

Marginalized community members' perceptions of nature and psychological wellbeing: Focus group findings on variability in perceived benefits

Everly Jazi^{a,*}, Matilda van den Bosch^{a,b,c,d,e,f}, Margarita Triguero-Mas^{c,g,h},
Michael Meitner^a, Annmarie Thomsonⁱ, Jade Chenⁱ, Keunhyun Park^a

^a Faculty of Forestry, The University of British Columbia, Vancouver, BC, Canada

^b Faculty of Medicine, The University of British Columbia, Vancouver, BC, Canada

^c ISGlobal, Barcelona, Spain

^d Universitat Pompeu Fabra (UPF), Barcelona, Spain

^e CIBER Epidemiología y Salud Pública, Madrid, Spain

^f The European Forest Institute, Biocities Facility, Rome, Italy

^g Barcelona InTerdisciplinary Research Group on Planetary Health (BITAL), Faculty of Health Sciences, Universitat Oberta de Catalunya (UOC), Barcelona, Spain

^h Barcelona Lab for Urban Environmental Justice and Sustainability (BCNUEJ), Institute of Environmental Science and Technology (ICTA), Universitat Autònoma de Barcelona (UAB), Bellaterra, Spain

ⁱ Faculty of Science, The University of British Columbia, Vancouver, BC, Canada

1. Introduction

Exposure to natural spaces, broadly defined to encompass both maintained and unmaintained natural areas, is widely recognized as improving psychological wellbeing through benefits to mood, enhanced cognitive functioning, and reduced stress (Bratman et al., 2019; Brauer et al., 2002; Browning et al., 2022; Schafer et al., 2022; Schilhab et al., 2018; Ventriglio et al., 2021; Zhan et al., 2023). These benefits are often explained through two foundational theoretical models, Attention Restoration Theory (ART; Kaplan & Kaplan, 1989), and Stress Reduction Theory (SRT; Ulrich, 1983). Together, these models propose that connecting to natural space facilitates emotional regulation, psychological restoration, and stress reduction. ART examines how natural space replenishes depleted cognitive resources through involuntary attention (Sonntag-Öström et al., 2014; Hartig et al., 2003; Lee & Maheswaran, 2011). Similarly, SRT posits that psychophysiological and emotional restoration is triggered by exposure to natural space. These frameworks establish a direct pathway linking exposure to natural space with improvements in psychological wellbeing.

However, emerging research also suggests a tension within this literature. While access to natural spaces is unequally distributed across different populations (Frumkin et al., 2017; Gascon et al., 2015; Hartig et al., 2014; Jimenez et al., 2021; Kabisch, 2019; Kondo et al., 2018; Markevych et al., 2017; Rigolon et al., 2021; Twohig-Bennett & Jones, 2018), the benefits derived from such spaces may be

disproportionately greater for marginalized community members, such as individuals of low-socioeconomic status (SES) and people of color (POC) (Mitchell et al., 2015; Mitchell & Popham, 2008; Pearce et al., 2018). Previous studies have consistently demonstrated that marginalized groups experience reduced access to high-quality natural spaces due to structural inequalities (Hartig et al., 2014; Kabisch, 2019; Rigolon et al., 2021). At the same time, previous literature suggests that when access and interaction with natural space are present, groups facing the greatest stress in making ends meet may experience amplified psychological and health benefits relative to more advantaged populations, a pattern described as “equigenesis” (Maas et al., 2009; Mitchell & Popham, 2008; Roe et al., 2013). This pattern is often attributed to higher baseline stress levels and fewer alternative opportunities for restoration, such that natural spaces may play a more significant compensatory role in promoting wellbeing (Maas et al., 2009; Roe et al., 2013).

Evidence supporting the equigenic effects of natural space has largely emerged from epidemiological and population-level studies examining whether associations between natural space exposure and health differ across socioeconomic groups. Rigolon et al.'s (2021) systematic review largely found that the presence of natural space may confer disproportionately greater psychological wellbeing improvements for socioeconomically disadvantaged populations, positing that natural space may reduce existing health inequities rather than benefiting all populations equally (Mitchell et al., 2015; Rigolon et al.,

* Corresponding author. Forest Sciences Centre, 2424 Main Mall, Vancouver, BC, V6T 1Z4, Canada.

E-mail address: ejazi@student.ubc.ca (E. Jazi).

<https://doi.org/10.1016/j.jenvp.2026.103220>

Received 24 September 2025; Received in revised form 21 September 2026; Accepted 21 September 2026

Available online 26 September 2026

0272-4944/© 2026 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

2021). Foundational population-based studies are consistent with this pattern. Mitchell and Popham (2008), for example, found that greater neighborhood green space exposure reduced income-related disparities in health across the UK, and Maas et al. (2009) reported lower rates of anxiety and depression among residents of greener neighborhoods, with implications for reducing health disparities. More recent studies further link proximity to specific types of natural environments with improved wellbeing outcomes among low-SES populations (Guo et al., 2025; Wang et al., 2024; Wei et al., 2023). When considered in tandem, these studies suggest that natural spaces may help reduce health inequities. However, because they predominantly rely on population-level measures of exposure and access, the studies identify broader patterns, while providing comparatively limited insight into how marginalized individuals themselves experience, interpret, and derive psychological benefits from these environments in their everyday lives.

These approaches have been essential in establishing broad structural relationships between the environment and health outcomes of interest. However, because they primarily rely on indicators of access and exposure (Davis et al., 2023; Rugel et al., 2017), they provide more limited insight into how residents themselves perceive, interpret, and interact with these environments in their everyday lives. This limitation is of particular importance in the context of health equity, where lived experience, including perceptions of safety, belonging, and cultural relevance, may substantially shape whether and how benefits are realized (Dietsch et al., 2021; Rigolon et al., 2021).

Correspondingly, recent work suggests the importance of considering not only sociodemographic variables and spatial predictors, but also individual-level factors such as attachments, symbolism or meanings, and nature-related family traditions (Ghasemieshkaftaki et al., 2025). These factors may act as moderators of the natural space-wellbeing chain, influencing both the use measures and the magnitude of benefits experienced. For marginalized community members in particular, historical exclusion, culturally specific norms, and differential childhood exposure to natural space may result in varied interaction patterns or meaning-making that is not as evident in broadly captured, quantitative methodology (Dietsch et al., 2021; Finney, 2014). This idea of individual-level moderators is also conceptually informed by existing theoretical perspectives such as place attachment and emotional or experiential connections (e.g., environmental identity or emotional or spiritual involvement with nature; Clayton et al., 2021; Keltner, 2023).

Despite increasing recognition of this gap, the existing evidence remains dominated by quantitative research. While these studies are vital for establishing associations between natural space and health outcomes, they provide limited insight into the processes through which these relationships are experienced and negotiated in participants' lives. Factors related to natural space, such as access, safety, belonging, cultural relevance, and connection or meaning, might be difficult to capture through spatial indicators or survey methodology alone. Qualitative research is aptly positioned to investigate the mechanisms underlying observed population-level patterns by exploring how marginalized community members perceive, interpret, navigate, and experience wellbeing benefits from natural spaces within the context of structural inequities.

Integrating structural and use inequities (e.g., access), sociodemographic influence (e.g., SES, race/ethnicity), and individual-level processes (e.g., perceptions and connections to natural space) allows for further understanding the pathways through which nature influences wellbeing. This builds on Hartig et al. (2014)'s conceptual framework through examination of how these factors play out in daily lives, interacting with each other as an interconnected chain of variables. This methodological approach might then generate a more contextually grounded understanding of nature and health inequities, informing interventions that are historically and relationally attuned (Finney, 2014; Rigolon et al., 2018).

The current study examines how participants interact with and

perceive natural space, the wellbeing benefits they derive, and how they interpret the influence of marginalization on these experiences. We further explore how factors such as safety, cultural belonging, and access barriers shape experiences of natural spaces and variability in perceived benefits. Focus group methodology was selected as the primary method to facilitate collective reflection and collaborative affirmation, and to challenge various perspectives, ultimately surfacing data points on upheld norms, points of consensus, and areas of divergence (Tolley, 2016).

These interviews were conducted with low SES and marginalized racial and ethnic residents of Metro Vancouver, BC, Canada. Vancouver provided a theoretically meaningful context for such examination because of its international recognition for proximity to mountains, forests, and coastal environments, yet highly socioeconomic-dependent disparity in access, in class- and race-related variation in high-quality natural space distribution, and in ongoing settler-colonial histories affecting POC and First Nations community members (Nesbitt et al., 2023). These overlapping dynamics make it a relevant setting for examining how natural space is experienced within conditions of both opportunity and exclusion.

By centering lived experience, this study examined to how participants understand their wellbeing in natural and built environments, to better explain differential outcomes and the potential for equigenesis (Twohig-Bennett & Jones, 2018).

2. Methods

2.1. Guiding propositions

To guide this qualitative study, the following three propositions were developed.

P1 Marginalized Populations perceive natural spaces as beneficial for psychological wellbeing. Proposition 1 refers to the direct chain from natural space to wellbeing.

P2 Marginalized populations report that factors related to their sociodemographic identity influence how natural space impacts psychological wellbeing. The direction of this effect may vary; for instance, those with lower baseline wellbeing may receive greater proportional benefits, but at the same time, those with limited access to natural spaces may experience fewer benefits overall. Proposition 2 refers to the moderating role of sociodemographic factors within the natural space-wellbeing chain.

P3 Marginalized populations report that the relationship between natural space and wellbeing is influenced by individual connections to and perceptions of these spaces, beyond their sociodemographic identity. For example, an individual's hometown nature could impact what natural spaces they perceive as beneficial in adulthood. Proposition 3 refers to the moderation of the nature-wellbeing chain by perceptions of and connections to natural spaces.

2.2. Participants and sample size

2.2.1. Study setting

Metro Vancouver encompasses the City of Vancouver and its surrounding municipalities. The Greater Vancouver metropolitan area (also referred to as the "Lower Mainland"), which includes cities such as Burnaby, Richmond, and Surrey, is the third largest metro area in Canada and is located in southwestern British Columbia. It is situated on the Burrard Peninsula and bordered by English Bay, Burrard Inlet, and the Fraser River and is located on the traditional, unceded territories of the x̱məθḵw̱əy̱əm (Musqueam), Skwx̱ wú7mesh (Squamish), and səliwətaʔ (Tsleil-Waututh) Peoples. Vancouver residents have immediate access to mountains, forests, and ocean/blue spaces. According to the 2021 Census, approximately 47% of the population are visible minorities, with substantial communities of Chinese, South Asian, Filipino, Latin American, and Persian residents. Nearly 40% of Vancouver's residents are immigrants, contributing to a rich cultural scene (City of

Vancouver, 2025; Statistics Canada, 2021). Socioeconomic disparities are pronounced across the region, with income, educational attainment, and access to high-quality natural spaces varying markedly across neighborhoods (Nesbitt et al., 2023).

2.2.2. Participant recruitment and sampling

Adults from marginalized communities (low SES and/or POC) in Metro Vancouver were recruited for online focus groups. Recruitment was done via emails and flyers through partner organizations and community spaces.

2.2.3. Eligibility criteria

Eligibility was assessed via a brief online screening survey accessible through a QR code or URL on recruitment material, and hosted on Qualtrics. To be eligible, participants were required to be 18 years of age or older, residing within Metro Vancouver, and identifying as either low-SES and/or a POC.

