



What Visitors Want From Urban Parks: Diversity, Utility, Serendipity

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Urban parks may provide a range of ecosystem services, but community perspectives can influence the conservation of parks and their biodiversity. Cultural ecosystem services, or the non-material benefits that people receive from nature, can prompt a park's use and motivate a management response from local government. Our study aimed to explore why people visit urban parks, whether the tacit biodiversity of a park influenced visitation, and understand what park visitors notice, and how being in an urban park makes them feel. Combining both human and more-than-human aspects, we carried out park surveys that comprised an ecological survey and short, three-question interview with park visitors. The park surveys were carried out in six parks each in Melbourne and Sydney, Australia, and Auckland and Wellington, New Zealand. While the biodiversity of species in parks differed significantly within and between cities, we found no consistent relationships between park biodiversity and the numbers of people in parks nor how being in the parks made participants feel. Some park visitors did say that their reason for being in the park was to engage with nature, but other reasons were also listed, such as to meet friends or use specific park facilities, such as gym equipment or playgrounds. Park visitors valued a diverse range of services and natural utilities, such as shade, from their visit. Many interactions were also serendipitous for visitors due to the proximity of urban parks near residential areas, businesses and transport hubs, or as extensions of their homes. We conclude that although the use of parks was not directly tied to biodiversity *per se*, visitors considered them to be places where they can interact with nature in a range of ways.

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INTRODUCTION

There are many benefits to having nature in cities. Nature supports human well-being by facilitating stress reduction (Ulrich et al., 1991), affording cognitive restoration (Kaplan and Kaplan, 1989) and sustaining ecosystem function (United Nations, 2005). The cities that support their human inhabitants the best incorporate greenspace, biodiversity, and ecosystem function (for a review, see Taylor and Hochuli, 2015). In many cities, a common way for urban residents to experience nature is by their proximity to or visiting urban parks. In the context of the COVID-19 pandemic, the presence of urban parks has become increasingly important to ensure a baseline of support and nature-based solutions for stressed communities (Neßhöver et al., 2017; Kleinschroth and Kowarik, 2020). While there are multiple uses of the word “park,” we define urban parks as public patches of

recreational land in cities that incorporate nature, including at least some vegetation. We use the term “nature” to incorporate biodiversity and refer to non-human features and processes, including vegetation, animals, water, air, geological processes, and landscapes (Hartig et al., 2014).

Urban parks have the potential to provide key ecosystem services (Mexia et al., 2018). The range of ecosystem services that urban parks can deliver is broad, for example, air and water purification, climate regulation, carbon sequestration, and the provision of habitat and resources for wildlife (United Nations, 2005; Mexia et al., 2018; Qijiao et al., 2019). Such ecosystem services ensure that urban ecosystems continue to function, but cultural ecosystem services are also critical because they signify the nexus of the human-nature relationship (Elmqvist et al., 2015). The Millennium Ecosystems Assessment describes cultural ecosystem services as the “non-material benefits” of nature (2005). However, those non-material benefits have the potential to drive and inform the presence and variety of nature in cities because cultural ecosystem services impact the governance of cities, including urban parks, and influence how communities engage with nature (Plieninger et al., 2015). As such, understanding why urbanites visit parks and how being there makes them feel is important.

Biodiversity is essential to the functioning of ecosystem services (United Nations, 2005). Whether greater biodiversity influences cultural ecosystem services is uncertain. For example, one UK study looked at levels of biodiversity in a park and whether they impact psychological well-being of park visitors (Fuller et al., 2007). That study found a link between the species richness of vegetation and birds with psychological well-being, and that the people who participated in the study could accurately perceive the richness of plant species (Fuller et al., 2007). However, a later study using the same, but extended, instruments found no consistent relationship between biodiversity and psychological well-being but did find a relationship with *perceived* biodiversity and psychological well-being (Dallimer et al., 2012). This highlights a potential incongruity between perceived and actual biodiversity that could have implications for human-nature relationship management. In cities, where human populations are dense, it is important to understand how people perceive local biodiversity to better understand effects on cultural ecosystem services. This is also relevant to consider in cities because urban biodiversity differs from historic biodiversity due to greater numbers of non-native and hyper-abundant species (McKinney, 2006; Grimm et al., 2008). Biodiversity is often measured as species richness, particularly at the local level (Bakkes et al., 1994). Another way to consider the question of biodiversity and human well-being could be to look at the numbers of people in urban parks correlated with a park's biodiversity, or species richness. Our interest lies in whether people are either consciously or unconsciously attracted to park biodiversity, either as a reason for or co-benefit of visiting parks. The first aspect of our research sought to identify whether there are links between urban park biodiversity and park visitation.

