino, and White. Results showed that during the span of about six months after the onset of the pandemic, Black and Latino residents experienced a significant loss of time in urban nature, while Asian and White residents did not. This decrease in the Black and Latino groups was partly explained by their

feeling like they did not belong in their surrounding urban nature, as assessed by a newly developed measurement for Sense of Belonging. This measurement consisted of six themes: Ease of Access, Safety, Feeling Out of Place, Unwelcomeness, Institutional Acceptance, and Different Ways of Interacting with Nature Acceptance. These six themes provide guidance for how governmental agencies can promote more equitable access to urban nature during the pandemic and beyond.

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Introduction

This research lies at the intersection of three large conditions that are radically restructuring human lives and social systems. The first is recent: the COVID-19 pandemic. The second – and here I speak about the United States specifically – is the longstanding structural racism within society that continues to harm People of Color.[1] And the third is the increasing diminishment of nature on this planet, and in the lives of people. Because interacting with nature can help people physically and psychologically, it seems plausible that being in nature can buffer some of the pandemic's negative effects. Yet, if so, and given existing structural racism, it is also plausible that People of Color have not equally benefited.

In a nutshell, that is the motivation for this study. I investigated whether Seattle, Washington residents' time spent in urban nature changed after six months of the pandemic, and how those changes affected four racial/ethnic groups: Asian, Black and African American, Hispanic & Latino/a/x, and White.[2, 3] In this introduction, I outline racial/ethnic inequities in urban nature, including social barriers and factors related to ease of access. Racial/ethnic inequities in how one feels they belong in urban nature are then discussed accompanied by an overview of how sense of belonging has been investigated in the literature. Finally, the COVID-19 pandemic and its

[1] I acknowledge that the terms "People of Color" and "Communities of Color" can homogenize the experiences of different racial/ethnic groups. Terms like BIPoC (Black, Indigenous, and People of Color) are used to pull out the shared experiences of colonization among Black and Indigenous communities. In this study, however, this study's sample does not include indigenous people, therefore I chose to use People of Color and Communities of Color throughout this paper. When discussing studies in the introduction, racial/ethnic groups will be disaggregated where possible. In this study's results, I disaggregate results from Asian, Black, and Latino participants.

[2] Throughout this paper, 'Black or African American' is shortened to 'Black'.

[3] Latinx and Latiné have been used as alternatives to Latino in efforts to be more gender inclusive (Azmitia, 2021; Blas, 2019). I recognize that there are people who oppose the use of each of the terms Latino, Latinx, and Latiné within the Hispanic and Latino community (Blas, 2019; Guerra & Orbea, 2015; Tlapoyawa, 2019). I also recognize the issue with researchers, often outside the Hispanic and Latino community, imposing Western norms and altering the way that Hispanic and Latino individuals identify themselves and their community (Guerra & Orbea, 2015; Tlapoyawa, 2019). Here, Latino/a/x is used to be inclusive of those within the community who identify as Latino or Latina, and those who wish to use an ungendered term. Latino/a/x is shortened to Latino throughout this paper.

effects on urban nature visitation are described, with a focus on how COVID-19 may have affected the urban nature visitation of People of Color more negatively than a White population.

Racial/Ethnic Inequities in Urban Nature Accessibility

With urbanization increasing and urban nature spaces diminishing, opportunities for interacting with urban nature are decreasing for all urban residents (Cox et al., 2017; Li et al., 2019). Over half of the world's population resides in cities, with "urban attractiveness" expected to continue to increase (Romão et al., 2018). The demand for higher capacity in urban cities continues to put pressure on any remaining open urban nature spaces (Deng et al., 2009; Zhou & Wang, 2011). Urban nature spaces are often developed to accommodate the increasing urban population, resulting in an urban landscape with very little nature.

While all urban residents experience limited nature access, different populations have varying levels of accessibility. Several urban nature characteristics have been shown to vary according to the racial/ethnic composition of the surrounding neighborhood. These inequities result in less ease of access to urban nature and a decreased likelihood of urban nature visitation in neighborhoods with predominantly People of Color (Dai, 2011; Heynen et al., 2006; McConnachie & Shackleton, 2010; Williams et al., 2020). The following are examples of such inequities.

- Urban nature areas are often less accessible for Communities of Color due to inequities in geospatial dispersion. Majority-white neighborhoods have been shown to contain a higher density of urban nature areas compared to neighborhoods consisting mostly of People of Color (Byrne, 2012; Heynen et al., 2006; Shinew et al., 2006; Stodolska et al., 2013; Wolch et al., 2014).

- In addition to density, inequities have been found in the total quantity of urban nature in neighborhoods of predominantly People of Color. In a comprehensive review of urban nature racial/ethnic inequities, (Rigolon, 2016) found that neighborhoods with predominantly People of Color often contain a smaller total area of urban nature spaces and a fewer number of parks compared to predominantly White neighborhoods. White-serving urban parks across the US are also twice as large, on average, than those that primarily serve Communities of Color (Muqueeth, 2020).
- Inequities in the quality of nearby urban nature spaces contribute to lower levels of accessibility for Communities of Color. The maintenance and upkeep of urban nature facilities and infrastructure are key components of urban nature quality (Weiss et al., 2011). Areas serving primarily nonwhite populations are shown to be significantly lacking in maintenance and upkeep of facilities (Muqueeth, 2020; Rigolon, 2016). Crawford et al. (2008) found that higher socioeconomic status neighborhoods had more urban nature amenities such as picnic tables, trees that provide shade, and water features compared to low socioeconomic neighborhoods in Brisbane, Australia.

Urban nature accessibility is affected not only by qualities of nearby urban nature spaces, but by social barriers which reduce the likelihood of someone visiting an urban nature space. Social barriers to urban nature accessibility for People of Color can exist at the personal, institutional, or systemic level. These barriers include lack of multilingual signage, safety concerns, lack of free time, transportation limitations, cultural expectations and norms, and historically segregated park design among others (Byrne, 2012; Nesbitt et al., 2018; Roberts & Zamore, 2020; Roberts, 2020).

Historical and cultural context plays a role in the social barriers to urban nature accessibility. Finney (2014) examines how urban parks were historically often the stage for acts of racism and how they still carry these racist sentiments. Natural landscapes can be associated, for some Black and African American individuals, with lynchings, slavery, segregation policies, and events of conflict and violence (Byrne & Wolch, 2009; Finney, 2014; Johnson & Bowker, 2004). In contrast, for many White individuals more "wild" or unkept nature harkens to a simpler time before industrialization and represents a nostalgic longing for the past (Finney, 2014; Johnson & Bowker, 2004).

Urban nature is known to provide many health and wellbeing benefits to urban residents (Hartig et al., 2014; Larson et al., 2016). However, not all urban residents may be able to receive those benefits due to inequities in accessibility. Considering inequities in both ease of access and the social barriers that one faces when accessing urban nature can provide a more holistic view of peoples' urban nature visitation behavior. Characterizing inequities in accessibility can help explain why disparities in urban nature visitation exist, and provide a pathway for decreasing these disparities.

Racial/Ethnic Inequities in Sense of Belonging in Urban Nature

Experiencing unjust barriers to urban nature accessibility can result in feelings of exclusion from nature spaces and activities among People of Color. Repeated themes of perceived exclusion from urban nature spaces were presented by Byrne (2012), who conducted focus groups with Latina women living in Los Angeles, California near an urban national park. Most participants in this study expressed feeling 'out of place' and/or 'unwelcome' in the nearby urban park. One Latina woman expressed worry that a resident would call the sheriff if they saw a Latino in a part of the park that was too close to the White neighborhoods (Byrne, 2012).

Racist confrontations in urban nature spaces are not uncommon and contribute to the exclusion of People of Color from urban nature spaces. As a case in point, in May 2020, a White woman called the cops on a Black man who asked her to leash her dog in accordance with the law. The man, Christian Cooper, was a Black birdwatcher, in Central Park, New York, New York, USA (Bittel, 2020). Corina Newsome, a Seaside Sparrow researcher at Georgia Southern University, co-organized an event called #BlackBirdersWeek in response to this event. Newsome said in a video:

> "For far too long, Black people in the United States have been shown that outdoor exploration activities are not for us, whether it be because the way the media chooses to present who is the 'outdoorsy type' or the racism experienced by Black people when we do explore the outdoors, as we saw recently in Central Park." (Newsome, 2020)

Exclusion of People of Color from urban nature spaces is not a recent phenomenon. Roberts (2020) discusses the long history of racism in Central Park and the exclusion of Black bodies from urban nature. Central Park, when created, was intended to be an urban oasis for some, but was also designed to separate People of Color from those with more privilege. These deeply rooted exclusionary systems are reflected in the "nature white privilege" that exists in urban nature spaces today (Roberts, 2020).

Given the repeated sentiments across the literature and in personal accounts of People of Color being excluded from urban nature, inequities in sense of belonging may play a large role in differences in urban nature visitation across racial/ethnic groups. One way to empirically investigate this is to use a measure of sense of belonging in urban nature. Part of this study's aim is to understand how sense of belonging in urban nature varies across racial/ethnic groups, and whether it is tied to other inequities in urban nature visitation.

Measuring Sense of Belonging in Urban Nature

The existing work investigating feelings of exclusion, or sense of belonging, is mostly not specific to a particular place. Instead, the focus with belongingness has been on one's perceptions of their place within a broader community or social group. Hagerty et al. (1992) described belongingness as perceiving oneself as a part of and integral to the collective whole. Hagerty and Patusky (1995) went on to develop the Sense of Belonging Instrument (SOBI) which includes items with imagery evoking social alienation. One example is an item that reads: "I feel like a square peg trying to fit into a round hole".

There are some concepts adjacent to sense of belonging that characterize the relationship between an individual and landscape. Sense of place and place attachment have been discussed as constructs which focus on the environment. According to Shamai (1991), sense of place is an overarching construct which describes one's feelings towards a place. Place attachment, which falls under the umbrella of sense of place, is a more specific concept referring to the positive connection between an individual and a specific place (Williams & Vaske, 2003). Peters et al. (2016) used the idea of place attachment to better understand whether urban parks encourage social cohesion within a neighborhood. The study, which took place in the Netherlands, found that establishing an attachment to urban nature was associated with increased social cohesion amongst non-Western Dutch immigrants' (Peters et al., 2016).

There is emerging research investigating inequitable feelings of belongingness in the context of urban nature specifically. Pipitone and Jović (2021) measured participants' sense of belonging in urban green space before and during the COVID-19 pandemic through a single Likert-scale question adapted from Rugel et al. (2019) which reads: "*How would you describe your sense of belonging to local parks or urban green space?*" This study found no significant

difference in sense of belonging between White and nonwhite participants before COVID-19. Four months into the pandemic, White participants' sense of belonging was nearly significantly higher than nonwhite participants (Pipitone & Jović, 2021).

To my best knowledge, there is no existing scale or multi-item measurement which directly evaluates sense of belonging in urban nature. The literature on People of Color's feelings of exclusion from urban nature spaces shows a relationship between three dimensions: The self, the social, and nature. These dimensions are similar to Kyle and Chick's (2007) three sense of belonging processes: The individual, the social world, and the physical setting. Sense of belonging, as it is currently characterized in the literature, largely centers around one's place within society—capturing the self and the social dimensions—and lacks the relationship to nature dimension. Sense of place and place attachment both focus on the relationship between the individual and nature, but do not include a larger social dimension. A sense of belonging in urban nature measurement has the potential to bridge the self, the social, and nature to understand the intricate relationships between these dimensions.

By characterizing how belongingness in urban nature varies across racial/ethnic groups, we may better understand the complicated and evolving social systems that contribute to urban nature inequities. May (2011) describes how measuring an individual's sense of belonging is a reflection of social change, bringing the effects of embedded systemic racism to the forefront. Thus, one task of this research is to begin to create a measurement of sense of belonging in urban nature and explore the relationships between belonging and inequities in urban nature visitation. To do so, I draw on 1.) The inequities in urban nature accessibility outlined in this section, and 2.) Feelings of exclusion from urban nature spaces among People of Color across the literature and in personal accounts.

Inequities in the Effects of COVID-19 on Urban Nature Visitation

Since it was declared a pandemic in March 2020, the coronavirus disease 2019 (COVID-19) has been a major stressor for Americans. People in the US have endured persistent stress and anxiety over the disease. With the long-duration lockdowns, social distancing mandates, and closures of public spaces in response to the disease, Americans have additionally experienced isolation, confinement, and increased rates of clinical depression and anxiety (Salari et al., 2020). Jacobson et al. (2020) found that the implementation of stay-at-home orders in many states in the US were associated with an increase in Americans' Google searches for mental health terms, especially "anxiety", "depression", "insomnia", and "irritable".