2.2.3.1. Socioeconomic status criteria. Consistent with a multidimensional conceptualization of SES, eligibility on this factor was determined using three indicators, with eligible participants meeting at least one of the following criteria: perceived social class below middle class (e.g., working class, lower class), annual household income below or near \$60,000 CAD (i.e., the approximate poverty line for Vancouver for an average household, as per the Canadian Income Survey of 2018; Government of Canada, 2024), or educational attainment less than a bachelor's degree (as around one-third of Canadians have a bachelor's degree, which itself is an indicator of socioeconomic status; Statistics Canada, 2022).

Meeting any single indicator was sufficient for eligibility. This inclusive approach was intentional and theoretically aligned with the equigenic hypothesis, which emphasizes how multiple and intersecting forms of socioeconomic disadvantage may shape access to and benefits from health-promoting environments. Because subjective class identity, income, and education capture distinct dimensions of stratification, participants could qualify as low-SES even if other indicators suggested relative advantage. For example, an individual with a higher household income but without postsecondary educational credentials would still be eligible on the education dimension of SES. This approach allowed us to capture multiple perspectives of this lived experience.

2.2.3.2. Person of color criteria. Race and ethnicity were assessed using a two-part question modelled directly based on the 2021 Canadian Census categories (Statistics Canada, 2021). Participants were asked to indicate their cultural or ethnic ancestry, and whether they identified as Indigenous (i.e., First Nations, Métis, Inuk). Individuals who did not exclusively select both "White" and "Not an Indigenous person" were categorized as POC for eligibility purposes. This operationalization reflects Canadian census conventions (Statistics Canada, 2021).

Because racial and ethnic identities are socially constructed and multifaceted, participants were able to select multiple categories. Classification for recruitment purposes was used to structure focus groups and, as results show in the detailed section below, did not imply homogeneity within groups.

2.3. Study design

The study used a qualitative design with both semi-structured interviews and focus groups. All sessions were conducted over Zoom, the online video conferencing platform, to allow for accessibility and ease of attendance, without need for transportation to a set location in the sprawling Metro Vancouver area or for making childcare arrangements. The platform also provided closed captioning to address potential accessibility needs.

Between December 2023 and June 2024, a total of three focus groups

(ranging from four to eight participants) and three individual interviews were conducted. Participants were purposively recruited via email based on relevant marginalized identity characteristics (e.g., low-SES or racialized/POC experiences) and invited to focus groups organized around those identities. Participants' scheduling availability determined their assigned session. Individual interviews were not separately recruited or purposively planned; they occurred when only one participant attended a scheduled focus group and were conducted using the same semi-structured guide and procedures. Consistent with qualitative methodology guidance supporting the combination of individual interviews and focus groups to enhance data richness and capture complementary perspectives (Lambert & Loisele, 2008), these interviews were retained in the analysis, as they provided more in-depth reflections on personal experiences and ensured that participants who had committed to the study were not excluded due to others' attendance.

While some participants identified with both categories, such as being both low-income and a POC, discussions were directed toward the primary thematic focus of each group (e.g., the low-SES group focused on this aspect of identity). Given the limited focus group duration and the complexity of discussing identity, psychological wellbeing, and relationship with natural space simultaneously, structuring the groups around the primary shared identity allowed participants to more thoroughly discuss a common set of experiences while still ensuring diversity across the overall sample (e.g., a high-income participant of color in the group regarding race and ethnicity was encouraged to focus on their racialized experience rather than their socioeconomic position). Although participants were prompted to discuss the one aspect of their identity, discussions were not constrained to that dimension. Participants referenced intersectional aspects of their identities, including race, SES, migration history, family background, and gender. While the analytic framing emphasized one identity dimension at a time, the participants' narratives often reflected layered forms of marginalization.

Sessions lasted 90 to 120 min and all followed the same semi-structured script (Appendix) using lay terminology like outdoor activities in nature and mental health to maximize clarity for the participants. Based on the initial set of questions, the moderator employed probing techniques to encourage deeper exploration of participants' responses, ensuring that the discussion remained focused on the research objectives. While the moderator facilitated the conversation by clarifying points and redirecting the group when necessary, the overall direction of the discussion was largely driven by the participants, allowing for organic exploration of relevant topics within the framework of the study. Participants were instructed to only display and use first names, and to be completely visible in front of the camera as much as possible. Participants received a \$25 digital gift card of their choice following the session.

2.4. Analysis methods

The research team analyzed the focus groups and semi-structured interviews using thematic analysis with a combined deductive-inductive approach, guided by the principles of reflexive thematic analysis (Braun & Clarke, 2006, 2019). This method emphasizes the researcher's active role in interpreting the data, with a more deductive lens, while simultaneously focusing on identifying patterns of meaning across the dataset in an inductive manner. The analysis followed the applied qualitative analysis practices outlined by Tolley et al. (2016). Analysis was conducted using a computer-assisted qualitative data analysis software (CAQDAS), NVivo 14. To achieve this, the notetaker edited the Zoom-captured transcripts for clarity, adding any non-verbal communication, participant reactions, and notable group interactions that she had documented throughout the process. These transcripts were imported into NVivo, then coded using a mixed deductive-inductive coding approach, combining theory and grounded in participant narratives (Riddick & Russell, 2008).

First, a deductive coding scheme was developed by the moderator

before analyzing the transcripts, based on studies on the psychological benefits of nature (Kuo, 2015, mental health recovery through urban nature (Birch et al., 2020) informed content on emotional and behavioral health. Key constructs including nature connectedness (Ibes et al., 2021), place attachment (Scannell & Gifford, 2017), and social cohesion (Macaulay et al., 2022; van den Berg et al., 2017) shaped variables around identity, belonging, and community. Variables related to spatial and temporal experiences of nature (Bell et al., 2017), ecological quality (Dallimer et al., 2014), and distinctions between types of urban nature (Allard-Poesi & Massu, 2023) were central to exploring participants' relationships to place. Demographic and cultural variation (Bixler & Floyd, 1997), structural barriers, and lived experiences of marginalization were also considered. Reviews (Bratman et al., 2019; Frumkin et al., 2017; Hartig et al., 2014; Marselle et al., 2021) provided conceptual grounding, while context-specific work on forested environments (Wolf et al., 2020) helped tailor factors related to the study location.

Next, inductive codes were added, refined through iterative engagement with the data by both the notetaker and moderators. This process allowed for capturing emergent ideas, experiences, and group dynamics expressed by participants, following the approach outlined by Riddick and Russell (2008). Transcripts were coded to reflect both predetermined concepts and the new themes arising from the inductive coding scheme, capturing the depth and diversity of participant experiences.

The moderator and notetaker collaboratively coded one focus group session's transcript, comparing interpretations in reliability and correlation checks (Krueger & Casey, 2009; Tolley et al., 2016). The moderator applied both coding schemes to all transcripts, while the notetaker focused on the inductive coding scheme to capture new ideas. Whether contributing through a focus group or an individual interview, each participant was treated as a single analytic unit, and themes were identified based on the presence of ideas across participants rather than the frequency of mentions within a given session. Codes were organized into analytic categories (e.g., Amplifying Disparities) based on the number of references and agreement, and these categories were interpreted in relation to the three propositions developed prior to data collection. Key themes and standout quotes were synthesized into a narrative and ultimately yielded a diagram of results and table of themes and analytic categories to present (Tolley et al., 2016; Tomasso et al., 2021). The data were as organized into the current structure for the presentation of results. Table 1 illustrates an example of how raw excerpts were coded and subsequently grouped into themes during the analytic process.

2.5. Positionality statement

Researcher positionality was considered throughout the analysis. The moderator did not share all key sociodemographic characteristics with participants, particularly in regards to the variety of racial/ethnic groups represented. These differences may have shaped interactions with participants and the interpretation of the data; reflexive practices

were therefore used to examine these influences during both data collection and analysis.

To critically engage with potential interpretive bias, the moderator engaged in regular discussions with a diverse research team to check interpretations, establish reliability, and promote reflexivity. Practices like member checking, with the notetaker reading a summary of what was said at the end of discussions to participants to offer an opportunity for clarification or addition, were also used to mitigate biased interpretations (Birt et al., 2016). To further strengthen rigor and minimize this type of implicit bias, the moderator also completed courses in focus group facilitation, qualitative interviewing, and seminars on implicit bias, trauma-informed practices, and anti-racism.

Conducting the focus groups over Zoom may have also reduced some power differentials by making participation more comfortable. Importantly, participants appeared to feel comfortable diverging from the researchers' assumptions. Described later in the results, for instance, Proposition 2 was not supported in the way that is expected, which suggested participants felt able to speak freely and authentically. Throughout the process, questions were approached objectively, with researchers engaging reflexively during analysis, and maintaining checks and balances on interpretations with the support of the entire research team.

3. Results

3.1. Participant characteristics

Twenty-one marginalized community members living in Metro Vancouver, a highly diverse, nature-proximate region (~47% visible minorities; nearly 40% immigrants), offering immediate access to mountains, forests, and ocean, participated in the study (City of Vancouver, 2025; Statistics Canada, 2021). As outlined in Table 3, two focus groups and one semi-structured interview were guided on low SES experiences (group sizes of four and eight) with one focus group including six POC participants out of eight. The remaining two semi-structured interviews and one focus group (six participants) centered on POC experiences.

The average age of participants was 50, with 20% of the participants being over 60 and an average of 23 years spent in Metro Vancouver. Most respondents were female (71.4%) and lived in urban settings (76.2%) (Table 2). There was a wide breadth of education level, socioeconomic class, race and ethnicity, and immigration status represented.

3.2. Proposition 1. marginalized populations perceive natural spaces as beneficial for psychological wellbeing

Functioning as the foundational premise for subsequent propositions, P1 thematically followed participants' descriptions of natural space as offering psychological wellbeing benefits. Although the script did not explicitly ask for comparison of natural and built spaces, many framed their experiences of nature relative to predominantly built

Table 1
Examples of inductive/deductive coding techniques.

Raw Quote	Initial Code	Code Type	Analytic Category	Overarching Theme (Proposition)
"I get more out of being in a very rustic, rural environment. The psychological reward is probably greater." (A)	Preference for predominantly natural spaces	Deductive	Preference for predominantly natural spaces	Perceived Impact by Naturalness of Environments (P1)
"I don't really like being totally alone in nature because I'm worried about predators, whether they are human, bears, or cougars." (D)	Preference for mixed environments	Inductive	Preference for mixed environments	Perceived Impact by Naturalness of Environments (P1)
"I do think the people in my network who are in a higher socioeconomic category interact with nature in ways that I can't." (N)	SES Disparities	Deductive	Amplifying Disparities	Moderation by Sociodemographic Variables (P2)
"If a child hasn't been exposed to a lot of nature ... they wouldn't feel that connected to it as they got older." (N)	Childhood Connection	Inductive	Past Experiences	Connections to Natural Spaces (P3)

Table 2

Demographics of the sample (N = 21).

Characteristic	N = 21
Age, median (min, max)	50 (20, 68)
Years in Metro Vancouver, median (IQR)	23 (37)
Woman, n (%)	15 (71.4)
Man, n (%)	4 (19.1)
Other, n (%)	2 (9.5)
Urbanity, n (%)	
Urban	16 (76.2)
Suburban	5 (23.8)
Educational Attainment (Highest Degree), n (%)	
Below a bachelor's degree	10 (47.6)
Bachelor's degree or higher	11 (52.4)
Socioeconomic Class, n (%)	
Lower Class	3 (14.3)
Working Class	6 (28.6)
Middle Class	11 (52.4)
Upper-Middle Class	1 (4.8)
Upper Class	0 (0)
Race and Ethnicity, n (%) ^a	
White	6 (28.6)
South Asian (e.g., East Indian, Pakistani, Sri Lankan)	3 (14.3)
Chinese	8 (38.1)
Arab	1 (4.8)
Latin American	2 (9.5)
Southeast Asian (e.g., Vietnamese, Cambodian, Laotian, Thai)	1 (4.8)
Japanese	1 (4.8)
Other	1 (4.8)
Immigration Status, n (%)	
Canadian Citizen	12 (57.1)
Permanent Resident	7 (33.3)
Temporary Resident	2 (9.5)

^a Sums to greater than 100, multiple options allowed, IQR () is the middle 50% of the data.

spaces. These comparisons emerged inductively throughout the discussions and provided important context for understanding how participants evaluated spaces. Preferences were birthed from safety, accessibility and connection-based values. Participants posited specific benefits of natural space thematically organized in [Table 4](#).

3.2.1. Perceived impact by naturalness of environments

Many participants agreed that spending time in more natural settings led to more perceived wellbeing benefits than more built areas. Reporting that they “get more out of being in a very rustic, rural environment” and have “higher level of good feelings” (Participant J) as the “psychological reward is probably greater” (Participant A) compared to more built environments.

However, most participants emphasized that environments that balanced built and natural elements were both preferred and held the greatest benefit. Participants described wanting restoration without sacrificing safety or accessibility, still being surrounded by “other friendly people” (Participant D) and convenience of “be [ing] close to urban centers” (Participant M) found in built settings. “Hav [ing] a home, your refrigerator [laughs], and responsibilities” and not being “in the middle of nowhere” uses less of one's executive functioning” and can just “go and take the SkyTrain to a park, and walk around for an hour” (Participant C). While some participants expressed that the perceived “mechanisms [behind] nature for mental health is the solitude” (Participant K), many others disagreed, saying that being “totally alone” (Participant D) heightened concerns about both human and animal threats, inhibiting their ability to benefit from very natural spaces.

Still, most participants said built environments inhibited the “maximum benefit [of natural spaces] versus going into forest or green space” (Participant G). However, one participant felt that they “still [got] the same feelings from [built spaces]” and did not “believe there's any difference [in wellbeing benefits between more natural and built spaces]” (Participant E).

Table 3

Description of participants.

Focus Group Session Date and Theme	Participants Present (ID)	Description
December 14, 2023; Low-SES	Participant A	39-year-old Latin American and white nonbinary person, working class, no bachelor's degree, from Vancouver
	Participant B	32-year-old Chinese woman, upper-middle class, no bachelor's degree, from Vancouver
	Participant C	49-year-old White man, low-income, bachelor's degree, disabled, Canadian citizen living in Vancouver for 10 years
	Participant D	68-year-old white woman, middle class, no bachelor's degree, grew up in Vancouver
January 18, 2024; POC	Participant E	23-year-old South Asian man from Vancouver, middle class, bachelor's degree
	Participant F	68-year-old Chinese man, Canadian citizen, middle class, no bachelor's degree, grew up in Vancouver
	Participant G	31-year-old Japanese and Latin American woman, middle class, bachelor's degree, grew up in Vancouver
	Participant H	39-year-old Arab, single mother, working class, master's degree, living for 4 years in Vancouver
	Participant I	54-year-old Chinese woman, low-income, bachelor's degree, permanent resident, 15 years in Vancouver
	Participant J	61-year-old Chinese woman, working class, bachelor's degree, living in Vancouver for 47 years
	Participant K	66-year-old White woman, low-income, no bachelor's degree, Canadian citizen
	Participant L	63-year-old Chinese woman, middle class, bachelor's degree, living in Vancouver for 33 years
	Participant M	35-year-old Taiwanese man, middle class, master's degree in wildlife biology field, grew up in Vancouver
	Participant N	57-year-old white woman, working class, living in Vancouver for 55 years
	Participant O	70-year-old Chinese woman, permanent resident, no bachelor's degree, low-income, living in Vancouver for 35 years
April 25, 2024; POC	Participant P	63-year-old White woman, Canadian citizen, middle class
	Participant Q	29-year-old South Asian temporary resident, working class, master's degree
	Participant R	20-year-old Southeast Asian nonbinary person, low-income, lived in Vancouver for 2 years
	Participant S	33-year-old South Asian woman, middle class, master's degree, living in Vancouver for 6 years
	Participant T	20-year-old Chinese woman from Vancouver, middle class, no bachelor's degree
	Participant U	57-year-old White woman, working class

3.2.2. Perceived psychological wellbeing benefits from natural space

Participants described various psychological wellbeing benefits they received from natural space, citing cognitive, emotional, and spiritual dimensions.

Most participants emphasized that natural spaces were “good for [their] mental health,” (Participant H) describing how being in natural spaces helped them feel “lighter, happier, and more fulfilled,” (Participant G), reduce the effect of “stressful situation [s]” (Participant E), and improve focus. Several participants described affective (i.e., mood) benefits of natural space exposure, such as improved positive mood and

Table 4
Themes of proposition 1.

Themes	Analytic Categories (Number of Participants in Agreement ^a)	Examples/Excerpt (Participant ID)
<u>Perceived Impact by Naturalness of Environments</u>	Preference for predominantly natural spaces (4): Participants discussed that they derived more benefits from predominantly natural spaces.	"I get more out of being in a very rustic, rural environment. The psychological reward is probably greater." (A)
	Preference for a mixed space (9): Participants discussed a preference for, and greatest benefit from, spaces that had a balance of naturalness and built aspect.	"I don't really like being totally alone in nature because I'm worried about predators, whether they are human, bears, or cougars." (D)
	No preference (1): Participants discussed that the benefits of natural spaces and built spaces were equivalent.	"I'm still getting the same feelings from [built spaces], and in terms of the health benefits, 30 min of walking is still 30 min of walking. I don't believe there's any difference [in wellbeing benefits between more natural and more built spaces]" (E)
<u>Perceived Psychological Wellbeing Benefits from Natural Space</u>	Cognitive and Emotional Improvements (17): Underlying mental health changes leading to wellbeing benefits.	"There's not a lot of space for [ruminating] if I'm walking through the forest." (N)
	Spiritual Connection (6): Spiritual fulfilment and mindfulness leading to greater connection with natural spaces.	"Just being out there watching these trees that are hundreds of years old puts things in perspective to stay humble" (M)

^a Can sum to greater to or less than n = 21 per theme, as participants could agree with several analytic categories or none.

reduction in rumination, noting that, "there's not a lot of space for [ruminating (callback to phrase used before)] if I'm walking through the forest" (Participant N).

Multiple participants described how a simple nature exposure was recommended by doctors or mental health practitioners during difficult times to improve psychological wellbeing. These intentional exposures were described as making "a huge difference" (Participant H) during challenging circumstances, including depression, postpartum challenges, and social isolation during the COVID-19 pandemic. Beyond formal recommendations, many participants described seeking out natural spaces as a tool for "maintaining [their] mental wellbeing" (Participant R). As one person recalled, natural space exposure worked as a tool to "feel better" and less "overwhelmed by social media" (Participant B) when struggling with depression.

When analyzing nature's wellbeing impacts alongside the widely studied and less stigmatized domain of physical health, participants mentioned "the physical and mental health benefits" of a "walk for exercise", noting that, "It wasn't about how many steps [they] took, it was just about going [out] and convening with nature" (Participant K). Connected to this sentiment, a few participants described spiritual connections and common wellbeing influences like awe, purpose, and belonging in nature putting "things in perspective to stay humble", making "modern worries ... nothing" and contributing to "the mental part" of natural space exposure (Participant M).

With P1 establishing the foundational impacts of natural space or built, while also revealing important moderating factors like safety, ecological quality, and accessibility, deeper analysis was presented in P2

and P3.

3.3. Proposition 2: marginalized populations report that factors related to their sociodemographic identity influence natural space impacts psychological wellbeing

P2 explored how participants perceived their SES, race, and ethnicity shaping the link between natural space exposure and psychological wellbeing. These perceptions were organized under the overarching theme of Moderation by Sociodemographic Variables, comprising four interrelated analytic categories emerged, with similar structural patterns across SES and ethnicity groups, but often with different expression, reasonings, or contextual factors and outcomes (Table 5).

3.3.1. Amplifying Disparities

The first theme, Amplifying Disparities, captured participants' accounts of natural spaces reflecting and, at times, intensifying existing social inequalities.

Low-SES participants emphasized economic barriers that limited their access to and quality of experience of natural space, expressing that those "who are in a higher socioeconomic category ... can interact with nature in ways that [I] don't or can't" (Participant N). These constraints led to perceptions of health and wellbeing benefits of natural spaces as unequally distributed, with one participant emphasizing that this inequity is shaped from childhood, with early access "carry [ing] on into adulthood" (Participant T). The disparity amplified existing inequities in this manner, perpetuating a systemic issue. In addition to access, participants described how the expense of outdoor activities—mentioning boating and heli-skiing—facilitates social and professional networking and "useful connections" (Participant N), since you, "tend to meet a lot of other people who are doing those things" (Participant N), with material and social consequence and class-based advantages reinforced.

POC participants described parallel but distinct processes. Rather than focusing on cost primarily, they described natural spaces as amplifying concerns of safety, representation, and belonging. One participant described a trip in "the deep South [in the U.S.]" and how when he "was going in nature by [himself], [he was] more aware of my surroundings just because it's not a place with a lot of diversity" (Participant M).

Cultural differences in communication and representation were mentioned as subtler ways those of diverse race and ethnic backgrounds felt excluded. A participant working in an outdoor field said: "It was very rare for people of color in general ... to be studying in this field. I wouldn't say I feel alone, but sometimes I do feel like I have to put away the Taiwanese side of me to better connect with the Western community" (Participant M). However, participants said, "also a question of accessibility" (Participants S) and pointed to affordability.

Overall, these accounts suggest that natural spaces do not operate as socially neutral environments; instead, they can mirror broader structural inequities.

3.3.2. Distinct deeper connection

The second theme, Distinct Deeper Connection, described a potentially compensatory or equigenic relationship to natural spaces that was shaped by necessity, culture, lived experience, resourcefulness, or integration into daily life in ways that participants said more advantaged groups might not be able to replicate.

Several low-SES participants described developing deeper, "more grounded", or more embodied relationships with natural spaces through necessity and everyday interaction rather than leisure or recreation. Gardening due to "food costs [that are crazy]" (Participant N) or relying on walking or cycling for transportation, fostered a sense of physical and mental connection with the environment. As one participant reflected, "Someone who was in a higher socioeconomic bubble wouldn't have that experience with the plant pot full of lettuce and get the enjoyment that I'm getting from nature" (Participant N). Active transport out of

Table 5
Themes of proposition 2.