In US cities, the COVID-19 pandemic has brought additional stressors. A higher risk of contraction due to population density combined with intense isolation with few areas for respite have led to urban residents in the US feeling greater distress during the COVID-19 pandemic than those in more rural environments (Connolly et al., 2020; Rudenstine et al., 2021; Sharifi & Khavarian-Garmsir, 2020). Rudenstine et al. (2021) found that residents of New York, New York, USA experienced an increase in clinical depression and anxiety with the onset of the pandemic, and that those increases were associated with higher levels of COVID-19 stressors than in more rural environments.

Urban nature interaction has been found to help mitigate some of the negative effects of the COVID-19 pandemic for those living in dense cities. Samuelsson et al. (2020) describes how those living in dense urban cities benefit greatly from open urban nature areas within the city during COVID-19. The mandated isolation imposed in many US cities has made it challenging to meet social needs. In dense urban areas, one is at risk of contracting COVID-19 practically anywhere outside of one's home. Urban nature spots provide relatively safe open spaces to meet

social needs during the COVID-19 pandemic, reducing negative wellbeing outcomes (Samuelsson et al., 2020). This literature and more provide evidence of the potential for urban nature to increase resilience and act as a buffer against some of the negative health and wellbeing effects of the COVID-19 pandemic in city residents (Grima et al., 2020; Vos et al., 2022).

With the possibility for urban nature to mitigate some of the negative impacts that COVID-19 has had on urban residents, research has investigated how Americans have used urban nature during the pandemic. Most of the literature suggests that urban residents in the US have increased their urban nature use during the pandemic. In a study located in the city of Burlington, Vermont, USA, residents were found to increase their time spent in urban nature during the pandemic (Grima et al., 2020). Evidence of increased urban nature use can also be seen in the sentiments of land managers of urban nature. In a survey of urban parks land managers across 12 US cities, 83% reported an increase in visitation to the spaces they manage (Plitt et al., 2021).

Understanding how the COVID-19 pandemic has affected People of Color's urban nature interaction is especially important given the disproportionate effects the pandemic has had on Communities of Color in the US. People of Color in US cities have experienced more negative outcomes during COVID-19 than White city residents with a higher likelihood of COVID-19 infection, poorer COVID-19 outcomes, higher stress and anxiety levels, larger unemployment rates, and more (Bathina et al., 2021; Dorn et al., 2020; Fortuna et al., 2020; Gemelas et al., 2022; Hoernke, 2020; Pareek et al., 2020).

Conflicting results have been found in the effects of COVID-19 on People of Color's urban nature visitation. Larson et al. (2021) found that Black and Hispanic residents of cities across North Carolina, USA experienced a decrease in urban nature visitation six months after

the start of the COVID-19 pandemic. They further found that the decrease experienced by Black and Hispanic participants was greater than that of White participants. Similarly, a study of New York City residents found that Black and Native American participants were more likely to experience a decrease in urban nature visitation during COVID-19 compared to Asian and White participants (Lopez et al., 2021). In contrast, a few studies have found that People of Color living in cities have actually increased their time spent in urban nature during the COVID-19 pandemic. Pipitone and Jović (2021) found that nonwhite New York City residents increased their frequency of urban nature visitation during the first lockdown in New York City and again about four months after the pandemic started.

More work is needed to understand how the COVID-19 pandemic has affected People of Color's time spent in urban nature. With evidence of the potential for urban nature to act as a buffer against some of the negative health and wellbeing effects of the COVID-19 pandemic in city residents, urban nature may be used to increase resilience within Communities of Color (Berdejo-Espinola et al., 2021; Jackson et al., 2021; Pouso et al., 2021; Samuelsson et al., 2020; Vos et al., 2022). This study aims to add to our knowledge of how COVID-19 has affected the urban nature visitation of Communities of Color within the city and evaluates inequities in these changes compared to White city residents.

The Present Investigation

The work here seeks to better understand racial/ethnic disparities in Seattle in terms of 1.) The effects of the COVID-19 pandemic on frequency of urban nature interaction, and 2.) Sense of belonging in urban nature.

To achieve this, this study sought:

- To evaluate whether Seattle's four most-populous racial/ethnic groups experienced a change to their average frequency of urban nature interaction over the first six months of the COVID-19 pandemic.
- To compare the effects of the pandemic on frequency of urban nature interaction across racial/ethnic groups.
- To develop a Sense of Belonging in Urban Nature Questionnaire that was specific to nature spaces and also considered social processes.
- To evaluate the role of sense of belonging in the changes to frequency of urban nature interaction experienced during the pandemic.
- To evaluate the correlation between Seattle residents' sense of belonging in urban nature and their urban nature conservation values.

It was hypothesized that Asian, Black, and Latino participants' average frequency of urban nature interaction would be more negatively impacted than that of White participants. That is to say that if White participants experienced an increase in their frequency of urban nature interaction during the pandemic, it was hypothesized that Asian, Black, and Latino participants would experience a smaller increase, no change, or a decrease. If White participants were to experience no change or a decrease in their average frequency, it was expected that the other racial/ethnic groups would experience a larger decrease. In this study, it was also hypothesized that participants' sense of belonging in urban nature would be associated with changes to frequency of urban nature interaction. More specificity in the hypotheses for this study was difficult due to the exploratory nature of this study and the varying findings on People of Color's time spent in urban nature during COVID-19.

Methods

Study Site

Seattle is located in the state of Washington in the Pacific Northwest of the United States. Seattle has a population of 737,015 (U.S. Census Bureau, 2020). 67.3% of Seattle's population identifies as White, 15.4% Asian, 7.3% Black or African American, 6.7% Hispanic or Latino (of any race), 0.5% American Indian and Alaska Native, and 0.3% Native Hawaiian and other Pacific Islander. 0.3% of the Seattle population identifies as some other race and 6.9% identifies as two or more races. The median household income of Seattle is $92,263 (U.S. Census Bureau, 2020).

Williams et al. (2020) found Seattle to have less inequity in urban nature access compared to other major cities in the US including Atlanta, GA, Baltimore, MD, Detroit, MI, and Los Angeles, CA. Nonetheless, inequities in urban nature are prevalent. In Seattle, the amount of urban canopy cover in a given census tract is inversely correlated with the proportion of People of Color living in the census tract (Trees for Seattle, 2016).

Seattle has a long history of racial segregation that has shaped the city. From 1910 to 1960, many Seattle housing property deeds contained clauses that explicitly prohibited People of Color or certain communities from renting or buying the property. By the 1920's, certain areas of the Central District and Chinatown were the only "open neighborhoods" available to People of Color (Silva, 2009). Today, Seattle's Central District and International District (formerly Chinatown) are composed of 35.5% and 66.8% nonwhite residents, respectively. Both the Central District and International District have significant gaps in urban nature accessibility (Seattle Parks and Recreation, 2017).

Participant Recruitment

Convenience sampling was used to recruit participants online via the social media platforms Facebook and Instagram. Facebook and Instagram ads were run by study researchers. These ads provided a short description of the study, advertised participant compensation, and provided a link to the study's eligibility questionnaire. A Facebook post with identical information to the ad was shared in various community Facebook Groups and Pages such as 'Seattle Latinx Pride', 'Families of Color Seattle', 'Mt. Baker Neighborhood, Seattle', and 'Beacon Hill Social Club'. The study description and eligibility questionnaire link were also distributed by study researchers to personal and professional connections via email to reach more potential participants.

Individuals interested in participating in the study were directed to an eligibility questionnaire hosted on Qualtrics where they provided responses used to determine eligibility (see Appendix A for full eligibility questionnaire). Prior to beginning the eligibility questionnaire, participants viewed a consent form and provided acknowledgement of consent. To be eligible for participation, individuals must have resided within Seattle city limits, lived in the same residence since at least fall 2019, be at least 18 years of age, be able to read and write English, and identify as Asian, Black or African American, Hispanic or Latino, or White. Individuals who identified as any other race/ethnicity or more than one race/ethnicity were not eligible. Eligible participants received a link to take the main survey after completing the eligibility questionnaire (see Appendix B for full survey). Participants who completed the main survey received a $10 Amazon gift card via email.

Data Collection

Data collection began in January of 2021 and concluded March 2021. A quota sampling technique was used to achieve an equal number of participants in each of the four included

racial/ethnic groups (Asian, Black, Latino, and White). After receiving 75 responses from White participants, White participant recruitment ceased and the survey was modified so that only Asian, Black, and Latino individuals were eligible. Similarly, after 75 Asian responses were collected, Asian participant recruitment closed. 78 responses from Latino individuals and 80 responses from Black individuals were received before the survey fully closed. 75 participant responses were randomly sampled from each of these two groups to achieve an equal sample size between the four racial/ethnic groups. The procedure for this study was approved by the Institutional Review Board prior to beginning recruitment and data collection.

Participant Characteristics

The sample consisted of 300 participants with 75 participants in each racial/ethnic group (Asian, Black, Latino, and White). The median annual household income for the sample was $75,000-$99,000, encompassing the Seattle median of $92,263. There were slightly more females (56%) than males (42%) in the sample. The median age was 25-34 years old. Detailed demographic information about the sample can be found in Table 1.

Table 1

Sample Demographic Information

Demographic	Frequency (%)
Gender	
Female	167 (56)
Male	126 (42)
Gender variant/non-conforming	5 (2)
Prefer not to answer	2 (< 1)
Age	
18-24 years old	51 (17)
25-34 years old	133 (45)
35-44 years old	72 (24)
45-54 years old	24 (8)
55-64 years old	11 (4)
65-74 years old	8 (3)
75 years or older	1 (< 1)
Annual Household Income	
Less than $25,000	15 (5)
$25,000-$34,999	17 (6)
$35,000-$49,000	40 (13)
$50,000-$74,999	78 (26)
$75,000-$99,999	49 (17)
$100,000-$149,999	58 (20)
$150,000-$199,000	20 (7)
$200,000 or more	23 (8)

Survey Instrument

A 25-minute survey consisting of 48 multiple-choice, Likert-scale, and open-ended questions was administered to participants. This online survey was hosted on Qualtrics. The survey sought to capture changes in urban nature visitation six months into the pandemic as well as evaluate participants' urban nature perceptions and values. The following definition of urban nature was given to participants before and throughout the survey: "*Urban nature refers to parks, green areas, open spaces, and places with water, vegetation, and/or animals within the city of Seattle. Urban nature does not include things you may pass by briefly, such as trees along a sidewalk.*"

To understand how participants' urban nature use changed as a result of the COVID-19 pandemic, a set of questions were given twice within the survey. The first time, participants were asked to reflect back to their experiences in fall 2019 (before the COVID-19 pandemic). Participants were then given the same set of questions and asked to respond according to their recent experiences in fall 2020 (six months into the COVID-19 pandemic). Fall was chosen as the reference period for both before the pandemic and during the pandemic. One reason for this was to reduce variability that may be due to different levels of outdoor activity throughout the year. Fall was also chosen because it was the most recent full season to pass when participants took the survey in winter.

In this repeated set of survey questions, information on the types of activities participants enacted in urban nature and their frequency of urban nature visitation were collected. One of the multiple-choice questions in this section provided a list of 20 common urban nature activities, and asked participants to indicate which they had enacted. The question was given in regards to fall 2019 and again for fall 2020. Also within this group of pre- and during COVID-19 questions, participants were also asked about how frequently they spent time in urban nature in fall 2019

and fall 2020. This question read: "*Over the course of fall [2019 or 2020], how frequently did you spend time in or around urban nature*?"

Measures

A section of the survey focused on understanding urban nature perceptions amongst participants. Questions in this section were not asked in reference to any time frame, but we may assume they are applicable to the time when the survey was taken. The key measurements and scales included in this section of the survey are below.

Demographic information. Demographic information collected included age range, income level, and racial/ethnic identity. These demographic variables were chosen based on their relevance in previous studies of inequities in urban nature interaction and disparities in the effects of the COVID-19 pandemic. The racial/ethnic groups included in the sample were: Asian, Black, Latino, and White. I acknowledge race and gender as social constructs. The concept of race is thought of as the result of externally formed shared-identity groups in response to stereotyping processes. Ethnicity is specific to a given moment in time and geospatial location. One's ethnic identity reflects both external and internal group processes (Stewart &Sewell, 2011).

Perceived Coronavirus Threat Questionnaire (short). The short version of the Perceived Coronavirus Threat Questionnaire, developed and validated by Conway et al. (2020), was used to assess the level of which participants were fearful of the COVID-19 virus. This shortened scale was modified from a 7-point Likert-scale to a 5-point Likert-scale ranging from *not at all true of me* (1) to *very true of me* (5). The scale includes three items which read: *"Thinking about the coronavirus (Covid-19) makes me feel threatened."*; "*I am afraid of the Coronavirus (Covid-19).*"; *"I am stressed around other people because I worry I'll catch the*

coronavirus (Covid-19).” Cronbach’s alpha for the Perceived Coronavirus Threat Questionnaire in this study was 0.74.

Perceived Green Space Quality Scale. The Perceived Greenspace Quality Scale (Dzhambov et al., 2018) aims to understand the perceived quality of nearby green space in one’s neighborhood. This scale was adapted by replacing the term “greenspace” with “urban nature”. The 10-point Likert-scale was converted to a 5-point Likert-scale ranging from *completely disagree* (1) to *completely agree* (5). Examples of items in this scale include: *“My neighborhood has safe urban nature spots.”*; *“My neighborhood has well-maintained urban nature spots.”*; *“My neighborhood has beautiful urban nature spots.”* Cronbach’s alpha for the Perceived Greenspace Quality Scale in this study was 0.84.

Urban Nature Conservation Values. A single Likert-scale question was used to measure participants’ level of importance of urban nature conservation. Conservation value was evaluated by asking: *“How important to you is the protection of urban nature?”* The 5-point Likert question response options ranged from *not at all important* (1) to *very important* (5).

Sense of Belonging in Urban Nature Questionnaire. A questionnaire was developed for this study to better understand experiences of inequity in urban nature, specifically as it relates to one’s sense of belonging. Each of the six items correspond to a larger overall theme of inequity distilled from the existing literature. (See Table 1 for all items and corresponding literature). Participants responded to each item on a 5-point Likert-scale ranging from *completely disagree* (5) to *completely agree* (1). Internal reliability of this questionnaire was high (Cronbach’s alpha= 0.84), however this questionnaire remains unvalidated (see Appendix C for results from exploratory validity testing).

The Sense of Belonging in Urban Nature Questionnaire is composed of six themes which characterize six racial/ethnic inequities. These inequities were identified through a literature review of social barriers to urban nature use among People of Color and the resulting feelings of exclusion. The themes included in the sense of belonging measurement are by no means the only ways in which Communities of Color feel excluded from urban nature. Nor are they likely uniform for experiences across all Communities of Color. The themes of inequity included in the exploratory Sense of Belonging in Urban Nature Questionnaire are intended to characterize broad ways in which exclusion presents. The sense of belonging inequity themes are Ease of Access, Safety, Feeling Out of Place, Unwelcomeness, Institutional Acceptance, and Different Ways of Interacting with Nature Acceptance. See Table 2 for source literature for each theme. Descriptions of these inequity themes are below:

Ease of Access. This theme characterizes difficulties in spending time in urban nature due to socioeconomic inequities including distance to nearby urban nature spot, poor quality of nearby urban nature, lack of free time, and transportation limitations.

Safety. One is less likely to feel a sense of belonging in urban nature if spending time in urban nature poses a risk to personal safety or the safety of others.

Feeling Out of Place. This theme seeks to capture feelings of not belonging or fitting in within the landscape. There are several factors that may lead to one feeling out of place in urban nature spaces. Some include having very limited representation of People of Color in nature spaces, cultural expectations and norms, and being the only Person of Color in an urban nature space.

Unwelcomeness. Feelings of not belonging in urban nature can arise from external exclusion from those in the White majority. Overt and covert messages from White

individuals in urban nature spaces can send a clear message of unwelcomeness to People of Color in the space.

Institutional Acceptance. If People of Color are not accepted in urban nature on an institutional level, urban nature spaces and management practices will reflect that. People of Color may feel that urban nature areas were not created for them, with the design catering to typically Eurocentric ways of interacting with urban nature. People of Color also experience conflicts with those who manage urban nature spaces due to their presence in these spaces.

Different Ways of Interacting with Nature Acceptance. People of Color may feel that the way that they use urban nature is not deemed acceptable or welcome by others. When Communities of Color interact with urban nature in a way that is outside of the Eurocentric norm (e.g., picnicking with friends and family, celebrating, having social family gatherings), they may feel unaccepted by others in the space.

Table 2

The Sense of Belonging in Urban Nature Questionnaire

Theme	Item
Ease of Access [1, 3, 7, 9, 13, 17, 19, 20]	*"It is not easy for me to get to a park or other urban nature spot near my home."*
Safety [1, 2, 8, 13, 15, 16, 17]	*"When in an urban nature spot near my residence, I fear for my own safety or the safety of others around me."*
Feeling Out of Place [1, 5, 12, 15, 16]	*"I feel out of place in the urban nature spots I visit."*
Unwelcomeness [1, 2, 12, 17]	*"I feel unwelcome by others when in urban nature."*
Institutional Acceptance [1, 2, 5, 10, 14, 18]	*"I feel uncomfortable when I see a park management employee when in urban nature."*
Different Ways of Interacting with Nature Acceptance [1, 2, 4, 6, 11, 12]	*"I feel that the way I use urban nature is unwelcome or unaccepted by other visitors."*

Note. Source literature for each theme is noted in superscript.

[1] Byrne, 2012; [2] Byrne & Wolch, 2009; [3] Dai, 2011; [4] Floyd et al., 1994; [5] Ho et al., 2005; [6] Hutchison, 1987; [7] Jennings et al., 2012; [8] Madge, 1997; [9] McConnachie & Shackleton, 2010; [10] Nesbitt et al., 2018; [11] Payne et al., 2002; [12] Peters et al., 2010; [13] Powers et al., 2020; [14] Roberts, 2020; [15] Roe et al., 2016; [16] Rigolon, 2016; [17] Shinew et al., 2004; [18] Virden & Walker, 1999; [19] Wolch et al., 2014; [20] Zhang et al., 2011

Analysis

One question of interest in this study was whether people have experienced a change in their frequency of urban nature interaction as a result of the COVID-19 pandemic and whether

this change differs across racial/ethnic groups. In the study survey, participants responded to multiple choice questions with how many days per week, on average, they spent time in or around urban nature in fall 2019 (before the pandemic) and fall 2020 (about six months into the pandemic). Multiple choice response options included: *Less than once per month*, *1-3 times per month*, *once per week*, *2-3 days per week*, *4-5 days per week*, *6 days per week*, and *Daily*. These responses were converted to days per month. The average of each response option was used (e.g., *Less than once per month* was replaced with 0 days per month, *2-3 days per week* was replaced with 10 days per month, and *Daily* was replaced with 28 days per month).

Participants' frequencies of urban nature interaction were first compared across racial groups for the two separate time points: Fall 2019 (before COVID-19) and fall 2020 (six months into the pandemic). The Kruskal-Wallis non-parametric equivalent to ANOVA was conducted to test whether any pair(s) of racial/ethnic groups had significantly different frequencies of urban nature interaction in fall 2019. Dunn's test for stochastic dominance was then used to identify which pair(s) of racial/ethnic groups significantly differed in frequency of urban nature interaction in fall 2019. The "dunnTest()" function in R was used with the specification that the comparisons were one-sided. One-sided post hoc tests allow for the results to speak of directionality. The Bonferroni method was used to adjust the p-values of this post hoc test to reduce the familywise error rate associated with multiple testing. The same process was then conducted to compare groups' 2020 frequencies.

To test whether a given racial/ethnic group experienced a significant change in frequency of urban nature interaction, the average 2019 and 2020 frequencies were first calculated for each group. One-tailed paired-sample t-tests were conducted within each racial/ethnic group to compare their 2019 and 2020 average frequencies. Although the distributions for 2019 and 2020

reported frequencies of urban nature interaction are mildly non-normal, the sample size (300 total, 75 participants in each racial/ethnic group) is large enough to justify the use of Student's t-test. The tests were directional because each group's 2020 average frequency was observed, descriptively, to be either greater or less than their 2019 frequency. If these tests were significant, it meant the racial/ethnic group experienced a significant increase or decrease (depending on the directionality of the test) in frequency of urban nature interaction from fall 2019 to fall 2020.

It was then tested whether the COVID-19 pandemic impacted frequency of urban nature interaction differently across racial/ethnic groups. The Kruskal-Wallis test was conducted to test whether the observed changes in frequency were different across racial/ethnic groups. Given that this test was significant, one or more pairs of racial/ethnic groups experienced significantly different effects of COVID-19 on their frequency of urban nature interaction. Dunn's test for stochastic dominance was then used to identify which pair(s) of racial/ethnic groups significantly differed in observed change to frequency of urban nature interaction. A one-sided Dunn's test was used for post-hoc comparisons in order to speak about directionality of significant differences. The Bonferroni method was used to adjust the p-values of this post hoc test.

Three measures used in the survey were explored as possible explanatory variables for the differences in the effects of COVID-19 on urban nature interaction frequency. These scales were the short version of the Perceived Coronavirus Threat Questionnaire (Conway et al., 2020), the Perceived Greenspace Quality Scale (Dzhambov et al., 2018), and the Sense of Belonging in Urban Nature Questionnaire. A stepwise regression analysis was conducted to test whether one or more of these measures could explain differences in the effects of COVID-19 on frequency of urban nature interaction. Control variables (age, gender, income, and pre-pandemic frequency) were introduced to better isolate the effects of racial/ethnic inequities. Age was converted from

categorical responses to integers by taking the average of the multiple response options for age (e.g., *18-24 years old* was replaced with 21). Average annual income categories were similarly replaced with the average for that response category and rounded to the nearest whole dollar (e.g., *$50,000 to $74,999* was replaced with 62500). *Less than $25,000* was replaced with 24999 and *$200,000 or more* was replaced with 200000. Pre-pandemic frequency of urban nature interaction was included as a control variable as those with a high 2019 (pre-pandemic) frequency have the potential for a larger decrease in average days per month than those with a lower 2019 frequency (and vice versa for those who start with a low 2019 frequency). Perceived coronavirus threat, perceived quality of urban nature, and sense of belonging variables were added to a regression formula with the control variables. The dependent variable of this regression formula was the change in frequency of urban nature interaction. A forward and backward variable selection process was automated using the "step()" command in R to select a formula-based linear regression model by AIC. This stepwise regression analysis removes any independent variables which do not significantly contribute to predicting the outcome variable. Both control and explanatory variables were permitted to be removed in this process. The "step()" function returns a regression formula that includes the independent variables which best predict the outcome variable for that specific data set.

With sense of belonging in urban nature being a key variable of interest, this study looked at differences in sense of belonging across racial/ethnic groups. A Kruskal-Wallis test was performed to test whether sense of belonging significantly varied across racial/ethnic groups. Dunn's test for stochastic dominance was then used to identify which pair(s) of racial/ethnic groups significantly differed in sense of belonging. A one-sided Dunn's test was used for post-

hoc comparisons in order to speak about directionality of significant differences in belonging. The Bonferroni method was used to adjust the p-values of this post hoc test.

The association between one's level of importance of urban nature conservation and their sense of belonging in urban nature was explored using a linear regression model. Importance of urban nature conservation was regressed onto several control variables (race/ethnicity, age, gender, and income) and responses to the Sense of Belonging in Urban Nature Questionnaire. The covariate *p* values were used to assess whether sense of belonging significantly predicted urban nature conservation values.

Data were analyzed in RStudio version 1.4.1103. Statistical significance was $\alpha = 0.05$ for all analyses.

Results

Types of Urban Nature Interactions

To attain more specificity in Seattle residents' urban nature behaviors, the survey asked about the types of urban nature activities participants engaged in. Participants were given a list of 20 common activities in urban nature such as walking a dog and having a picnic. They were asked to indicate all urban nature activities which they engaged in before the pandemic and six months after the pandemic. The frequencies of each urban nature interaction for both 2019 and 2020 are presented in Table 3.