Themes:	Analytic Categories (Number of Low-SES Participants in Agreement, Number of POC Participants in Agreement ^a)	Examples/Excerpt (Participant ID)
Moderation by Sociodemographic Variables	Amplifying Disparities (8, 3): Limited access and affordability (especially of activities) and inability to connect with nature in childhood due to income characterized low-SES experiences, while concerns related to safety, belonging, limited access, and negative experiences like discrimination shaped POC natural space exposure. These themes illustrated how existing economic and social disparities were reflected and, at times, heightened in natural spaces.	"I do think the people who are in my network, who are in a higher socioeconomic category, they do interact with nature, or they can interact with nature in ways that I don't or can't." (N) "I actually just came back from the deep South [in the U.S.], and when I was going in nature by myself, I [was] more aware of my surroundings just because it's not a place with a lot of diversity." (M)
	Distinct Deeper Connection (7, 3): A connection rooted in necessity, resourcefulness, and/or accessibility for those of low-SES and ethnically rooted traditions for participants of color. These connections were discussed as existing differently to advantaged groups' connection in a way that felt uniquely meaningful and beneficial.	"But I don't know, maybe someone who was in a higher socioeconomic bubble wouldn't have that experience with the plant pot full of lettuce and get the enjoyment that I'm getting from nature in that way." (N) "I do think for those who might have a practice or ritual that's tied with certain aspects of nature, they might be more grateful towards it. They might have a different level of respect towards certain aspects of it." (G) "I don't think it makes any difference at all what your socioeconomic class is or your education attainments to how you value nature and use it—or not use it ... I think it has to do with whether they like nature or not." (U) "I feel like the color of my skin has no relationship with [wellbeing benefit from natural spaces]." (I)
	Canvas (7, 6): Participants determine natural space's benefit is shaped by an individual's own experience, values, and backgrounds, rather than their SES, race, or ethnicity.	"In hiking groups that I've been in there have been people with a lot of money, showing up in nice cars at the trailhead. But we're all twisting our ankles the same way. We're all going up this mountain and sweating the same." (K)
	Equalizer (3, 0): Natural space offers universal or compensatory benefits regardless of sociodemographic identity.	

^a Can sum to greater to or less than n = 21 per theme, as participants could agree with several analytic categories or none.

necessity meant having “their feet ... on the ground” physically “feeling the earth”, emphasizing that “the people that are driving by in their fancy cars, I don't think they are connected.” (Participant K). At the beach, there was a sense of embodiment and observing natural elements up close, illustrated by a participant comparing an experience “feeling

[ing] more grounded being on the sand” compared to those with higher SES being “up on their patio looking at it ... not touching the real world” while “seeing the same view” of the ocean (Participant K).

Among POC participants, a few described a deeply culturally rooted natural space connection, shaped by collective histories and spiritual practices. In this unique depth of connection to natural spaces, However, compared to the low-SES participants, this connection appeared non-directional and complex and reflected considerable variability across groups and individuals. One participant shared a spiritual practice they did to help feel safer, not necessarily increasing wellbeing, in unfamiliar natural spaces, “before I go in to do my fieldwork, I would say in my head, either in Mandarin or Japanese, something like, “Oh, I'm sorry to bother you. I'm entering now.” Some sort of respect for the nature out there ... Something I don't think white folks would do ... to thank a piece of land before you go in ... makes me feel safer” (Participant M). Others reflected on how “those who might have a practice or ritual that's tied with certain aspects of nature ... might be more grateful towards it ... have a different level of respect” (Participant G). Another agreed, exploring connection developed by ancestral and cultural influences, “I appreciate all of these different stories from different cultures, and what different aspects of nature means to them” (Participant G). These accounts suggest that cultural histories can shape how natural spaces are interpreted and experienced, though varying widely across individuals.

3.3.3. *Canvas*

The theme of Canvas captured resistance towards sociodemographic-based explanations. Many participants, particularly the POC groups, described the idea that natural spaces reflect and are shaped by individual preferences, life experiences, and personal connections rather than direct influence by sociodemographic variables, a contrast to P2 One low-SES participant agreed, saying “I don't think it makes any difference at all what your socioeconomic class is or your education attainment ... for how you value nature and use it. I think it has to do with whether [people] like nature or not” (Participant U). Similarly, a POC participant noted what many participants of color made clear: “The color of [one's] skin has no relationship with [wellbeing benefit from natural spaces]” (Participant I). Their reflections redirected attention to the moderators related to connections to and perceptions of natural spaces, focusing on the impact of “the environments that [they] were raised or brought up in” (Participant E), “[their] background, [their] childhood, [and] what [they] did as a kid” (Participant H), simultaneously exploring Proposition 2 and 3. Similarly, one individual said, “When I go to Japan, the buildings, the environment, and a lot of parks are designed, not natural. I like visiting Nitobe [Garden in Vancouver] because it's a Japanese garden. Many of the elements are designed by my culture (i.e., similar to Chinese culture). It just resonates inside ... That's a part of why I enjoy nature. I don't know how to describe that feeling, but whenever I see these [designed spaces] I just feel a different feeling” (Participant I).

A few low-SES participants expressed that benefits of natural space are driven by initiative and personal desire regardless of SES, with one saying that individuals can “borrow [gear] and make [outdoor recreation] happen” (Participant U). Others discussed structural asymmetry in options for exposure for natural space, expressing that “wealthier people, those with an advantage, they can just choose not to use that advantage and [still] do what we do. Whereas [those with low SES] don't have a choice” (Participant B) highlighting broader inequity.

3.3.4. *Equalizer*

A key divergence between the SES and the race and ethnicity discussions emerged around the Equalizer theme, which was only present in SES-related narratives. For POC participants, natural space did not neutralize concerns of representation, safety, and cultural barriers.

Here, natural space was described as offering universal or slightly compensatory benefits to those from lower-SES backgrounds. One participant said, “In hiking groups that I've been in there have been

people with a lot of money, showing up in nice cars at the trailhead. But we're all twisting our ankles the same way. We're all going up this mountain and sweating the same. It makes for common denominator, right? The natural world" (Participant K). Participants reported meeting others from diverse SES backgrounds or building professional connections through shared natural space experiences, a way to promote upward social mobility and expanding social networks.

3.4. Proposition 3: marginalized populations report that the relationship between natural space and wellbeing is influenced by individual connections to and perceptions of these spaces, beyond their sociodemographic identity

The previous proposition, P2, revealed that natural space functions as neither as universally beneficial nor uniformly exclusionary environments, diving into the nuances. At the same time, the resistance to sociodemographic-based explanations in the Canvas complicates simplistic narratives of disadvantage, pointing toward the importance of individual histories, experiential knowledge, and attachment. In P3, these individualized perceptions of and connections to natural spaces were examined as influencing perceived benefits particularly focusing on place attachment, their familial (current or of origin) view of natural space and upbringing, and geographic context (Table 6). This was inductive and exploratory research.

Within this proposition, we distinguish between perceptions and connections to natural space. Perceptions are cognitive beliefs shaped by

Table 6
Themes of proposition 3.

Themes	Analytic Categories (Number of Participants in Agreement ^a)	Examples/Excerpt (Participant ID)
Perceptions of Natural Space	Hometown Nature (12): The impact that hometown types of natural spaces and certain familiarities have on perceptions of natural space.	"As I said, where I grew up it wasn't very easy to be exposed to nature in terms of what I want as a person. So if I had grown up here, I think it would have been different, my perspective would have been different, what I like would have been different." (R)
	Familial Views: (11): How an individual's family's views of outdoor recreation and natural space impact their perception of natural space.	"Actually, family is a bigger factor, I would say. Because if we were brought up by two sporty parents, I think I would be very sporty. Because you have no choice. I might have to jump at one year old." (L)
Connections to Natural Spaces	Past Experiences (6): The impact of childhood and recent experiences in natural spaces on an individual's connection to natural spaces.	"If a child hasn't been exposed to a lot of nature—touched it and been immersed in it—then they wouldn't feel that connected to it as they got older just because they haven't really been exposed to it" (N)
	Education As Relating Nature (6): How information, exposure, and education about ecology, areas, and natural processes impact an individual's connection to natural space.	"It's important to have some knowledge about the nature to feel more connected to it. If you do not know what the nature consists of or how it works, you won't really feel like that connectivity." (R)
	Geography and Accessibility (11): How natural space availability, accessibility and quality in participants' city affects individual's connections to the concept.	"I also feel like here in Vancouver we have that privilege to be so close to nature at a low cost or maybe at no cost." (R)

^a Can sum to greater to or less than $n = 21$ per theme, as participants could agree with several analytic categories or none.

context (e.g., upbringing, culture, or environment) about what nature is and its value (Bayne et al., 2019). In contrast, connections are emotional or relational, formed through direct experiences with nature, often leading to attachment or environmental identity (Clayton, 2003; Clayton et al., 2021). While access influences both, participants emphasized emotional connections to their local geographies, so this theme was grouped under connection to natural space.

3.4.1. Perceptions of natural space

Participants frequently reflected on how the environments in which they were raised shaped their expectations, preferences, and comfort in natural spaces, reflecting that "what [they're] used to or where [they] came from" (Participant J) impacted the relationship. As one participant explained, growing up "in a very small town on Vancouver Island" limited exposure since "there were no programs and volunteers ... you weren't introduced to [natural space]" (Participant P). Others similarly described how if they had grown up with access to different natural spaces their "perspective would have been different, what [they] like would have been different," (Participant R) or "if you enjoy the desert, then you enjoy it more than the ocean. It depends on what you're used to, or where you came from" (Participant J), with one specifying "just being close to nature is important or enough for me, but if I had already lived here [in Vancouver], then maybe it would have been not enough" (Participant R). The idea that the "environment that [they've] been brought up in" shaped the "formation of a unique and deep connection to nature" (Participant E) was echoed throughout the interviews.

Similarly, participants highlighted their families as contributing to shaping their early perceptions of natural spaces and whether natural space became a regular part of their lives. When discussing the impact of hometown nature, one participant stated that "family is a bigger factor, I would say," explaining that if they were, "brought up by two sporty parents, I think I would be very sporty. Because you have no choice." (Participant L).

Participants' narratives indicate that perceptions of natural space, by way of familial modelling and hometown landscapes lead to differences in benefits.

3.4.2. Connections to natural spaces

In addition to hometown nature and familial connection, several participants observed that connections to natural spaces were built through childhood and current exposure, and direct and personal experiences in natural spaces.

Participants expressed that "what [they] did as a kid [in natural spaces] definitely impacts what [they] do in the future and how [they] enjoy activities" (Participant H), exploring a larger theme of past experiences shaping their connections to natural space. Several participants contrasted their own experiences with those of others who had greater early exposure. One participant shared, "For my son, hiking is no problem [because] he started doing it when he was younger", while reflecting that without "that experience when [he was] young," hiking continued to feel more challenging (Participant I). Many participants agreed with the sentiment expressed by one, saying, "if a child hasn't been exposed to a lot of nature—touched it and been immersed in it—then they wouldn't feel that connected to it as they got older just because they haven't really been exposed to it." (Participant N). For many participants, being "exposed to [natural spaces] at an early age" built connection, comfort, and confidence in natural spaces that "might carry on into adulthood" (Participant T). Those without childhood exposure felt less "connected ... they got older" (Participant I) making natural spaces feel inaccessible and a source of possible discomfort.