Table 3

Types of Urban Nature Interaction Before and During the COVID-19 Pandemic

	Frequency (%)									
	Sample (n=300)		Asian (n= 75)		Black (n= 75)		Latino (n= 75)		White (n=75)	
	Before	During	Before	During	Before	During	Before	During	Before	During
Took a walk with other people	194 (65)	137 (46)	53 (71)	38 (51)	37 (49)	15 (20)	40 (53)	24 (32)	64 (85)	60 (80)

Took a walk alone	179 (60)	164 (55)	51 (68)	47 (63)	26 (35)	24 (32)	44 (44)	36 (48)	58 (77)	57 (76)
Sat in nature	155 (52)	116 (39)	38 (51)	30 (40)	24 (32)	18 (24)	40 (53)	24 (32)	53 (71)	44 (59)
Enjoyed the stillness and quietness of nature	153 (51)	129 (43)	39 (53)	29 (39)	28 (37)	21 (28)	40 (53)	35 (47)	46 (61)	44 (59)
Watched the sunrise or sunset	137 (46)	108 (36)	32 (43)	14 (19)	14 (15)	20 (27)	36 (48)	26 (35)	55 (73)	48 (64)
Looked out at a large view of water	135 (45)	112 (37)	41 (55)	34 (45)	9 (12)	8 (11)	32 (43)	20 (27)	53 (71)	50 (67)
Ran or jogged	129 (43)	72 (24)	34 (45)	19 (25)	30 (40)	12 (16)	37 (49)	17 (23)	28 (37)	24 (32)
Looked out at a large view of the city	97 (32)	77 (26)	31 (41)	24 (32)	4 (5)	1 (1)	19 (25)	13 (17)	43 (57)	39 (52)
Had a picnic	94 (31)	57 (19)	27 (36)	18 (24)	9 (12)	1 (1)	23 (31)	13 (17)	35 (47)	25 (33)
Looked at wildlife	84 (28)	71 (24)	23 (31)	13 (17)	5 (7)	2 (3)	14 (19)	10 (13)	42 (56)	46 (61)
Rode a bike	83 (28)	62 (21)	16 (21)	11 (15)	11 (15)	6 (8)	21 (28)	15 (20)	35 (47)	30 (40)
Walked a dog	65 (22)	67 (23)	13 (17)	14 (19)	11 (15)	11 (15)	19 (25)	18 (24)	22 (29)	24 (32)
Tended to a garden	57 (19)	60 (20)	10 (13)	12 (16)	7 (9)	6 (8)	11 (15)	11 (15)	28 (37)	31 (41)
Played a sport	53 (18)	19 (6)	20 (27)	8 (11)	11 (15)	3 (4)	13 (17)	3 (4)	9 (12)	5 (7)
Watched my children play	49 (16)	36 (12)	13 (17)	9 (12)	17 (23)	11 (15)	10 (13)	9 (12)	9 (12)	7 (9)
Used a water vessel such as a kayak, canoe, paddle board, or sailboat	44 (15)	30 (10)	6 (8)	7 (9)	3 (4)	1 (1)	10 (13)	2 (3)	25 (33)	20 (27)
Collected berries, nuts, mushrooms, greens, or other edible items	44 (15)	29 (10)	11 (15)	8 (11)	4 (5)	1 (1)	8 (11)	3 (4)	21 (28)	17 (23)
Swam or submerged in water	37 (12)	24 (8)	5 (7)	5 (7)	4 (5)	2 (3)	9 (12)	3 (4)	19 (25)	14 (19)
Rode a skateboard or scooter	18 (6)	12 (12)	3 (4)	1 (1)	3 (4)	0 (0)	4 (5)	5 (7)	8 (11)	6 (8)
Volunteered with an organization outside	14 (5)	5 (2)	4 (5)	0 (0)	0 (0)	1 (1)	4 (5)	0 (0)	6 (8)	4 (5)
Other	5 (2)	5 (2)	0 (0)	1 (1)	0 (0)	1 (1)	0 (0)	0 (0)	5 (7)	3 (4)

Note. The above types of interaction were presented to participants in a multiple-choice question. They were asked to indicate all that they had enacted at each time point.

Sense of Belonging in Urban Nature

Results of other measurements of interest (including perceived coronavirus threat, perceived quality of urban nature, importance of urban nature conservation, and sense of

belonging) are given in Table 4 for Asian, Black, Latino, and White participants. A Kruskal-Wallis test shows disparities in sense of belonging in urban nature across racial/ethnic groups ($p<$ .001). White participants had a significantly higher sense of belonging in urban nature (M= 25.31, SD= 4.4) than that of Latino (M= 20.12, SD= 5.21, adjusted $p<$ .001) and Black participants (M= 18.56, SD= 4.75, adjusted $p<$ .001). Sense of belonging among Asian participants (M= 23.24, SD= 4.62) was significantly higher than that of Latino (adjusted $p<$ .002) and Black (adjusted $p<$ .001) participants.

Using a linear regression with control variables for race/ethnicity, age, gender, and income, sense of belonging is found to significantly predict one's importance of urban nature conservation ($p=$ .02). Participants with a higher sense of belonging in urban nature had a higher level of importance of urban nature conservation.

Frequencies of Urban Nature Interaction Before and During COVID-19

Table 4 presents the average frequency of time spent in urban nature (in days per month) across Asian, Black, Latino, and White participants both before the pandemic (fall 2019) and during the pandemic (fall 2020).

In fall 2019 (before the COVID-19 pandemic), White participants spent time in or around urban nature an average of 11.20 days per month. This was followed by Black (M=8.32, SD= 6.50) and Latino participants (M= 7.65, SD= 6.40). White participants did not spend time in urban nature significantly more frequently than Black (adjusted $p=$ .584) or Latino participants (adjusted $p=$ .064). Average frequency of urban nature interaction for Asian participants (M= 7.81 days per month) was significantly lower than that of White participants (M= 7.81 days per month, adjusted $p=$ .004).

About six months after the start of the pandemic (in fall 2020), White participants still had the most frequent urban nature use with an average frequency of 12.35 days per month. Asian participants had the next most-frequent urban nature use with an average of 7.09 days per month. This was followed by Latino participants (M= 5.55 days per month) and Black participants (M= 4.56 days per month). About six months after the pandemic began, the average frequency of urban nature interaction among White participants was significantly higher than that of Asian (adjusted $p < .01$), Latino (adjusted $p < .001$), and Black participants (adjusted $p < .001$). The Asian, Latino, and Black frequencies did not significantly differ from each other.

Table 4

Average Measurement Values Across Racial/Ethnic Groups

	Measurement Average (*SD*)			
	Asian	Black	Latino	White
2019 Frequency [1]	7.81 (8.21)	8.32 (6.50)	7.65 (6.40)	11.20 (8.43)
2020 Frequency [1]	7.09 (8.47)	4.56 (6.24)	5.55 (7.12)	12.35 (8.99)
Change in Frequency (δ) [1]	-0.72 (8.08)	-3.76 (6.42)	-2.12 (6.75)	1.15 (8.56)
Perceived Coronavirus Threat (Low: 3, High: 15)	12.15 (2.08)	12.88 (1.70)	12.25 (1.99)	11.87 (2.61)
Perceived Urban Nature Quality (Low: 6, High: 30)	24.07 (4.09)	21.76 (4.78)	22.31 (4.15)	24.61 (4.99)
Sense of Belonging in Urban Nature (Low: 6, High: 30)	23.24 (4.62)	18.56 (4.75)	20.12 (5.21)	25.31 (4.41)

Level of Importance of Urban Nature Conservation (Low: 1, High: 5)	4.80 (0.40)	4.44 (0.78)	4.64 (0.63)	4.97 (0.16)

Note. n= 300 total, 75 in each racial/ethnic group.

[1] *Frequencies of urban nature interaction and change in frequency of urban nature interaction are given in average number of days per month.*

Average Change in Frequency of Urban Nature Interaction

This study investigated whether or not COVID-19 had an effect on each racial/ethnic group's frequency of urban nature interaction. Although the average frequency of urban nature interaction for White and Asian participants was higher six months into COVID-19 than it was before COVID-19, the increases were not significant. Latino and Black participants, however, experienced a significant decrease in frequency of urban nature interaction six months into the COVID-19 pandemic.

White participants experienced **no significant change** in average days per month spent in urban nature from fall 2019 to fall 2020 ($\delta = 1.15$; $p = .125$; $H_0 : \delta \not\geq 0$; $95\%CI_{low}$: -0.50).

Asian participants experienced **no significant change** in average days per month spent in urban nature from fall 2019 to fall 2020 ($\delta = -0.72$; $p = .222$; $H_0 : \delta \not\leq 0$; $95\%CI_{high}$: 0.84).

Latino participants experienced a **significant decrease** in average days per month spent in urban nature from fall 2019 to fall 2020 ($\delta = -2.12$; $p < .004$; $H_a : \delta \leq 0$; $95\%CI_{high}$: -0.81).

Black participants experienced a **significant decrease** in average days per month spent in urban nature from fall 2019 to fall 2020 ($\delta = -3.76$; $p < .001$; $H_a : \delta \leq 0$; $95\%CI_{high}$: -2.53).

In order to test whether COVID-19 impacted frequency of urban nature interaction equally amongst racial/ethnic groups, changes to frequency of urban nature interaction were compared across racial/ethnic groups. The Kruskal-Wallis non-parametric equivalent to ANOVA was used. This test was significant ($p< 0.001$), meaning the COVID-19 pandemic did not impact frequency of urban nature interaction equally across racial/ethnic groups.

Dunn's test for stochastic dominance (one-sided) showed that Black participants were impacted to a greater degree than White participants ($\delta_{Black} > \delta_{White}$, adjusted $p< .001$). Latino participants were impacted to a greater degree than White participants ($\delta_{Latino} > \delta_{White}$, adjusted $p= .009$). Black participants' frequency of urban nature interaction was also impacted significantly more than that of Asian participants ($\delta_{Black} > \delta_{Asian}$, adjusted $p= .009$). No other pairings of racial/ethnic groups significantly differed in change to frequency of urban nature interaction.

Explanatory Variables for the Inequitable Effects of COVID-19

With the observed disparate outcomes in frequency of urban nature interaction during COVID-19, it was tested whether other measures of inequities may predict this disparity. Perceived coronavirus threat, perceived quality of nearby urban nature, and sense of belonging in urban nature are all variables which may have predicted inequitable effects of COVID-19 on frequency of urban nature interaction. Control variables for age, gender, income, and pre-pandemic frequency of urban nature interaction were included in this analysis.

An automated forward and backward stepwise regression analysis was conducted on a regression formula with change in frequency of urban nature interaction from 2019 to 2020 as the dependent variable. The model's independent variables included race/ethnicity, perceived coronavirus threat, perceived quality of nearby urban nature, sense of belonging, and the control

variables. This starting regression model had an AIC of 1142.71. Table 5 presents the stepwise variable selection process.

Based on AIC, the stepwise variable selection determined that race/ethnicity, age, pre-pandemic frequency of urban nature interaction, and sense of belonging best predict the changes to frequency of urban nature interaction of this study's sample (AIC= 1132.52). To attain the smallest AIC value, perceived coronavirus threat, perceived quality of nearby urban nature, gender, and income variables were removed from the regression formula. This result shows that the effects of COVID-19 on frequency of urban nature interaction are associated with sense of belonging in urban nature. Participants with a lower sense of belonging in urban nature lost more time in urban nature during COVID-19.

Table 5

Automated Stepwise Variable Selection

Step		Df	Deviance	Resid. Df	Resid. Dev	AIC
0	NA	NA	NA	287	12408.43	1142.71
1	- *Gender*	3	58.69	290	12467.13	1138.12
2	- *Income*	1	0.05	291	12467.17	1136.12
3	- *Perceived coronavirus threat*	1	3.17	292	12470.34	1134.20
4	- *Perceived urban nature quality*	1	13.56	293	12483.90	1132.52

Discussion

The present study took place in Seattle, WA, USA with participants from the city's four most-populous racial/ethnic groups: Asian, Black and African American, Hispanic and

Latino/a/x, and White. Effects of the COVID-19 pandemic on time spent in urban nature were observed, and these effects compared across racial/ethnic groups. Using a new measurement for sense of belonging in urban nature, this study investigated the relationship between sense of belonging and changes to urban nature visitation six months into COVID-19.

Results of this study show that over the first six months of the pandemic, Latino and Black Seattle residents experienced a significant decrease in their frequency of urban nature interaction while Asian and White participants experienced no change.[4] Among the varying conclusions on how the pandemic has affected People of Color's urban nature interaction, the results of this study support findings of People of Color spending less time in urban nature after the onset of the pandemic. Our results specifically align with those of Larson et al. (2021), who found that Black and Hispanic urban residents across cities of North Carolina experienced a decrease in urban park use during the COVID-19 pandemic.

Inequities in sense of belonging in urban nature were observed, with White and Asian participants both having a significantly higher sense of belonging than Latino and Black participants. Based on results from a stepwise regression analysis, sense of belonging in urban nature was found to be significantly associated with participants' changes in frequency of urban nature interaction during COVID-19. Those with a lower sense of belonging experienced a greater loss of time in urban nature, while those with a higher sense of belonging in urban nature experienced less or no decrease.

Participants' sense of belonging in urban nature was found to be significantly associated with their level of importance of protecting urban nature. This may be due to the fact that those

[4] This is not to say that Asian Seattle residents were not disproportionately affected by the COVID-19 pandemic. Prejudice against Asian Americans and Pacific Islanders was amplified with the COVID-19 pandemic along with rises in hateful rhetoric. Hate crimes against Asian Americans and Pacific Islanders in Seattle increased 56% from 2019 to 2020 (Levin, 2021).

with a higher sense of belonging in urban nature are more likely to spend time in urban nature spaces and have meaningful experiences in urban nature. As some evidence has shown, meaningful experiences in nature may be associated with stronger conservation values (DeVille et al., 2021; Zelenski et al., 2015).

As COVID-19 either abates or becomes endemic, it remains to be known if and how urban residents' frequency of urban nature interaction will shift. It may be the case that Black and Latino urban residents return to their pre-pandemic frequencies of urban nature interaction. However, given the existing racial/ethnic disparities in urban nature and urban environments in general, as well as the disproportional impacts that COVID-19 has had on Black and Latino communities, it seems possible that Black and Latino urban nature interaction will not fully recover. If this is the case, there are some large implications moving forward. The first is that inequities may grow in who benefits from urban nature. Additionally, as the less frequent urban nature interaction caused by the COVID-19 pandemic becomes the new normal, sense of belonging in urban nature among Black and Latino communities may decrease. With even fewer People of Color represented in nature spaces, the cycle of exclusion could be perpetuated.