However, participants also offered important nuance, highlighting that connection to natural space is not solely contingent on childhood experience. Many expressed that eco-education, whether through formal or self-directed learning, such as joining naturalist trips to "just follow along and learn things" (Participant K), or experiential exposure, such as "listen [ing] to the birds and identify [ing] them by species" gave them a

“better awareness of the surrounds” (Participant M), helping them relate to and deepen their connection with natural spaces in adulthood. Several participants emphasized that, “it’s important to have some knowledge about the nature to feel more connected to it,” whereas “if you do not know what the nature consists of or how it works, you won’t really feel like that connectivity” (Participant R).

Most participants expressed gratitude for and attached to natural spaces where they lived in Metro Vancouver. Participants described that they feel “very, very fortunate ... to have that really quick access to green space” and “super lucky to live in a place with such a variety” (Participant M) of natural spaces fostering meaningful everyday natural space interactions. Many emphasized “the privilege to be so close to nature at a low cost or maybe at no cost” was “not the case everywhere” (Participant R) and that “not so many people have this opportunity (Participant E mouths ‘yeah’ while nodding head)” (Participant H). They almost all agreed that there is an equilibrium effect of living in Vancouver. Expressing how “absolutely fortunate [they] are to have such beautiful, green, and accessible spaces” (Participant A), that their “mental health is really better [here] compared with another city” (Participant I), and reflecting that geography can at times serve as an equalizer; that is, fostering a consistent connection with natural spaces that supports psychological wellbeing regardless of marginalized identity. Proposition 3 demonstrated that the natural space-wellbeing chain is more individualized than often reflected in past scientific knowledge. While sociodemographic identities shape structural access and experiences of exclusion (P2), perceptions of and connections to spaces influence benefits on another level.

4. Discussion

4.1. Summary of findings

This study examined how marginalized community members perceive the psychological wellbeing benefits of natural spaces. Beyond agreement that natural space offers meaningful psychological wellbeing benefits, participants discussed benefits shaped by both sociodemographic factors and individual experiences, including perceptions of and connections to natural space.

4.1.1. Diagram of moderating factors of natural space and psychological wellbeing

To capture these ideas of multifaceted factors, we developed a diagram of results using the analytic categories or codes of the focus groups (Fig. 1), which visually displays participants’ perceptions of the direct relationship between the benefits of exposure to natural space (P1), defined in the orange box below as use of natural space, access to natural space, and naturalness level of exposure (i.e., if the setting was predominantly built versus natural), and psychological wellbeing (green box), with perceived effects differing based on two categories of moderators.

Following the frameworks of Hartig et al. (2014) and Marselle et al. (2021), we identified “Effect Modifiers 1” (P2; blue box) as the

contextual, structural, and sociocultural moderators (i.e., SES, race, ethnicity). Second, we included “Effect Modifiers 2” (P3; purple box) to reflect individual-level moderators such as perceptions of and connections to natural space. In addition, we found that sociodemographic variables sometimes interacted with the individual-level factors (e.g., SES impacting whether a family can afford childhood natural space programming); represented by the black interaction term.

4.1.2. Proposition 1: marginalized populations perceive natural spaces as beneficial for psychological wellbeing

The findings from Proposition 1 suggest that participants widely perceived natural spaces as beneficial for psychological wellbeing, describing cognitive (e.g., reduced rumination, improved clarity), affective (e.g., stress reduction, mood enhancement), and spiritual (e.g., perspective, humility) dimensions of benefits. Although the interview guide focused on participants’ experiences of natural spaces rather than explicitly asking them to compare natural and built environments, participants frequently described these benefits relative to predominantly built settings. This suggests that for many participants the value of natural space was understood relationally or with a reference point of built spaces. The findings of preference align with a substantial body of research demonstrating the multidimensional psychological benefits of natural space (Anderson et al., 2018; Bratman et al., 2019; Dadvand et al., 2019; Hartig et al., 1997; Kaplan & Kaplan, 1989; Keltner, 2023; Markevych et al., 2017; Ulrich, 1983; White et al., 2013).

Participants also emphasized that benefits were context dependent, reflecting not just the presence of nature but also the nuances of the degree and character of naturalness. Participants’ preference for hybrid urban-natural environments highlights the importance of designing natural spaces that are not only ecologically rich but also physically and socially accessible. They further underscore the risks of universalizing natural space interventions, consistent with findings by Jiang et al. (2014), Jennings and Johnson Gaither (2015), Rigolon et al. (2021), and Taylor (2018), who critique the assumption that natural spaces are universally beneficial and point to the ways in which race, class, and cultural identity shape how individuals perceive and experience natural spaces. These insights reaffirm the importance of researching individual-level differences between perceived and realized benefits, as a park that is simply ecologically rich but perceived as unsafe, exclusionary or disconnected from practical use may produce attenuated outcomes and therefore is an insufficient metric on its own.

4.1.3. Proposition 2: marginalized populations report that factors related to their sociodemographic identity influence how natural space impacts psychological wellbeing

Proposition 2 was supported by most of the low-SES participants and a few of the POC participants who described their marginalized identity as shaping how they accessed, perceived, and experienced natural spaces. In our findings, these aspects of identity were not just influential, but could further dictate how meaningful access and use of natural space was, connecting to Shores et al. (2007) and Rigolon (2016)’s evaluation of unequal distribution of resources required to engage with these spaces

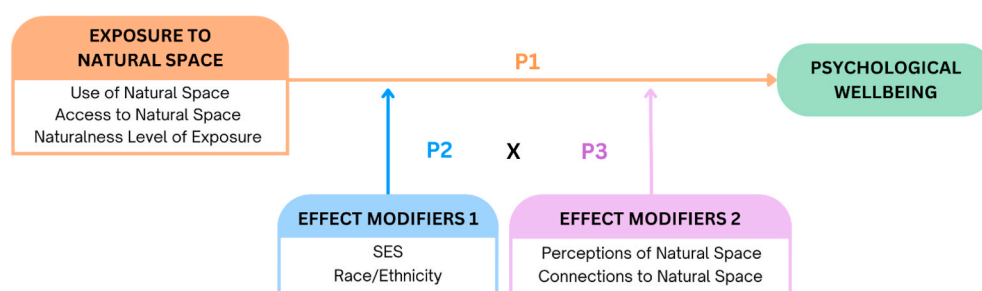


Fig. 1. Visual representation of propositions.

(e.g., transportation, time flexibility, childcare, social networks, cultural familiarity, and perceived belonging).

This finding calls for interventions that address not only access but also affordability, safety, cultural representations, and social inclusion so as to not risk reinforcing disparities already experienced by marginalized communities. Prior studies similarly note that natural space is not universally restorative or consistently perceived as neutral, welcoming, or safe (Byrne, 2012; Byrne and Wolch, 2009; Jelks et al., 2021; Lopez et al., 2021; Quinton et al., 2022; Rigolon et al., 2022b).

Additionally, participants' distinct deeper connections to natural space are consistent with the equigenic hypothesis (Triguero-Mas, Gidlow, et al., 2017; Mitchell et al., 2015; Wells & Evans, 2003). Among POC participants, this connection appeared non-directional and complex and was highly individualized. This variability between and within groups challenges earlier work assuming inherent or fixed environmental preferences among racial or cultural groups, such as Kaplan and Talbot (1988). Further and more empirical consideration of a distinctly deeper connection can be conducted to determine how consistently it is present and highlight the importance of individuals articulating their own unique meanings and connections to natural spaces, perhaps co-creating alongside planners for culturally sensitive designs.

With the discussion of natural spaces as an equalizer, low-SES participants suggested that natural spaces may also serve as a tool for promoting upward social mobility and expanding social networks, particularly for individuals who may lack traditional access to such opportunities through work or education. This finding connects with prior research as both our evidence and literature suggests that public natural spaces can foster social cohesion across a variety of people, in a way that can potentially enhance wellbeing (Peters et al., 2010; Jennings & Bamkole, 2019). However, the absence of this theme among POC participants suggests that the social affordances of natural space are unevenly distributed.

This leads to the conclusion that there is a coexistence of amplified disparities, potentially compensatory experiences, and individualized connections in natural spaces underscores the need for pluralistic approaches to interventions that look to support marginalized community member's psychological wellbeing.

4.1.4. Proposition 3: marginalized populations report that the relationship between natural space and wellbeing is influenced by individual connections to and perceptions of these spaces, beyond their sociodemographic identity

Proposition 3 took the analytical lens from structural positioning to individual-level moderators examining how perceptions of and connections to natural space shape the psychological benefits derived from natural spaces. This was an exploratory discussion, revealing domains for further examination.

Participants' accounts suggest that familiarity, early-life exposure, and ongoing opportunities to engage with natural spaces shape whether natural space exposure feels comforting, meaningful, and beneficial. These findings reinforce literature around place attachment shaping environmental responses, in addition to the life course, shaping bonds (Bell et al., 2017; Christens et al., 2025; Elsadek et al., 2019; Scannell & Gifford, 2017). Knowledge acquisition was also pointed to as facilitating greater connection and increase the perceived benefits of natural space, even for those who lacked access or exposure during their youth, illuminated implications for intervention design. Aligning with research on life-course development of environmental identity, these findings suggest that opportunities to learn about and interact with natural space can expand who connects with and benefits from natural space exposure (Ardoin, 2006; Chawla, 1999; Clayton et al., 2021; Kudryavtsev et al., 2011).

4.2. Contribution

Considering the findings together, our findings build on the predominantly quantitative literature on natural space and health in three

ways. First, we build on epidemiological study findings suggesting that marginalized populations may experience disproportionately greater health benefits from natural spaces, providing insight into the lived processes that may contribute to these equigenic effects. Participants described natural spaces as providing meaningful opportunities for restoration, stress reduction, and connection, particularly in contexts where other restorative resources were limited; however, these benefits were shaped by practical and social conditions such as convenience, safety, and belonging.

Second, these findings extend research that has traditionally examined sociodemographic characteristics such as SES, race, and ethnicity as control variables or predictors in studies of differential exposure and health outcomes by demonstrating how these identities are experienced and interpreted, and how they interact to shape experiences of natural spaces. Rather than functioning as fixed determinants, participants described sociodemographic factors as working in relation with their past experiences, socioecological contexts, and access to natural spaces in a dynamic manner.

Third, this study expands existing approaches using interventions or spatial predictors by highlighting experiential pathways through which natural spaces may influence wellbeing. Beyond proximity or availability of natural space, participants emphasized the importance of childhood experiences, familial views, cultural relationships, past attachments and connections, and perceptions of safety and convenience. Overall, these findings suggest that the relationship between natural space and psychological wellbeing is shaped through interconnected structural and experiential processes that are often difficult to capture through population-level indicators alone.

4.3. Limitations and future directions

One limitation of this study is the specificity of its regional context. Participants were recruited from a city with notably high access to diverse natural spaces, which may not reflect the experiences of individuals living in more densely urbanized or nature-scarce areas. While this context allowed participants to speak about a wide range of natural space interactions, it may limit generalizability to populations with less access. Nevertheless, the cultural and SES diversity within the city's natural spaces allowed for nuanced insights into how various forms of naturalness are perceived and valued. Future studies might consider including participants from different geographic regions to explore a broader range of types of naturalness or interactions (Beil & Hanes, 2013; Li et al., 2023; Nieuwenhuijsen et al., 2014; Sang et al., 2016).

Another limitation is the use of online platforms (i.e., Zoom) for conducting focus groups and interviews. While virtual methods allowed for greater accessibility, the methods may have influenced participants' willingness to share openly due to concerns around digital privacy or the lack of in-person rapport. Despite this, participants engaged meaningfully and provided rich narratives, suggesting that virtual methodologies can still yield high-quality qualitative data when facilitated with care and sensitivity (Archibald et al., 2019). Still, future research may consider hybrid or in-person methods (e.g., walking interview, photo-voice) to build intimacy and trust for sensitive or identity-based topics (Archibald et al., 2019; Catalani & Minkler, 2010; Evans & Jones, 2011).

Moreover, this study also focused solely on marginalized community members with a lack of representation from some groups such as Indigenous individuals. Including and capturing the views of other groups would enrich the field's understanding of how many cultures view land and ecological relationships in maintaining wellness and balance, something many Indigenous communities have long-recognized (Díaz et al., 2018; Finn et al., 2017; Frumkin et al., 2017; Kahn-John & Koithan, 2015).

Additionally, to center voices underrepresented in nature-health research, we did not collect data from advantaged groups, which limits comparative analysis. Including participants from more privileged identities, could illuminate differences in values, experiences, and

structural advantages that might offer explanation for outcome differences.

5. Conclusions

This study demonstrates the value of using qualitative methods to surface complex and context-specific insights that may be overlooked in quantitative research (Ratcliffe et al., 2024). Findings indicate that marginalized community members recognize a range of wellbeing benefits from natural spaces shaped by intersecting social and personal factors; with access, design, and social context shaping the benefits received. The nuanced data presented can now inform future research using complementary methods, such as quantitative analyses or intervention work, to further examine the patterns identified. Moreover, these insights can guide researchers, policymakers, and practitioners to create more inclusive and equitable natural space, that address structural barriers and respond to the needs of marginalized community members.

CRedit authorship contribution statement

Everly Jazi: Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Matilda van den Bosch:** Writing – review & editing, Methodology, Conceptualization. **Margarita Triguero-Mas:** Writing – review & editing, Methodology, Conceptualization. **Michael Meitner:** Writing – review & editing, Methodology, Conceptualization. **Annamarie Thomson:** Writing – review & editing. **Jade Chen:** Writing – review & editing. **Keunhyun Park:** Writing – review & editing, Supervision, Methodology, Conceptualization.

Ethics declaration

Written informed consent to take part in the study and to publish the article has been obtained from all participants or their legal representatives. The privacy rights of participants have been observed.

This study was performed in compliance with relevant laws, regulatory frameworks and guidelines where the research took place. This study was approved by the University of British Columbia BREB. (Approval No. H23-00260-A005)

Funding

This work was supported by the University of British Columbia's Faculty of Forestry. MTM is funded by the Ramón y Cajal program (RYC2021-034215-I) of the Spanish Ministry of Science, Innovation, and Universities and received support from the HEurope project GreenME (101084198). MTM is also funded from grant CEX2023-0001290-S funded by MCIN/AEI, and support from the CERCA Program, as well as grant CEX2024-001506-M at ICTA-UAB.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

6. Appendix

Semi-Structured Script Used to Guide Focus Groups and Interviews.

1. What comes to mind when you think of “nature?”
2. What activities do you do in nature (like parks, tree-lined streets, beaches)?

3. How do you think your outdoor activities in nature impact your mental health and wellbeing?
4. Why do outdoor activities in nature impact you in this way?
5. Do you think outdoor activities impact mental wellbeing differently based on [your marginalized identity]? What contributes to this?
6. Is there something nature gives you that you think those of [socially advantaged identities] don't get?

References

- Allard-Poesi, Florence, & Massu, Justine (2023). Research Note: Is urban nature necessary for well-being? For whom? A necessary condition analysis. *Landscape and Urban Planning*, 234, 104728. <https://doi.org/10.1016/j.landurbplan.2023.104728>, 104728 <https://linkinghub.elsevier.com/retrieve/pii/S0169204623000476>.
- Anderson, C. L., Monroy, M., & Keltner, D. (2018). Awe in nature heals: Evidence from military veterans, at-risk youth, and college students. *Emotion*, 18(8), 1195–1202. <https://doi.org/10.1037/emo0000442>
- Archibald, M. M., Ambagtsheer, R. C., Casey, M. G., Lawless, & Michael. (2019). Using zoom videoconferencing for qualitative data collection: Perceptions and experiences of researchers and participants. *International Journal of Qualitative Methods*, 18, Article 1609406919874596. <https://doi.org/10.1177/1609406919874596>
- Ardoin, N. (2006). *Toward an interdisciplinary understanding of place: Lessons for environmental education* (Vol. 11). Canadian Journal of Environmental Education.
- Bayne, T., Brainard, D., Byrne, R. W., Chittka, L., Clayton, N., Heyes, C., Mather, J., Ölveczky, B., Shadlen, M., Suddendorf, T., & Webb, B. (2019). What is cognition? *Current Biology*, 29(13), R608–R615. <https://doi.org/10.1016/j.cub.2019.05.044>. Cell Press.
- Beil, K., & Hanes, D. (2013). The influence of urban natural and built environments on physiological and psychological measures of stress- A pilot study. *International Journal of Environmental Research and Public Health*, 10(4), 1250–1267. <https://doi.org/10.3390/ijerph10041250>
- Bell, S. L., Wheeler, B. W., & Phoenix, C. (2017). Using geonarratives to explore the diverse temporalities of therapeutic landscapes: Perspectives from “Green” and “Blue” settings. *Annals of the Association of American Geographers*, 107(1), 93–108. <https://doi.org/10.1080/24694452.2016.1218269>
- Birch, J., Rishbeth, C., & Payne, S. R. (2020). Nature doesn't judge you – How urban nature supports young people's mental health and wellbeing in a diverse UK city. *Health & Place*, 62(January), Article 102296. <https://doi.org/10.1016/j.healthplace.2020.102296>
- Birt, L., Scott, S., Cavers, D., Campbell, C., & Walter, F. (2016). Member checking: A tool to enhance trustworthiness or merely a nod to validation? *Qualitative Health Research*, 26(13), 1802–1811. <https://doi.org/10.1177/1049732316654870>
- Bixler, Robert D., & Floyd, Myron F. (1997). Nature is Scary, Disgusting, and Uncomfortable. *Environment and Behavior*, 29(4), 443–467. <https://doi.org/10.1177/001391659702900401>. <https://journals.sagepub.com/doi/10.1177/001391659702900401>. (Accessed 1 July 1997)
- Bratman, G. N., Anderson, C. B., Berman, M. G., Cochran, B., de Vries, S., Flanders, J., Folke, C., Frumkin, H., Gross, J. J., Hartig, T., Kahn, P. H., Kuo, M., Lawler, J. J., Levin, P. S., Lindahl, T., Meyer-Lindenberg, A., Mitchell, R., Ouyang, Z., Roe, J., ... Daily, G. C. (2019). Nature and mental health: An ecosystem service perspective. *Science Advances*, 5(7). <https://doi.org/10.1126/sciadv.aax0903>
- Brauer, M., Hoek, G., van Vliet, P., Meliefste, K., Fischer, P. H., Wijga, A., Koopman, L. P., Neijens, H. J., Gerritsen, J., Kerkhof, M., Heinrich, J., Bellander, T., & Brunekreef, B. (2002). Air pollution from traffic and the development of respiratory infections and asthmatic and allergic symptoms in children. *American Journal of Respiratory and Critical Care Medicine*, 166(8), 1092–1098. <https://doi.org/10.1164/rccm.200108-0070C>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*, 11(4), 589–597.
- Browning, M. H. E. M., Rigolon, A., McAnirlin, O., & Yoon, H.(V.). (2022). Where greenspace matters most: A systematic review of urbanicity, greenspace, and physical health. In *Landscape and urban planning*. 217Elsevier B.V. <https://doi.org/10.1016/j.landurbplan.2021.104233>.
- Byrne, J. (2012). When green is White: The cultural politics of race, nature and social exclusion in a Los Angeles urban national park. *Geoforum*. <https://doi.org/10.1016/j.geoforum.2011.10.002>
- Byrne, J., & Wolch, J. (2009). Nature, race, and parks: Past research and future directions for geographic research. *Progress in Human Geography*, 33(6), 743–765. <https://doi.org/10.1177/0309132509103156>
- Catalani, C., & Minkler, M. (2010). Photovoice: A review of the literature in health and public health. *Health Education & Behavior: The Official Publication of the Society for Public Health Education*, 37(3), 424–451. <https://doi.org/10.1177/1090198109342084>
- Chawla, L. (1999). Life paths into effective environmental action. *The Journal of Environmental Education*, 31(1), 15–26. <https://doi.org/10.1080/00958969909598628>
- Christens, B. D., McCormick, M. L., & Wolf, J. H. (2025). Understanding and promoting nature connectedness: A human ecological perspective. *Current Opinion in Psychology*, 65. <https://doi.org/10.1016/j.copsyc.2025.102046>