Implications for Government Agencies

The types of interactions participants engaged in prior to the pandemic and during the pandemic (presented in Table 3) may be of aid to city governments in understanding what types of urban nature spaces are beneficial or desirable during pandemics. Prior to the pandemic, Seattle residents took walks with other people more frequently than they took walks alone. Six months into the pandemic, residents took walks alone more frequently than with other people. This is likely due to social distancing mandates and attempts to limit risk of contracting COVID-19. This type of information about urban nature interaction may be of value as urbanization

continues and city governments need to make decisions on what types of urban nature spaces to preserve and implement. Wide walking trails, for example, may be desirable as population density increases. The results of this study suggest that wide walking trails—which allow for maintaining social distancing—may also be more appealing during future pandemics as people shift from walking with others to walking alone.

Results of this study may also be used by city governments to decrease disparities in the effects of future pandemics on urban nature interaction by increasing Black and Latino urban residents' sense of belonging in urban nature. With a higher sense of belonging in urban nature, Black and Latino urban residents may be less likely to lose as much time in urban nature in the face of future disruptive events. With evidence showing that urban nature may be able to buffer some of the negative effects of a pandemic, maintaining urban nature interaction may help mitigate some of the disproportionate pandemic outcomes to Black and Latino urban residents.

The six themes of the Sense of Belonging in Urban Nature Questionnaire—Ease of Access, Safety, Feeling Out of Place, Unwelcomeness, Institutional Acceptance, and Different Ways of Interacting with Nature Acceptance—are entry point for city governments to begin to decrease disparities in sense of belonging in urban nature. Examples of actions that city government agencies can take to target the inequity themes of the Sense of Belonging in Urban Nature Questionnaire include:

- Direct urban parks budget to urban nature spaces serving predominantly People of Color.
- Organize urban nature programming specifically for Black or Latino urban residents.
- Present urban nature information on signage and online in multiple languages.
- Increase representation of People of Color on urban park signage and websites.
- Improve racial/ethnic diversity of people hired into city government, especially departments

which oversee urban nature areas (such as Parks and Recreation departments).

- Create urban nature spaces that encourage an inclusive array of types of urban nature interaction (e.g., urban nature spaces with open areas and picnic benches, trails, forested areas, secluded areas, and social gathering spaces).

Environmental Government Organizations (EGO's), which often manage land that lies outside of city limits, can benefit from the results of this urban nature study. EGO's (such as the Department of Fish and Wildlife, US Forest Service, and National Park Service), at least to some degree, rely on public interest in nature conservation in order to achieve their conservation goals on the lands that they oversee. With most of the US population living within cities and urban populations continuing to grow, it is crucial for EGO's to appeal to the urban population to maintain public support. Our results show that one way of increasing conservation values among city residents may be to increase peoples' sense of belonging in urban nature. Participants of this study who had a higher sense of belonging in urban nature reported a higher level of importance of urban nature protection. With urban nature often being the most accessible nature for those living within the city, improving urban nature conservation values may act as a bridge to engaging urban residents in the conservation of more wild nature.

EGO's that oversee large nature areas can use the themes of the Sense of Belonging in Urban Nature Questionnaire to increase urban residents' conservation values. The three main sense of belonging themes that EGO's can target include Feeling Out of Place, Unwelcomeness, and Institutional Acceptance. The following are examples of actions EGO's can take to target these themes.

- Provide nature programming for Black and Latino urban residents.

- Increase representation of People of Color in EGO signage, material, webpages, and social media.
- Increase representation within the agency itself through hiring practices and volunteer outreach with Communities of Color.
- Partner with local city governments to influence changes within the city related to belongingness in urban nature spaces.

Limitations

Achieving equal representation of the included racial/ethnic groups of this study allowed for comparisons between groups to be made with higher confidence. In order to logistically achieve equal representation, this study excluded several racial/ethnic groups including American Indian, Alaska Native, Native Hawaiian, and Pacific Islander individuals. Those who identified as belonging to more than one racial/ethnic group were also not eligible for participation. Research that includes and appropriately represents these racial/ethnic groups is of importance in future research given that these racial/ethnic groups are frequently underrepresented or not represented at all.

Due to the study participation opportunity being posted to social media, many responses were received from 'bots'—automated software programs which infiltrate surveys to receive the participant compensation. These bot responses were mostly filtered out by Qualtrics' bot-detection software, but some were able to get through. I carefully examined survey responses that were suspected to be from bots and deleted responses from the data set when deemed appropriate. Multiple indicators of a bot response were required to warrant deleting. There is no way of knowing whether the deletion criteria were too stringent and thus legitimate responses were deleted, or if the criteria allowed for some bot responses to remain. Given the presence of

the Qualtrics bot-detection software and the hand-inspection of data, however, there is good reason to have confidence in the integrity of the data.

A limitation of our data is that the responses which pertain to fall 2019 are retrospective. When participants took the survey in winter 2020, they were asked to recall their experiences in fall 2019 and respond to certain questions accordingly. The pre-pandemic data is therefore not as reliable as it would have been had this been a longitudinal study with two data collection periods.

To collect data on participants' experiences during the pandemic, participants were asked to refer to their experiences in fall 2020, about six months after the start of the pandemic in the US. Without data at later periods during the pandemic, it is impossible to speak of whether the observed effects on peoples' frequency of urban nature interaction will persist or whether frequencies have shifted back towards what they were prior to the pandemic. As the pandemic becomes endemic, further research will be needed to observe the long-term effects of COVID-19 on Peoples' urban nature interaction. The strength of collecting data pertaining to shortly after the pandemic began is that it reflects a time when the impacts of COVID-19 may have been felt most strongly. It may be the case that more of the inequities tied to the COVID-19 pandemic are reflected in data collected closer to the onset of the pandemic compared to further into the pandemic.

The Sense of Belonging in Urban Nature Questionnaire developed for this study, while achieving high internal reliability, remains unvalidated. Further exploratory and confirmatory factor analyses would be needed to validate this questionnaire.

In a study investigating the effects of racism and racial/ethnic inequities, it is important as a researcher to situate oneself within the context of the research. University researchers approach studies from a place of significant privilege and often have more power in a situation than

participants. This is especially true when the participants are from a marginalized group. There exists a level of distrust between Communities of Color and researchers due to this power and privilege imbalance being used for the exploitation of Communities of Color for data. I acknowledge that my place of privilege within the university institution affects who participates in this study and the data that participants provide.

Conclusion

Beyond the current pandemic, this study may reveal what we might expect with future pandemics or other similarly disruptive events. As shown in this study, sense of belonging in urban nature is important for all urban residents in the face of a pandemic. Sense of belonging in urban nature was able to predict the impact of COVID-19 on frequency of urban nature interaction across all participants. However, this study suggests that increasing sense of belonging among Black and Latino urban communities is most pertinent. Results from the newly developed Sense of Belonging in Urban Nature Questionnaire reveal significant disparities in sense of belonging between Black and Latino urban residents and White urban residents. Using the six themes of the Sense of Belonging in Urban Nature Questionnaire, the measurement may provide insight into how the loss of urban nature interaction among Communities of Color can be minimized in the face of future pandemics or similarly disruptive events. In doing so, Communities of Color within cities may be better positioned to be resilient against the disproportionate effects of such events.

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Appendix A

Eligibility Questionnaire

Before you proceed, please complete the captcha below. Thank you!

[ReCaptcha]

Hello! We are a group of researchers at the University of Washington seeking to recruit participants for an exciting study. Our survey aims to understand Seattle residents' experiences in nature during the COVID-19 pandemic, conservation values and behaviors, and urban nature inequity issues. We are looking for study participants to complete an online survey. Participants who complete all parts of their participation will be financially compensated in the form of a $10 Amazon gift card. Please complete the following questionnaire to see if you are eligible for study participation. This questionnaire takes approximately 5 minutes to complete.

Q1 Please leave your name and email address below so we can contact you about study participation if you are eligible.

First name _____

Last name _____

Email address _____

Please read the following Consent Information Form and check the box below to indicate your consent.

Consent Information Form
University of Washington
Research Study

"Seattle Residents' Relationships with Nature"
Lead Investigators: Peter Kahn, pkahn@uw.edu; Josh Lawler, jlawler@uw.edu
Graduate Researcher: Audryana Nay, audryn@uw.edu

We are asking you to be in a research study. The purpose of this form is to give you the information you will need to help you decide whether to be in the study or not. Being in the study is voluntary. Please read the form carefully. You may email a member of the research staff with any questions you have about the study before deciding if you want to be in the study or not. This study is being funded by Washington Department of Fish & Wildlife and will be carried out by UW researchers.

Key information:

- We will be investigating Seattle Residents' attitudes towards and behaviors with urban nature before the Covid-19 pandemic and during the Covid-19 pandemic.
- As a participant in the study you will be sent an email with a link to an online survey. You will be asked to complete this online survey which takes approximately 25 minutes to complete.
- You will be compensated with a **$10 gift card** (valid towards a variety of retailers you can choose from- including Amazon) for completing the survey. This gift card will be sent via email.
- Participation is completely voluntary, and you may withdraw from the study at any time.

The purpose of this study is to understand Seattle residents' attitudes towards urban nature, how they interact with urban nature, and how public land can be better managed to serve all Seattle residents. We are also seeking to find out how these relationships have been affected by the COVID-19 pandemic. The information we learn from this study may help us better understand the importance of urban nature exposure during this current pandemic and advise Washington Department of Fish & Wildlife how they can better serve Seattle residents.

Being in this study involves completing an online survey. This survey should take approximately 25 minutes to complete. After acknowledging your consent, you will be sent a personal link to complete the survey. You can expect to receive your $10 gift card by email within 5 days of completing the survey.

You may refuse to participate, and you are free to withdraw from this study at any time. You are not required to disclose any information you wish to keep private and may decline to answer any question.

All study data, including demographic data, will be securely stored and accessible only to the study researchers. The link between your identifier and the research data will be destroyed after the records retention period required by state and/or federal law. We will share study data with other researchers, but it will not include any information that could identify you.

Study data may be used in future studies, publications, presentations or other avenues of research dissemination. Direct identifiers will not be used in any future use of the data.

Please note that there is no intention to provide participants with study results.

If you have questions later about the study, or if you feel that you have been harmed by participating in this study, you can contact one of the researchers listed at the top of this form. If you have questions about your rights as a research subject, you can call the UW Human Subjects Division at (206) 543-0098.

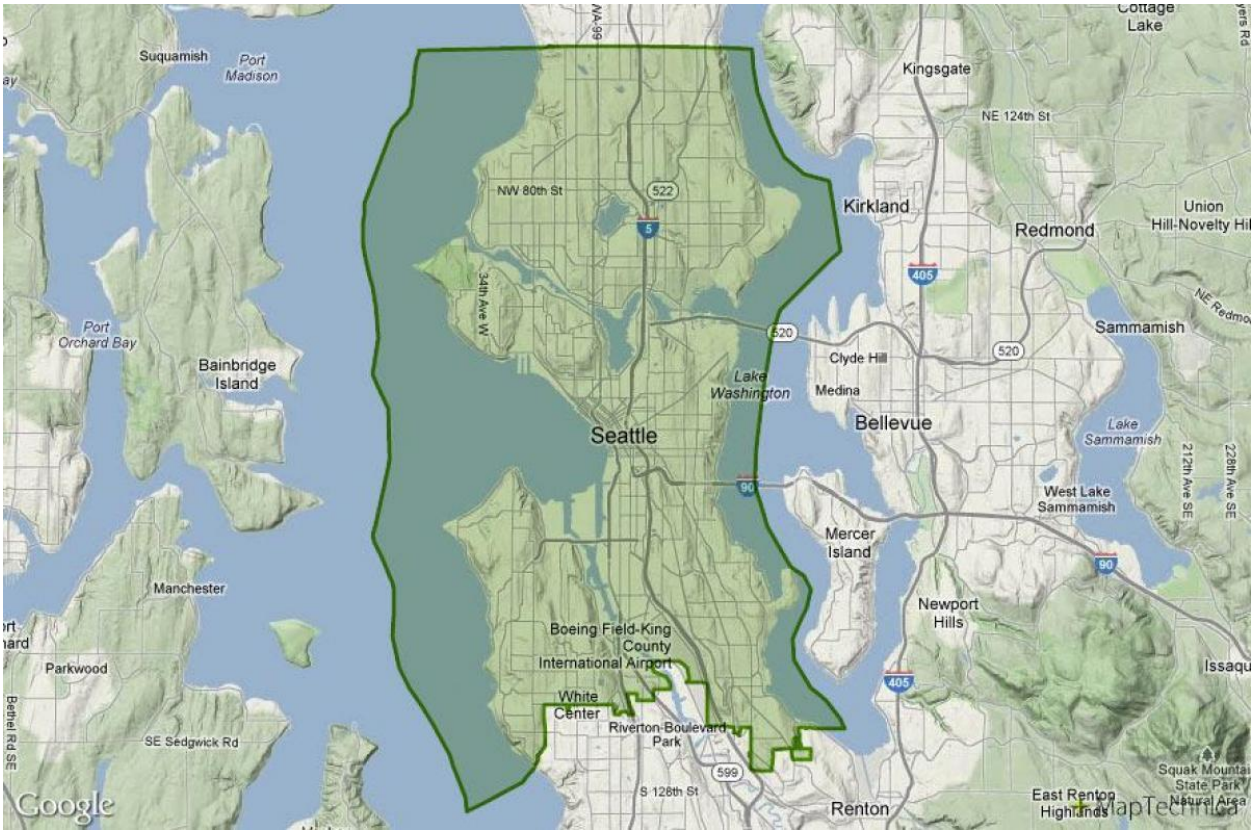
After consenting to participate in this study, you can expect to receive an email with your personal survey link shortly.

Downloadable Consent Information Form

Q2 Please indicate your consent below.

- Yes, I acknowledge that I have read and understood the Consent Information Form. I agree to participate in this study and to all parts of the Consent Information Form.
- No, I do not consent to participate in this study.

The green shape in the image below covers Seattle city limits.



Q3 Do you live within Seattle city limits?

- Yes
- No

Q4 What is your zip code? _____

Q5 Have you been living in the same place of residence since at least September 2019?
- Yes
- No

Q6 Are you at least 18 years of age?
- Yes
- No

Q7 What is your age?
- Under 12 years old
- 12-17 years old
- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65-74 years old
- 75 years or older

Q8 Are you comfortable speaking, writing, and reading English?
- Yes
- No

Q9 What gender do you identify with?
- Female
- Male
- Gender variant/nonconforming
- Not Listed
- Prefer not to answer

Q10 Please specify your ethnicity.
- White
- Black or African American
- Hispanic or Latino
- Native American or American Indian
- Native Hawaiian or Pacific Islander
- Asian
- Two or more races

Q11 Approximately what is your total household annual income?
- Less than $25,000
- $25,000 to $34,999
- $35,000 to $49,999
- $50,000 to $74,999
- $75,000 to $99,999
- $100,000 to $149,999
- $150,000 to $199,999
- $200,000 or more

[IF ELIGIBLE] Thank you! Based on your responses, you are eligible to participate in our study. You will receive a follow-up email with a link to the study survey shortly. You can reach out to us at audryn@uw.edu with any questions or concerns.

Appendix B

Full Survey

Before you begin, please complete the captcha below.

[ReCaptcha]

With this survey, we first seek to understand Seattle residents' interactions with urban nature before and during the Covid-19 pandemic. This survey will take about 30 minutes to complete.

Q1 Indicate to what extent the following statements are true of you.

	Not at all true of me	Somewhat untrue of me	Neither true nor untrue of me	Somewhat true of me	Very true of me
Thinking about the coronavirus (Covid-19) makes me feel threatened.	○	○	○	○	○
I am afraid of the coronavirus (Covid-19).	○	○	○	○	○
I am stressed around other people because I worry I'll catch the coronavirus (Covid-19).	○	○	○	○	○

Q2 Are any of the following statements true of you?

	True of me	Not true of me
I have 1 or more child under 18 years of age living with me.	○	○

I own 1 or more pets.	○	○
I have a private yard at my residence.	○	○

Q3 What type of residence do you live in?
- ○ Apartment
- ○ House
- ○ Condo
- ○ Mobile home or tiny house
- ○ Other: _____

Q4 Do you have a view of nature from at least one window in your home? (This could be a view of trees, a lawn, water, etc.)
- ○ Yes
- ○ No

Q5 In a few sentences, please describe your favorite view of nature from one of the windows in your home.

_____

In some questions of this survey, we ask about your experiences in "urban nature". **For our purposes, "urban nature" refers to parks, green areas, open spaces, and places with water, vegetation, and/or animals within the city of Seattle. Urban nature does not include things you may pass by briefly, such as trees along a sidewalk.**

In this survey, we will be asking about your experiences in both fall 2019 (September 2019 - November 2019, before the pandemic) and fall 2020 (September 2020 - November 2020, after the pandemic began). This following set of questions asks about your experiences in **fall 2019, before the pandemic began affecting your life.**

Q6 Over the course of fall 2019, how did you interact with nature **while staying in your residence**? This includes activities you could do from within your home, in a private yard, and/or on a private balcony/deck if available. (Select all that apply)
- ☐ Looked at birds or squirrels
- ☐ Looked at trees, bushes, and other plants
- ☐ Listened to the rainfall
- ☐ Smelled the rainfall
- ☐ Felt the rainfall
- ☐ Listened to the leaves rustle
- ☐ Listened to birdsong
- ☐ Played with/enjoyed the company of pets
- ☐ Kept houseplants

- ☐ Tended to a garden
- ☐ Looked out at a large view of water
- ☐ Looked out at a large view of nature
- ☐ Looked out at a large view of the city
- ☐ Watched the sunrise or sunset
- ☐ Sat outside
- ☐ Exercised in my yard
- ☐ Performed tasks outside such as reading, writing, working, creating art, and consuming media
- ☐ I did not interact with any nature in my residence
- ☐ Other (please specify): _____

Q7 Over the course of fall 2019, which of the following urban nature spots did you visit? (Check all that apply)

- ☐ A lake in the city
- ☐ A river in the city
- ☐ A nearby residential park with a playset
- ☐ A nearby residential park with no playset
- ☐ A spot near my place of work or school campus
- ☐ A community garden
- ☐ A dog park
- ☐ A ball field (such as a baseball field)
- ☐ An open field or open area
- ☐ My yard
- ☐ A beach in the city
- ☐ A forest or green belt in the city
- ☐ A courtyard with plants and/or a water feature
- ☐ A trail system
- ☐ I did not visit any urban nature spots
- ☐ Other (please specify): _____

Q8 Of the urban nature spots you visited in fall 2019, Where did you **most frequently** go to experience urban nature?

- ○ A lake in the city
- ○ A river in the city
- ○ A nearby residential park with a playset
- ○ A nearby residential park with no playset
- ○ A spot near my place of work or school campus
- ○ A community garden
- ○ A dog park
- ○ A ball field (such as a baseball field)
- ○ An open field or open area
- ○ My yard
- ○ A beach in the city

- ○ A forest or trail system in the city
- ○ A courtyard with plants and/or a water feature
- ○ A trail system
- ○ Other (please specify): _____

Q9 Describe the nature at the spot you chose in the previous question and what you did there. Please provide a few sentences to a few paragraphs.

_____

Q10 Over the course of fall 2019, what activities did you do in urban nature? (Select all that apply)

- ☐ Took a walk alone
- ☐ Took a walk with other people
- ☐ Walked a dog
- ☐ Rode a bike
- ☐ Rode a skateboard or scooter
- ☐ Ran or jogged
- ☐ Sat in nature
- ☐ Enjoyed the stillness and quietness of nature
- ☐ Looked out at a large view of water
- ☐ Looked out at a large view of the city
- ☐ Watched the sunrise or sunset
- ☐ Had a picnic
- ☐ Looked at wildlife
- ☐ Watched my children play
- ☐ Played a sport
- ☐ Swam or submerged in water
- ☐ Used a water vessel such as a kayak, canoe, paddleboard, or sail boat
- ☐ Tended to a garden
- ☐ Collected berries, nuts, mushrooms, greens, or other edible items
- ☐ Volunteered with an organization outside
- ☐ Other (please specify): _____

Q11 Of the activities you did in urban nature in fall 2019, which activity did you **most frequently** do?

- ○ Took a walk alone
- ○ Took a walk with other people
- ○ Walked a dog
- ○ Rode a bike
- ○ Rode a skateboard or scooter
- ○ Ran or jogged
- ○ Sat in nature
- ○ Enjoyed the stillness and quietness of nature
- ○ Looked out at a large view of water

- Looked out at a large view of the city
- Watched the sunrise or sunset
- Had a picnic
- Looked at wildlife
- Watched my children play
- Played a sport
- Swam or submerged in water
- Used a water vessel such as a kayak, canoe, paddleboard, or sail boat
- Tended to a garden
- Collected berries, nuts, mushrooms, greens, or other edible items
- Volunteered with an organization outside
- Other (please specify): _____

Q12 Over the course of fall 2019, how did you typically get to urban nature?
- I walked
- I drove my car
- I rode a bike
- I rode a skateboard or scooter
- I took public transportation
- I took a rideshare service such as Lyft or Uber
- Other (please specify): _____

Q13 Over the course of fall 2019, did you typically visit urban nature with other people?
- Yes
- No

Were those you typically visited urban nature with members of your household or individuals outside of your household?
- Members of my household
- Individuals outside of my household

How many people did you typically visit urban nature with?
- 1-2 others
- 3-5 others
- 6 or more others

Q14 Over the course of fall 2019, how often did you spend time in or around urban nature?
- Less than once per month
- 1-3 times per month
- Once per week
- 2-3 days per week
- 4-5 days per week
- 6 days per week
- Daily

Q15 In fall 2019, how often **would you have liked** to spend time in or around urban nature?

- ○ Less than once per month
- ○ 1-3 times per month
- ○ Once per week
- ○ 2-3 days per week
- ○ 4-5 days per week
- ○ 6 days per week
- ○ Daily

In fall 2019, what prevented you from spending as much time in or around urban nature as you would have liked? Select all that apply.

- ☐ Lack of free time
- ☐ I did not feel safe in the urban nature spots near where I live
- ☐ I felt guilty having leisure time
- ☐ There was too much planning involved
- ☐ There were no desirable urban nature spots near where I live
- ☐ The urban nature spots near where I live were not well-maintained
- ☐ I had no transportation to urban nature spots and could not walk
- ☐ I did not know what to do in urban nature
- ☐ No one else I know spent time in urban nature
- ☐ I had poor health or was too out of shape
- ☐ I felt unwelcome in urban nature
- ☐ The urban nature spots near where I live were too crowded
- ☐ I have a physical disability that made it difficult to spend time in urban nature
- ☐ I did not have the physical energy to spend time in urban nature
- ☐ I did not have the mental energy to spend time in urban nature
- ☐ Other: _____

Q16 Indicate to what extent the following statement is true of you.

	Not at all true of me	Somewhat untrue of me	Neither true nor untrue of me	Somewhat true of me	Very true of me
Over the course of fall 2019, if I wanted to spend time in or around urban nature I felt that I had to plan in advance.	○	○	○	○	○

Q17 Over the course of fall 2019, what personal benefits (if any) did you experience as a result of spending time in urban nature? (Select all that apply)

- ☐ My mood improved
- ☐ My stress decreased
- ☐ I felt less anxious

- [ ] I felt less aggressive
- [ ] My mind was more clear
- [ ] I slept better
- [ ] I didn't worry as much about every little thing
- [ ] I got to exercise my body
- [ ] I got to enjoy the fresh air
- [ ] I got a break from technology
- [ ] I got to interact with other people in my community
- [ ] It allowed my kids to get their energy out
- [ ] I learned more about urban nature
- [ ] I appreciated urban nature more
- [ ] I did not experience any benefits as a result of spending time in urban nature
- [ ] Other (please specify): _____

Q18 Of the personal benefits you experienced in fall 2019, which was most important to you?

- ○ My mood improved
- ○ My stress decreased
- ○ I felt less anxious
- ○ I felt less aggressive
- ○ My mind was more clear
- ○ I slept better
- ○ I didn't worry as much about every little thing
- ○ I got to exercise my body
- ○ I got to enjoy the fresh air
- ○ I got a break from technology
- ○ I got to interact with other people in my community
- ○ It allowed my kids to get their energy out
- ○ I learned more about urban nature
- ○ I appreciated urban nature more
- ○ Other (please specify): _____

Q19 Please describe a meaningful experience you had in urban nature in fall 2019 (September 2019 - November 2019, before the pandemic). Be as specific as you can in describing the nature at the spot, what you did there, and why it was meaningful. Please write at least one paragraph.

_____

The following set of questions ask about your experiences in **fall 2020 (September 2020 - November 2020), after the pandemic began affecting your life.**

Remember that "urban nature" refers to parks, green areas, open spaces, and places with water, vegetation, and/or animals within the city of Seattle. Urban nature does not include things you may pass by briefly, such as trees along a sidewalk.