- City of Vancouver. (2025). *Geography*. Retrieved from <https://vancouver.ca/new-s-calendar/geo.aspx>.
- Clayton, S. (2003). Environmental identity: A conceptual and an operational definition. In *Identity and the natural environment: The psychological significance of nature*.
- Clayton, S., Czellar, S., Nartova-Bochaver, S., Skibins, J. C., Salazar, G., Tseng, Y. C., Irkhin, B., & Monge-Rodriguez, F. S. (2021). Cross-cultural validation of a revised environmental identity scale. *Sustainability*, 13(4), 1–12. <https://doi.org/10.3390/su13042387>
- Dadvand, P., Hariri, S., Abbasi, B., Heshmat, R., Qorbani, M., Motlagh, M. E., Basagaña, X., & Kelishadi, R. (2019). Use of green spaces, self-satisfaction and social contacts in adolescents: A population-based CASPIAN-V study. *Environmental Research*, 168, 171–177. <https://doi.org/10.1016/j.envres.2018.09.033>
- Dallimer, Martin, Davies, Zoe, Irvine, Katherine, Maltby, Lorraine, Warren, Philip, Gaston, Kevin, & Armsworth, Paul (2014). What Personal and Environmental Factors Determine Frequency of Urban Greenspace Use? *International Journal of Environmental Research and Public Health*, 11(8), 7977–7992. <https://doi.org/10.3390/ijerph110807977>. <https://www.mdpi.com/1660-4601/11/8/7977>. (Accessed 7 August 2014)
- Davis, Z., Nesbitt, L., Guhn, M., & van den Bosch, M. (2023). Assessing changes in urban vegetation using Normalised Difference Vegetation Index (NDVI) for epidemiological studies. *Urban Forestry and Urban Greening*, 88, Article 128080. <https://doi.org/10.1016/j.ufug.2023.128080>
- Díaz, S., Pascual, U., Stenseke, M., Martín-López, B., Watson, R. T., Molnár, Z., Hill, R., Chan, K. M. A., Baste, I. A., Brauman, K. A., Polasky, S., Church, A., Lonsdale, M., Larigauderie, A., Leadley, P. W., van Oudenhoven, A. P. E., van der Plaats, F., Schröter, M., Lavorel, S., ... Shirayama, Y. (2018). Assessing nature's contributions to people. *Science*, 359(6373), 270–272. <https://doi.org/10.1126/science.aap8826>
- Elsadek, M., Liu, B., Lian, Z., & Xie, J. (2019). The influence of urban roadside trees and their physical environment on stress relief measures: A field experiment in Shanghai. *Urban Forestry and Urban Greening*, 42, 51–60. <https://doi.org/10.1016/j.ufug.2019.05.007>
- Evans, J., & Jones, P. (2011). The walking interview: Methodology, mobility and place. *Applied Geography*, 31(2), 849–858. <https://doi.org/10.1016/j.apgeog.2010.09.005>
- Finn, S., Herne, M., & Castille, D. (2017). The value of traditional ecological knowledge for the environmental health sciences and biomedical research. *Environmental Health Perspectives*, 125(8), Article 085006. <https://doi.org/10.1289/EHP858>
- Finney, C. (2014). *Black faces, white spaces: Reimagining the relationship of African Americans to the great outdoors*. University of North Carolina Press. http://www.jstor.org/stable/10.5149/9781469614496_finney.
- Frumkin, H., Bratman, G. N., Breslow, S. J., Cochran, B., Kahn, P. H., Jr., Lawler, J. J., Levin, P. S., Tandon, P. S., Varanasi, U., Wolf, K. L., & Wood, S. A. (2017). Nature contact and human health: A research agenda. *Environmental Health Perspectives*, 125(7), Article 075001. <https://doi.org/10.1289/EHP1663>
- Gascon, M., Mas, M. T., Martínez, D., Dadvand, P., Fors, J., Plasencia, A., & Nieuwenhuijsen, M. J. (2015). Mental health benefits of long-term exposure to residential green and blue spaces: A systematic review. *International Journal of Environmental Research and Public Health*, 12(4), 4354–4379. <https://doi.org/10.3390/ijerph120404354>. MDPI.
- Ghasemishkaftaki, M., Dupre, K., Campbell, J., & Fernando, R. (2025). Developing public open places: A cross-cultural study in Gold Coast, Australia. *Architecture*, 5(1), 10. <https://doi.org/10.3390/architecture5010010>
- Government of Canada. (2024). Standing committee on human resources, skills and social development and the status of persons with disabilities (HUMA). *Employment and Social Development Canada*. <https://www.canada.ca/en/employment-social-development/corporate/reports/committees-binders/2024-may-9-huma-sudds.html>.
- Guo, H., Zhang, S., You, Y., Zheng, Q., Zhu, L., Hong, X.-C., & Ho, H. C. (2025). Assessing the impact of street-level greenery on older adults' emotional well-being: A longitudinal study of equigenic potential and socioeconomic disparities. *Building and Environment*, 267, Article 112309. <https://doi.org/10.1016/j.buildenv.2024.112309>
- Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., & Gärling, T. (2003). Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology*, 23(2), 109–123. [https://doi.org/10.1016/S0272-4944\(02\)00109-3](https://doi.org/10.1016/S0272-4944(02)00109-3)
- Hartig, T., Korpela, K., Evans, G. W., & Gärling, T. (1997). A measure of restorative quality in environments. *Scandinavian Housing and Planning Research*, 14(4), 175–194. <https://doi.org/10.1080/02815739708730435>
- Hartig, T., Mitchell, R., de Vries, S., & Frumkin, H. (2014). Nature and health. *Annual Review of Public Health*, 35(1), 207–228. <https://doi.org/10.1146/annurev-publhealth-032013-182443>
- Jelks, N. O., Jennings, V., & Rigolon, A. (2021). Green gentrification and health: A scoping review. *International Journal of Environmental Research and Public Health*, 18(3), 1–23. <https://doi.org/10.3390/ijerph18030907>. MDPI AG.
- Jennings, V., & Bamkole, O. (2019). The relationship between social cohesion and urban green space: An avenue for health promotion. *International Journal of Environmental Research and Public Health*, 16(3), 452. <https://doi.org/10.3390/ijerph16030452>
- Jennings, V., & Johnson Gaither, C. (2015). Approaching environmental health disparities and green spaces: An ecosystem services perspective. *International Journal of Environmental Research and Public Health*, 12(2), 1952–1968. <https://doi.org/10.3390/ijerph120201952>
- Jiang, B., Chang, C.-Y., & Sullivan, W. C. (2014). A dose of nature: Tree cover, stress reduction, and gender differences. *Landscape and Urban Planning*, 132, 26–36. <https://doi.org/10.1016/j.landurbplan.2014.08.005>
- Jimenez, M. P., Deville, N. V., Elliott, E. G., Schiff, J. E., Wilt, G. E., Hart, J. E., & James, P. (2021). Associations between nature exposure and health: A review of the evidence. *International Journal of Environmental Research and Public Health*, 18(9). <https://doi.org/10.3390/ijerph18094790>
- Kabisch, N. (2019). The influence of socio-economic and socio-demographic factors in the association between urban green space and health. In M. R. Marselle, J. Stadler, H. Korn, K. N. Irvine, & A. Bonn (Eds.), *Biodiversity and health in the face of climate change* (pp. 91–119). Springer International Publishing. https://doi.org/10.1007/978-3-030-02318-8_5
- Kahn-John, M., & Koithan, M. (2015). Living in health, harmony, and beauty: The Diné (Navajo) Hózhó wellness philosophy. *Global Advances in Health and Medicine*, 4(3), 24–30. <https://doi.org/10.7453/gahmj.2015.044>
- Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. New York, NY, US: Cambridge University Press.
- Kaplan, R., & Talbot, J. F. (1988). Ethnicity and preference for natural settings: A review and recent findings. *Landscape and Urban Planning*, 15(1–2), 107–117. [https://doi.org/10.1016/0169-2046\(88\)90019-9](https://doi.org/10.1016/0169-2046(88)90019-9)
- Keltner, D. (2023). *Awe: The new science of everyday wonder and how it can transform your life*. New York, NY: Penguin Press.
- Kondo, M. C., Fluehr, J. M., McKeon, T., & Branas, C. C. (2018). Urban green space and its impact on human health. *International Journal of Environmental Research and Public Health*, 15(3), 445. <https://doi.org/10.3390/ijerph15030445>
- Krueger, R., & Casey, M. (2009). *Focus groups: A practical guide for applied research*. Thousand Oaks, CA: Sage Publications.
- Kudryavtsev, A., Stedman, R. C., & Krasny, M. E. (2011). Sense of place in environmental education. *Environmental Education Research*, 18(2), 229–250. <https://doi.org/10.1080/13504622.2011.609615>
- Kuo, Ming (2015). How might contact with nature promote human health? Promising mechanisms and a possible central pathway. *Frontiers in Psychology*, 6. <https://doi.org/10.3389/fpsyg.2015.01093>. <http://journal.frontiersin.org/Article/10.3389/fpsyg.2015.01093/abstract>. (Accessed 25 August 2015)
- Lambert, S. D., & Loisel, C. G. (2008). Combining individual interviews and focus groups to enhance data richness. *Journal of Advanced Nursing*, 62(2), 228–237. <https://doi.org/10.1111/j.1365-2648.2007.04559.x>
- Lee, A. C., & Maheswaran, R. (2011). The health benefits of urban green spaces: A review of the evidence. *Journal of Public Health*, 33(2), 212–222. <https://doi.org/10.1093/pubmed/fdq068>
- Li, H., Browning, M. H. E. M., Rigolon, A., Larson, L. R., Taff, D., Labib, S. M., Benfield, J., Yuan, S., McAnirlin, O., Hatami, N., & Kahn, P. H. (2023). Beyond “bluespace” and “greenspace”: A narrative review of possible health benefits from exposure to other natural landscapes. In *Science of the total environment* (Vol. 856) Elsevier B.V. <https://doi.org/10.1016/j.scitotenv.2022.159292>
- Lopez, B., Kennedy, C., Field, C., & McPhearson, T. (2021). Who benefits from urban green spaces during times of crisis? Perception and use of urban green spaces in New York city during the COVID-19 pandemic. *Urban Forestry and Urban Greening*, 65, Article 127354. <https://doi.org/10.1016/j.ufug.2021.127354>
- Maas, J., Verheij, R. A., de Vries, S., Spreeuwenberg, P., Schellevis, F. G., & Groenewegen, P. P. (2009). Morbidity is related to a green living environment. *Journal of Epidemiology & Community Health*, 63(12), 967–973. <https://doi.org/10.1136/jech.2008.079038>
- Macaulay, Rose, Johnson, Katherine, Lee, Kate, & Williams, Kathryn (2022). Comparing the effect of mindful and other engagement interventions in nature on attention restoration, nature connection, and mood. *Journal of Environmental Psychology*, 81, 101813. <https://doi.org/10.1016/j.jenvp.2022.101813>, 101813 <https://linkinghub.elsevier.com/retrieve/pii/S0272494422000585>.
- Markevych, I., Schoierer, J., Hartig, T., Chudnovsky, A., Hystad, P., Dzhambov, A. M., de Vries, S., Triguero-Mas, M., Brauer, M., Nieuwenhuijsen, M. J., Lupp, G., Richardson, E. A., Astell-Burt, T., Dimitrova, D., Feng, X., Sadeh, M., Standl, M., Heinrich, J., & Fuertes, E. (2017). Exploring pathways linking greenspace to health: Theoretical and methodological guidance. *Environmental Research*, 158, 301–317. <https://doi.org/10.1016/j.envres.2017.06.028>
- Marselle, M. R., Hartig, T., Cox, D. T. C., de Bell, S., Knapp, S., Lindley, S., Triguero-Mas, M., Böhning-Gaese, K., Braubach, M., Cook, P. A., de Vries, S., Heintz-Buschart, A., Hofmann, M., Irvine, K. N., Kabisch, N., Kolek, F., Kraemer, R., Markevych, I., Martens, D., ... Bonn, A. (2021). Pathways linking biodiversity to human health: A conceptual framework. *Environment International*, 150(Febuary). <https://doi.org/10.1016/j.envint.2021.106420>
- Mitchell, R., & Popham, F. (2008). Effect of exposure to natural environment on health inequalities: An observational population study. *The Lancet*, 372(9650), 1655–1660. [https://doi.org/10.1016/S0140-6736\(08\)61689-X](https://doi.org/10.1016/S0140-6736(08)61689-X)
- Mitchell, R. J., Richardson, E. A., Shortt, N. K., & Pearce, J. R. (2015). Neighborhood environments and socioeconomic inequalities in mental well-being. *American Journal of Preventive Medicine*, 49(1), 80–84. <https://doi.org/10.1016/j.amepre.2015.01.017>
- Nesbitt, L., Sax, D., Quinton, J., Harris, L., Ordóñez-Barona, C., & Konijnendijk, C. (2023). Greening practitioners worry about green gentrification but many don't address it in their work. *Ecology and Society*, 28(4), 29. <https://doi.org/10.5751/ES-14579-280429>
- Nieuwenhuijsen, M. J., Kruijze, H., Gidlow, C., Andrusaityte, S., Antó, J. M., Basagaña, X., Cirach, M., Dadvand, P., Danileviciute, A., Donaire-Gonzalez, D., Garcia, J., Jerrett, M., Jones, M., Julvez, J., van Kempen, E., van Kamp, I., Maas, J., Seto, E., Smith, G., Triguero, M., ... Grazuleviciene, R. (2014). Positive health effects of the natural outdoor environment in typical populations in different regions in Europe (PHENOTYPE): A study programme protocol. *BMJ Open*, 4(4), Article e004951. <https://doi.org/10.1136/bmjopen-2014-004951>
- Pearce, J., Cherrie, M., Shortt, N., Deary, I., & Ward Thompson, C. (2018). Life course of place: A longitudinal study of mental health and place. *Transactions of the Institute of British Geographers*, 43(4), 555–572. <https://doi.org/10.1111/tran.12246>
- Peters, K., Elands, B., & Buijs, A. (2010). Social interactions in urban parks: Stimulating social cohesion? *Urban Forestry and Urban Greening*, 9(2), 93–100. <https://doi.org/10.1016/j.ufug.2009.11.003>

- Quinton, J., Nesbitt, L., & Sax, D. (2022). How well do we know green gentrification? A systematic review of the methods. *Progress in Human Geography*, 46(4), 960–987. <https://doi.org/10.1177/03091325221104478>
- Ratcliffe, E., Ogunbode, C., Wilkie, S., Jones, C. R., Devine-Wright, P., Uzzell, D., Canter, D., Korpela, K., Pinto de Carvalho, L., & Staats, H. (2024). On the importance of qualitative research in environmental psychology. *Journal of Environmental Psychology*, 93, Article 102199. <https://doi.org/10.1016/j.jenvp.2023.102199>
- Riddick, C. C., & Russell, R. V. (2008). *Research in recreation, parks, sport, and tourism* (2nd ed.). Sagamore Publishing.
- Rigolon, A. (2016). A complex landscape of inequity in access to urban parks: A literature review. *Landscape and Urban Planning*, 153, 160–169. <https://doi.org/10.1016/j.landurbplan.2016.05.017>
- Rigolon, A., Browning, M., & Jennings, V. (2018). Inequities in the quality of urban park systems: An environmental justice investigation of cities in the United States. *Landscape and Urban Planning*, 178, 156–169. <https://doi.org/10.1016/j.landurbplan.2018.05.026>
- Rigolon, A., Browning, M. H. E. M., McAnirlin, O., & Yoon, H. (2021). Green space and health equity: A systematic review on the potential of green space to reduce health disparities. *International Journal of Environmental Research and Public Health*, 18(5), 1–29. <https://doi.org/10.3390/ijerph18052563>
- Rigolon, A., Yañez, E., Abolata, M. J., & Bennett, R. (2022b). “A park is not just a park”: Toward counter-narratives to advance equitable green space policy in the United States. *Cities*, 128, Article 103792. <https://doi.org/10.1016/j.cities.2022.103792>
- Roe, J. J., Ward Thompson, C., Aspinall, P. A., Brewer, M. J., Duff, E. I., Miller, D., Mitchell, R., & Clow, A. (2013). Green space and stress: Evidence from cortisol measures in deprived urban communities. *International Journal of Environmental Research and Public Health*, 10(9), 4086–4103. <https://doi.org/10.3390/ijerph10094086>
- Rugel, E. J., Henderson, S. B., Carpiano, R. M., & Brauer, M. (2017). Beyond the Normalized Difference Vegetation Index (NDVI): Developing a natural space index for population-level health research. *Environmental Research*, 159(September), 474–483. <https://doi.org/10.1016/j.envres.2017.08.033>
- Sang, Å. O., Knez, I., Gunnarsson, B., & Hedblom, M. (2016). The effects of naturalness, gender, and age on how urban green space is perceived and used. *Urban Forestry and Urban Greening*, 18, 268–276. <https://doi.org/10.1016/j.ufug.2016.06.008>
- Scannell, L., & Gifford, R. (2017). Place attachment enhances psychological need satisfaction and wellbeing. *Environment and Behavior*, 49(4), 359–389. <https://doi.org/10.1177/0013916516637648>
- Schafer, K. M., Lieberman, A., Sever, A. C., & Joiner, T. (2022). Prevalence rates of anxiety, depressive, and eating pathology symptoms between the pre- and peri-COVID-19 eras: A meta-analysis. *Journal of Affective Disorders*, 298, 364–372. <https://doi.org/10.1016/j.jad.2021.10.115>
- Schilhab, T. S. S., Stevenson, M. P., & Bentsen, P. (2018). Contrasting screen-time and green-time: A case for using smart technology and nature to optimize learning processes. *Frontiers in Psychology*, 9(JUN), 1–5. <https://doi.org/10.3389/fpsyg.2018.00773>
- Shores, K. A., Scott, D., & Floyd, M. F. (2007). Constraints to outdoor recreation: A multiple hierarchy stratification perspective. *Leisure Sciences*, 29(3), 227–246. <https://doi.org/10.1080/01490400701257948>
- Sonntag-Öström, E., Nordin, M., Lundell, Y., Dolling, A., Wiklund, U., Karlsson, M., Carlberg, B., & Slunga Järholm, L. (2014). Restorative effects of visits to urban and forest environments in patients with exhaustion disorder. *Urban Forestry and Urban Greening*, 13(2), 344–354. <https://doi.org/10.1016/j.ufug.2013.12.007>
- Statistics Canada. (2021). 2021 census of population. <https://www12.statcan.gc.ca/ce/nsus-recensement/2021/dp-pd/prof/index.cfm?Lang=E>
- Statistics Canada. (2022). Canada leads the G7 for the most educated workforce, thanks to immigrants, young adults and a strong college sector, but is experiencing significant losses in apprenticeship certificate holders in key trades. *The Daily*. <https://www150.statcan.gc.ca/n1/daily-quotidien/221130/dq221130a-eng.htm>
- Taylor, D. E. (2018). Racial and ethnic differences in connectedness to nature and landscape preferences among college students. *Environmental Justice*, 11(3), 118–136. <https://doi.org/10.1089/env.2017.0040>
- Tolley, E. E., Ulin, P. R., Mack, N., Robinson, E. T., & Succop, S. M. (2016). Collecting qualitative data : The science and the art (chapter 4) and qualitative data analysis. *Qualitative methods in public health: A field guide for applied research*. Wiley (Chapter 6)).
- Tomasso, L. P., Laurent, J. G. C., Chen, J. T., Catalano, P. J., & Spengler, J. D. (2021). Cultural sets shape adult conceptualizations and relationships to nature. *Sustainability*, 13(20), 1–21. <https://doi.org/10.3390/su132011266>
- Triguero-Mas, M., Donaire-Gonzalez, D., Seto, E., Valentín, A., Martínez, D., Smith, G., Hurst, G., Carrasco-Turigas, G., Masterson, D., van den Berg, M., Ambrós, A., Martínez-Íñiguez, T., Dedele, A., Ellis, N., Grazulevicius, T., Voorsmit, M., Cirach, M., Cirac-Claveras, J., Swart, W., ... Nieuwenhuijsen, M. J. (2017). Natural outdoor environments and mental health: Stress as a possible mechanism. *Environmental Research*, 159, 629–638. <https://doi.org/10.1016/j.envres.2017.08.048>
- Triguero-Mas, M., Gidlow, C. J., Martínez, D., de Bont, J., Carrasco-Turigas, G., Martínez-Íñiguez, T., Hurst, G., Masterson, D., Donaire-Gonzalez, D., Seto, E., Jones, M. V., & Nieuwenhuijsen, M. J. (2017). The effect of randomised exposure to different types of natural outdoor environments compared to exposure to an urban environment on people with indications of psychological distress in Catalonia. *PLoS One*, 12(3), Article e0172200. <https://doi.org/10.1371/journal.pone.0172200>
- Twohig-Bennett, C., & Jones, A. (2018). The health benefits of the great outdoors: A systematic review and meta-analysis of greenspace exposure and health outcomes. *Environmental Research*, 166, 628–637. <https://doi.org/10.1016/j.envres.2018.06.030>
- Ulrich, R. S. (1983). Aesthetic and affective response to natural environment. In I. Altman, & J. F. Wohlwill (Eds.), *Behavior and the natural environment* (pp. 85–125). https://link.springer.com/10.1007/978-1-4613-3539-9_4
- van den Berg, Magdalena M., van Poppel, Mireille, van Kamp, Irene, Ruijsbroek, Annemarie, Triguero-Mas, Margarita, Gidlow, Christoffer, Nieuwenhuijsen, Mark J., Gražulevičienė, Regina, van Mechelen, Willem, Kruize, Hanneke, & Maas, Jolanda (2017). Do Physical Activity, Social Cohesion, and Loneliness Mediate the Association Between Time Spent Visiting Green Space and Mental Health? *Environment and Behavior*, 51(2), 144–166. <https://doi.org/10.1177/0013916517738563>. <https://journals.sagepub.com/doi/10.1177/0013916517738563>. (Accessed 14 November 2017)
- Ventriglio, A., Torales, J., Castaldelli-Maia, J. M., de Berardis, D., & Bhugra, D. (2021). Urbanization and emerging mental health issues. *CNS Spectrums*, 26(1), 43–50. <https://doi.org/10.1017/S1092852920001236>
- Wang, R., Dong, G., Cao, M., Zhou, Y., & Dong, G.-H. (2024). Exploring “equigenesis” in the associations between green space and kidney health among middle-aged and older adults using street view data. *Innovation in Aging*, 8(1), Article igad130. <https://doi.org/10.1093/geroni/igad130>
- Wei, D., Lu, Y., Wu, X., Ho, H. C., Wu, W., Song, J., & Wang, Y. (2023). Greenspace exposure may increase life expectancy of elderly adults, especially for those with low socioeconomic status. *Health & Place*, 84, Article 103142. <https://doi.org/10.1016/j.healthplace.2023.103142>
- Wells, N. M., & Evans, G. W. (2003). Nearby nature: A buffer of life stress among rural children. *Environment and Behavior*, 35(3), 311–330. <https://doi.org/10.1177/0013916503035003001>
- White, M. P., Alcock, I., Wheeler, B. W., & Depledge, M. H. (2013). Would you be happier living in a greener urban area? A fixed-effects analysis of panel data. *Psychological Science*, 24(6), 920–928. <https://doi.org/10.1177/0956797612464659>
- Wolf, Kathleen L., Lam, Sharon T., McKeen, Jennifer K., Richardson, Gregory R. A., van den Bosch, Matilda, & Bardekjian, Adrina C. (2020). Urban Trees and Human Health: A Scoping Review. *International Journal of Environmental Research and Public Health*, 17(12), 4371. <https://doi.org/10.3390/ijerph17124371>. <https://www.mdpi.com/1660-4601/17/12/4371>. (Accessed 18 June 2020)
- Zhan, C., Xie, M., Lu, H., Liu, B., Wu, Z., Wang, T., Zhuang, B., Li, M., & Li, S. (2023). Impacts of urbanization on air quality and the related health risks in a city with complex terrain. *Atmospheric Chemistry and Physics*, 23(1), 771–788. <https://doi.org/10.5194/acp-23-771-2023>