Q20 Over the course of fall 2020, how did you interact with nature **while staying in your residence**? This includes activities you could do from within your home, in a private yard, and/or on a private balcony/deck if available. (Select all that apply)

- ☐ Looked at birds or squirrels
- ☐ Looked at trees, bushes, and other plants
- ☐ Listened to the rainfall
- ☐ Smelled the rainfall
- ☐ Felt the rainfall
- ☐ Listened to the leaves rustle
- ☐ Listened to birdsong
- ☐ Played with/enjoyed the company of pets
- ☐ Kept houseplants
- ☐ Tended to a garden
- ☐ Looked out at a large view of water
- ☐ Looked out at a large view of nature
- ☐ Looked out at a large view of the city
- ☐ Watched the sunrise or sunset
- ☐ Sat outside
- ☐ Exercised in my yard
- ☐ Performed tasks outside such as reading, writing, working, creating art, and consuming media
- ☐ I did not interact with any nature in my residence
- ☐ Other (please specify): _____

Q21 Over the course of fall 2020, which of the following urban nature spots did you visit? (Check all that apply)

- ☐ A lake in the city
- ☐ A river in the city
- ☐ A nearby residential park with a playset
- ☐ A nearby residential park with no playset
- ☐ A spot near my place of work or school campus
- ☐ A community garden
- ☐ A dog park
- ☐ A ball field (such as a baseball field)
- ☐ An open field or open area
- ☐ My yard
- ☐ A beach in the city
- ☐ A forest or green belt in the city
- ☐ A courtyard with plants and/or a water feature
- ☐ A trail system
- ☐ I did not visit any urban nature spots
- ☐ Other (please specify): _____

Q22 Of the urban nature spots you visited in fall 2020, Where did you **most frequently** go to experience urban nature?

- ○ A lake in the city

- ○ A river in the city
- ○ A nearby residential park with a playset
- ○ A nearby residential park with no playset
- ○ A spot near my place of work or school campus
- ○ A community garden
- ○ A dog park
- ○ A ball field (such as a baseball field)
- ○ An open field or open area
- ○ My yard
- ○ A beach in the city
- ○ A forest or green belt in the city
- ○ A courtyard with plants and/or a water feature
- ○ A trail system
- ○ Other (please specify): _____

Q23 Describe the nature at the spot you chose in the previous question and what you did there. Please provide a few sentences to a few paragraphs. If your most frequented spot is the same spot you wrote about for fall 2019, you may write "Same as above".

_____

Q24 Over the course of fall 2020, what activities did you do in urban nature? (Select all that apply)

- ☐ Took a walk alone
- ☐ Took a walk with other people
- ☐ Walked a dog
- ☐ Rode a bike
- ☐ Rode a skateboard or scooter
- ☐ Ran or jogged
- ☐ Sat in nature
- ☐ Enjoyed the stillness and quietness of nature
- ☐ Looked out at a large view of water
- ☐ Looked out at a large view of the city
- ☐ Watched the sunrise or sunset
- ☐ Had a picnic
- ☐ Looked at wildlife
- ☐ Watched my children play
- ☐ Played a sport
- ☐ Swam or submerged in water
- ☐ Used a water vessel such as a kayak, canoe, paddleboard, or sail boat
- ☐ Tended to a garden
- ☐ Collected berries, nuts, mushrooms, greens, or other edible items
- ☐ Volunteered with an organization outside
- ☐ Other (please specify): _____

Q25 Of the activities you did in urban nature in fall 2020, which activity did you **most frequently** do?

- Took a walk alone
- Took a walk with other people
- Walked a dog
- Rode a bike
- Rode a skateboard or scooter
- Ran or jogged
- Sat in nature
- Enjoyed the stillness and quietness of nature
- Looked out at a large view of water
- Looked out at a large view of the city
- Watched the sunrise or sunset
- Had a picnic
- Looked at wildlife
- Watched my children play
- Played a sport
- Swam or submerged in water
- Used a water vessel such as a kayak, canoe, paddleboard, or sail boat
- Tended to a garden
- Collected berries, nuts, mushrooms, greens, or other edible items
- Volunteered with an organization outside
- Other (please specify): _____

Q26 Over the course of fall 2020, how did you typically get to urban nature?

- I walked
- I drove my car
- I rode a bike
- I rode a skateboard or scooter
- I took public transportation
- I took a rideshare service such as Lyft or Uber
- Other (please specify): _____

Q27 Over the course of fall 2020, did you typically visit urban nature with other people?

- Yes
- No

How many people did you typically visit urban nature with?

- 1-2 others
- 3-5 others
- 6 or more others

Were those you typically visited urban nature with members of your household or individuals outside of your household?

- Members of my household
- Individuals outside of my household

Q28 Over the course of fall 2020, how often did you spend time in or around urban nature?
- Less than once per month
- 1-3 times per month
- Once per week
- 2-3 days per week
- 4-5 days per week
- 6 days per week
- Daily

Q29 In fall 2020, how often would you have liked to spend time in or around urban nature?
- Less than once per month
- 1-3 times per month
- Once per week
- 2-3 days per week
- 4-5 days per week
- 6 days per week
- Daily

In fall 2020, what prevented you from spending as much time in or around urban nature as you would have liked? Select all that apply.
- ☐ Lack of free time
- ☐ I did not feel safe in the urban nature spots near where I live
- ☐ I felt guilty having leisure time
- ☐ There was too much planning involved
- ☐ There were no desirable urban nature spots near where I live
- ☐ The urban nature spots near where I live were not well-maintained
- ☐ I had no transportation to the urban nature spots and could not walk
- ☐ I did not know what to do in urban nature
- ☐ No one else I know spent time in urban nature
- ☐ I had poor health or was too out of shape
- ☐ I felt unwelcome in urban nature
- ☐ The urban nature spots near where I live were too crowded
- ☐ I have a physical disability that made it difficult to spend time in urban nature
- ☐ I did not want to catch Covid-19
- ☐ I did not like wearing a face mask when in public
- ☐ I did not have the physical energy to spend time in urban nature
- ☐ I did not have the mental energy to spend time in urban nature
- ☐ I could not practice social-distancing in the urban nature spots I would have gone to
- ☐ Many people did not wear a face mask at the urban nature spots I would have gone to
- ☐ The urban nature spots I would have gone to were closed because of Covid-19
- ☐ Other: _____

Q30 Indicate to what extent the following statement is true of you.

	Not at all true of me	Somewhat untrue of me	Neither true nor untrue of me	Somewhat true of me	Very true of me
Over the course of fall 2020, if I wanted to spend time in or around urban nature I felt that I had to plan in advance.	○	○	○	○	○

Q31 Over the course of fall 2020, what personal benefits (if any) did you experience as a result of spending time in urban nature? (Select all that apply)

- ☐ My mood improved
- ☐ My stress decreased
- ☐ I felt less anxious
- ☐ I felt less aggressive
- ☐ My mind was more clear
- ☐ I slept better
- ☐ I didn't worry as much about every little thing
- ☐ I got to exercise my body
- ☐ I got to enjoy the fresh air
- ☐ I got a break from technology
- ☐ I got to interact with other people in my community
- ☐ It allowed my kids to get their energy out
- ☐ I learned more about urban nature
- ☐ I appreciated urban nature more
- ☐ I forgot about the Covid-19 pandemic for a little while
- ☐ I did not experience any benefits as a result of spending time in urban nature
- ☐ Other (please specify): _____

Q32 Of the personal benefits you experienced in fall 2020, which was most important to you?

- ○ My mood improved
- ○ My stress decreased
- ○ I felt less anxious
- ○ I felt less aggressive
- ○ My mind was more clear
- ○ I slept better
- ○ I didn't worry as much about every little thing
- ○ I got to exercise my body
- ○ I got to enjoy the fresh air
- ○ I got a break from technology
- ○ I got to interact with other people in my community
- ○ It allowed my kids to get their energy out
- ○ I forgot about the Covid-19 pandemic for a little while

- Other (please specify): _____

Q33 Please describe a meaningful experience you had in urban nature in fall 2020 (September 2020 - November 2020, during the pandemic). Be as specific as you can in describing the nature at the spot, what you did there, and why it was meaningful. Please write at least one paragraph.

_____

Q34 The following questions are about your values of urban nature. **Remember that "urban nature" refers to parks, green areas, open spaces, and places with water, vegetation, and/or animals within the city of Seattle. Urban nature does not include things you may pass by briefly, such as trees along a sidewalk.**

Q35 How important to you is the protection of urban nature?
- Not at all important
- Somewhat unimportant
- Neither important nor unimportant
- Somewhat important
- Very important

Q36 Why do you think urban nature should or should not be protected? (Please provide a few sentences to a few paragraphs)

_____

Q37 How important to you is it to regularly get out into urban nature?
- Not at all important
- Somewhat unimportant
- Neither important nor unimportant
- Somewhat important
- Very important

Q38 Of the following urban nature conservation issues, which do you believe should be prioritized in Seattle? You may select up to 6 of the following.
- [ ] Air and water pollution
- [ ] Urban runoff
- [ ] Loss of nature spaces due to development
- [ ] Wildlife habitat loss
- [ ] Disagreements on how to use urban nature
- [ ] Native American ownership rights of urban nature
- [ ] Smog accumulation
- [ ] Urban heat island effect
- [ ] Urban sprawl
- [ ] Loss of biodiversity
- [ ] Green infrastructure policies
- [ ] Urban tree canopy establishment
- [ ] Light pollution

- [ ] Noise pollution
- [ ] Bird disturbance by pets
- [ ] Population density increase
- [ ] Homelessness presence in public urban nature spaces
- [ ] Lack of public appreciation for urban nature
- [ ] No conservation issues should be prioritized
- [ ] Other: _____

Q39 How often do you talk about urban nature conservation issues with friends, family, colleagues, or other individuals?

- ○ Never or less than once a month
- ○ Once a month to once a week
- ○ Twice a week or more

Q40 What conservation behaviors do you participate in? (Select all that apply)

- [ ] Pick up litter from nature areas
- [ ] Take public transportation
- [ ] Use a human-powered mode of transportation such as walking, bicycling, or skate boarding
- [ ] Reduce the amount of waste you produce (Ex. using reusable grocery bags)
- [ ] Recycle and/or reuse materials
- [ ] Buy products from environmentally conscious brands when possible
- [ ] Engage with environmental issues for work or school
- [ ] Speak about conservation issues with others
- [ ] Engage politically on environmental and conservation issues
- [ ] Vote in support of environmental and conservation issues
- [ ] Volunteer to maintain community parks or other nature areas
- [ ] Volunteer for non-governmental environmental organizations
- [ ] Volunteer for governmental environmental organizations
- [ ] Financially support non-governmental environmental groups
- [ ] Financially support government environmental organizations
- [ ] Share or engage with environmental and conservation issues on social media
- [ ] Decrease personal meat consumption
- [ ] Purchase goods from a Farmer's Market
- [ ] Buy from local businesses when possible
- [ ] Grow my own produce
- [ ] Avoid using lawn/gardening chemicals
- [ ] Support the use of native plant species
- [ ] I do not participate in any conservation behaviors
- [ ] Other (please specify): _____

Q41 Is there an urban nature spot that you like to go to within walking distance of your residence?

- ○ Yes
- ○ No

How far do you need to walk to get to an urban nature spot near your residence?

- ○ Less than 5 minutes
- ○ 5-10 minutes
- ○ 10-20 minutes
- ○ More than 20 minutes

Q42 To what extent do you agree with the following statements? "Neighborhood" refers to the Seattle neighborhood that you live in such as Beacon Hill, Central District, and Greenwood.

	Completely disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Completely agree
My neighborhood has safe urban nature spots.	○	○	○	○	○
My neighborhood has well-maintained urban nature spots.	○	○	○	○	○
My neighborhood has beautiful urban nature spots.	○	○	○	○	○
My neighborhood has urban nature spots where you can exercise/do a sport.	○	○	○	○	○
My neighborhood has urban nature spots where you can spend your time interacting with other people.	○	○	○	○	○
My neighborhood has urban nature spots with diverse plant and bird species.	○	○	○	○	○

Q43 To what extent do you agree with the following statements?

	Completely disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Completely agree
The public urban nature spots in my neighborhood are too crowded for me to feel safe during the Covid-19	○	○	○	○	○

(coronavirus) pandemic.					
When in the public urban nature spots in my neighborhood, I am constantly looking out for other people so as to not get Covid-19 (coronavirus).	○	○	○	○	○
When in public urban nature in my neighborhood, I do not feel like I need to wear a face mask because there are so few people around that I can stay 6 feet apart from others.	○	○	○	○	○
When I am in public urban nature spots in my neighborhood, I do not feel the same benefits I got from nature prior to the Covid-19 (coronavirus) pandemic because I am so worried about catching Covid-19.	○	○	○	○	○
When I am in public urban nature spots in my neighborhood, the Covid-19 (coronavirus) preventative measures I take (such as wearing a face mask and frequent hand-washing) prevent me from enjoying nature in the same way I used to.	○	○	○	○	○

Q44 To what extent do you agree with the following statements?

	Completely disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Completely agree
It is not easy for me to get to a park or other urban nature spot near my home.	○	○	○	○	○
When in an urban nature spot near my residence, I fear for my own safety or the safety of others around me.	○	○	○	○	○
I feel out of place in the urban nature spots I visit.	○	○	○	○	○
I feel unwelcome by others when in urban nature.	○	○	○	○	○
I feel uncomfortable when I see a park management employee when in urban nature.	○	○	○	○	○
I feel that the way I use urban nature is unwelcome or unaccepted by other visitors.	○	○	○	○	○

Q45 To what extent do you agree with the following statements? ("BIPOC" stands for Black, Indigenous, and People of Color, and is used to refer to any non-white individual.)

	Completely disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Completely agree
Seattle urban nature is not distributed equally among all neighborhoods.	○	○	○	○	○
Predominantly BIPOC Seattle neighborhoods do not have as many urban nature areas as predominantly White Seattle neighborhoods.	○	○	○	○	○

BIPOC Seattle residents are not as interested in nature as non-BIPOC Seattle residents.	○	○	○	○		○

Q46 Think about your ideal urban nature spot. What would your ideal urban nature space look like? What would be included? What would not be included? Be as specific and detailed as you can.

_____

Q47 Is there anything you don't like about the urban nature near where you live? If so, please elaborate.

_____

Q48 Have you ever had any negative experiences in urban nature? If so, please elaborate.

_____

Appendix C

Sense of Belonging Exploratory Validity Testing

The Sense of Belonging in Urban Nature Questionnaire developed for this study showed high internal reliability (Cronbach's alpha= 0.84) and warrants further validity testing. Here, I begin the process of validating this new sense of belonging measurement. The aim of this study

was to test for correlation between the Sense of Belonging in Urban Nature Questionnaire and three other scales that measure constructs similar to sense of belonging in urban nature.

In winter of 2021, 332 undergraduate University of Washington psychology students were sampled from the University of Washington Psychology Research Pool. Participants received 1 extra credit point for participating in the study. In order to be eligible, individuals from the research pool must have been at least 18 years old and be living within Seattle city limits at the time of participation.

The online survey, hosted on Qualtrics, contained four measurements. The first was the newly developed Sense of Belonging in Urban Nature Questionnaire. The Sense of Belonging in Urban Nature Questionnaire achieved good internal reliability in this study (Cronbach's alpha= 0.70). The other three included scales are below:

General Belongingness Scale (GBS)—Acceptance/Inclusion (Malone et al., 2011). The Acceptance/Inclusion subsection of the GBS was administered to participants (see Table C1). This scale, originally answered on a 7-point Likert scale, was modified to use a 5-point Likert scale. The phrase "in urban nature" was added to each item to make the scale contextually fit for this study's purposes.

Table C1

The Modified GBS—Acceptance/Inclusion

When I am with other people in urban nature, I feel included.
I have close bonds with family and friends in urban nature.

I feel accepted by others in urban nature.

I have a sense of belonging in urban nature.

I have a place at the table with others in urban nature.

I feel connected with others in urban nature.

Sense of Belonging Inventory (SOBI)—Psychological (Hagerty & Patusky, 1995).

The Psychological factor of the SOBI was administered to participants. In order for items in this scale to work in the context of urban nature, the phrase "urban nature" was added to all items. Some items were not relevant to belongingness in urban nature or did not make sense in this context and were therefore removed. An example of a removed item includes *"I could disappear for days and it wouldn't matter to my family."* In the process of validating the GBS, Malone et al. (2011) found positive convergent validity between the GBS and the SOBI.

Table C2

The Modified SOBI—Psychological

I often wonder if there is any place in urban nature where I really fit in.

I am just not sure if I fit in with my friends in urban nature.

I would describe myself as a misfit in most social urban nature situations.

I generally feel that people accept me in urban nature

I feel like a piece of a jig-saw puzzle that doesn't fit into the puzzle in urban nature.

I would like to make a difference to people or things around me in urban nature, but I don't feel that what I have to offer is valued.

I feel like an outsider in most urban nature situations.

I am troubled by feeling that I have no place in urban nature.

In general, I don't feel a part of the mainstream of society in urban nature.

I feel like I observe life rather than participate in it when in urban nature.

I feel like a square peg trying to fit into a round hole in urban nature.

I don't feel that there is any urban nature place where I really fit in Seattle.

I feel uncomfortable that my background and experiences are so different from those who are usually around me in urban nature.

I feel left out of things in urban nature.

Sense of Place Scale—Place Attachment (Williams & Vaske, 2003). The last scale included in the survey was the Place Attachment factor of the Sense of Place Scale. Williams and Vaske utilize this scale to measure sense of place to both general types of nature (such as forested areas, undeveloped areas, and "wild" areas" as well as specific nature locations

(including Shenandoah National Park and Mt. Rogers National Recreation Area). In each scale item, there is an "X" which denotes where the nature place/type is added. For the purposes of this validation study, participants were asked to think of an urban nature spot they enjoy going to. This spot was used as the "X" in each item.

Table C3

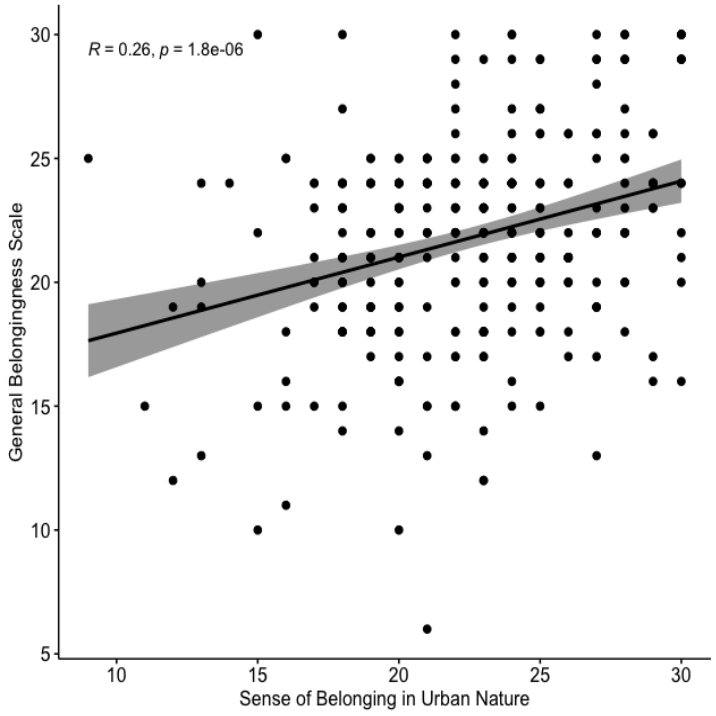
Modified Sense of Place Scale—Place Attachment

I feel my urban nature spot is a part of me.
My urban nature spot is the best place for what I like to do.
My urban nature spot is very special to me.
No other place can compare to my urban nature spot.
I identify strongly with my urban nature spot.
I get more satisfaction out of visiting my urban nature spot than any other.
I am very attached to my urban nature spot.
Doing what I do at my urban nature spot is more important to me than doing it in any other spot.
Visiting my urban nature spot says a lot about who I am.
I wouldn't substitute any other area for doing the types of things I do at my urban nature spot.
My urban nature spot means a lot to me.
The things I do at my urban nature spot I would enjoy doing just as much at a similar site.

Spearman's ρ was calculated for responses to the Sense of Belonging in Urban Nature Questionnaire and each of the three other scales. The first comparison was with the GBS—Acceptance/Inclusion (see figure C1). The GBS had a Cronbach's alpha of 0.84. Sense of belonging in urban nature and the GBS were significantly positively correlated ($p < .001$; Spearman's $\rho = 0.26$).

Figure C1

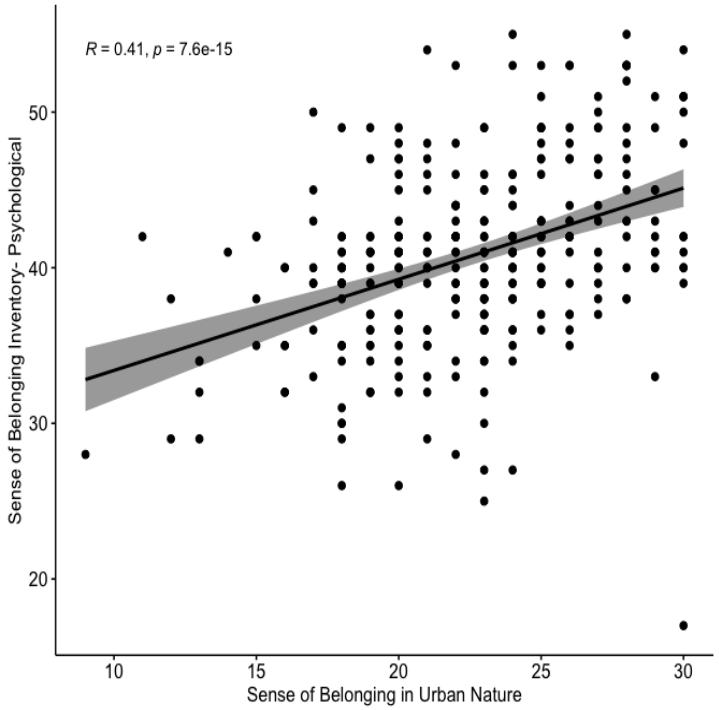
Sense of Belonging in Urban Nature Questionnaire and GBS



The Sense of Belonging in Urban Nature Questionnaire was then compared to the SOBI-Psychological (see figure C2). The SOBI-Psychological had high internal reliability with a Cronbach's alpha of 0.87. Sense of belonging in urban nature and the SOBI—Psychological were significantly positively correlated ($p < .001$; Spearman's $\rho = 0.41$).

Figure C2

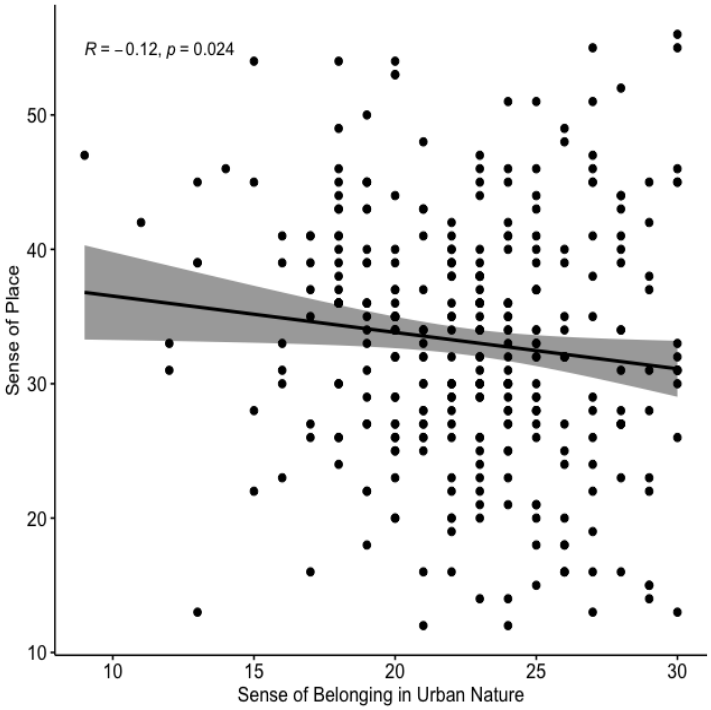
Sense of Belonging in Urban Nature Questionnaire and SOBI—Psychological



Lastly, the Sense of Belonging in Urban Nature Questionnaire was compared to the Sense of Place—Place Attachment scale (see figure C3). The Place Attachment scale had high internal reliability with a Cronbach's alpha of 0.90. Sense of belonging in urban nature and the Place attachment scale were significantly correlated (p= .024), however the two measurements were negatively correlated (Spearman's ρ= -0.12).

Figure C3

Sense of Belonging in Urban Nature Questionnaire and Sense of Place—Place Attachment



Upon first examination it seems that the Sense of Belonging in Urban Nature Questionnaire and the Place Attachment scale should be positively correlated, as sense of belonging is with the other two scales. However, there are conceptual reasons why that might not be the case. In section 1.2.1. Measuring Sense of Belonging in Urban Nature, I describe the three dimensions which I propose constitute sense of belonging in urban nature: The self, the social, and nature. The Sense of Belonging in Urban Nature Questionnaire clearly captures all three of these dimensions. The GBS and SOBI, without modifications, capture the self and the social but do not include the nature elements. However, with the modifications made for this study, the GBS and SOBI include the nature dimension as well. The Place Attachment scale, on the other hand, captures the self and nature, but does not include social relationships. These results suggest two things. The first is that these findings provide evidence of the three dimensions of belonging in urban nature. Secondly, these results may indicate that the social dimension of sense of belonging in urban nature plays a very influential role in the experience of belongingness.

Further research is needed to validate the Sense of Belonging in Urban Nature Questionnaire. This work will likely include further convergent/divergent validity testing and exploratory and confirmatory factor analyses.