While people may visit urban parks to experience or enjoy biodiversity, there are a range of motivations for park visitation.

Urban parks are generally used for walking, doing exercise, taking children to play, walking dogs, or getting fresh air (Irvine et al., 2013). There is evidence that people who have a strong connection with nature will travel to visit more vegetated parks with greater tree cover (Shanahan et al., 2015), though whether people choose to visit more vegetated parks or open parks has been linked to a community's cultural differences (Peters et al., 2010). As inclusive spaces, urban parks also have the potential to facilitate social interaction and even encourage social cohesion for people from a variety of ethnicities (Peters et al., 2010). A park's traits can influence the activities, for example, access to views afford meeting places and, if the facilities are available, a barbecue, whereas flat parks without hills attract cyclists (Peters et al., 2010). Other recreational activities, such as picnics, are common, though the maintenance of the park, and to a lesser extent, the day of the week influences the extent of recreational visitation (Bertram et al., 2017). Other more passive forms of recreation, such as resting and relaxing, are common, though again this is subject to park maintenance and perceptions of cleanliness of the area (Özgüner, 2011). In assessing park biodiversity, we also noted park traits, given the evidence that park traits may influence park visits. The second aspect of our research sought to explore the reasons for and experience of park visitation identified by park visitors, to help inform urban park planning and biodiversity management.

Cities often have similar types of spaces within them, such as high-density business districts, medium- and low-density residential areas, industrial areas, and so on (Catterall, 2009). It might be expected that there are similar patterns of nature between cities, with wildlife responding to various levels of human disturbance (Catterall, 2009). For example, parks in the most urbanized areas of cities may contain mown lawn, trees, and park traits such as paths and benches that afford recreation for office-workers. In contrast, a park in a more suburban area of a city might contain patches of remnant forest. As such, we would expect that urban nature is homogenized in highly urban areas (McKinney and Lockwood, 1999; McKinney, 2008). These sorts of differences between parks could be meaningful in that they could enable prediction of urban residents' well-being. Indeed, an advantage of studying ecological similarities of nature in cities could be that it enables us to predict outcomes for less-developed areas (Catterall, 2009) and their inhabitants. Using the ecology of cities affords comparisons between cities in this way (Niemelä et al., 2009). The third aspect of our research compares biodiversity, park traits, and park visitation among urban parks in four cities.

Our research explores the following research questions:

1. Are there links between urban park biodiversity and park visitation?
2. Are there links between urban park traits and park visitation?
3. Why people visit parks and how do they experience park visits?
4. Are there differences between parks and community use of parks among cities?

MATERIALS AND METHODS

We chose a mixed-methods study that included both human and ecological components in a series of park surveys to explore our research questions. Our approach integrated human and natural systems in line with an ecology of cities approach by integrating human and ecological aspects within an urban context (Niemelä et al., 2009). We focused on the ecology of parks in four cities: Auckland and Wellington in New Zealand, and Melbourne and Sydney in Australia. This study builds on previous work in those cities that explored the relationships between nature and urban residents (Taylor et al., 2018, 2019). Our methods involved three components: (1) a 10-min point count, (2) a transect to record the presence and abundance of all animal and plant species within 10–15 min, and (3) a social method of brief interviews with park visitors.

Six parks in each of the study cities were chosen based on whether they were big enough to accommodate a 50-m transect and were spatially spread around each city. Images of the parks selected are included in Section 1 of **Supplementary Material**. The four cities were surveyed sequentially: Sydney, Melbourne, Auckland, then Wellington, with all park visits occurring during the southern hemisphere summer of 2015–2016. Within each city, all park visits were conducted within the same 10-day period. Each park was visited twice in total, with visits on two different days: once during daylight hours, and once to incorporate dawn or dusk to increase the potential number of wildlife species observed. The same transect and point count location were used each time. Weather was fine during all park visits, although during extreme heat for some of the Melbourne visits, the daylight park visits occurred earlier in the day to avoid the early afternoon-temperatures that might affect wildlife or park visitor presence. Park visits involved an ecological survey and a short, three-question interview with five to seven park visitors. The park traits were noted from the position of the point count prior to the commencement of the ecological survey, with any traits out of sight from this position excluded. Each park visit involved a researcher (LT) with ecological survey and qualitative methods experience and a volunteer for safety and assistance purposes (EL, PL). A pilot survey was undertaken in Victoria Park in Sydney, Australia, to inform improvements to the process and to the interview questionnaire.

In line with our ecology of cities approach, we aimed to mimic a park visitor's experience during data collection. When visiting a park, experiences of nature can vary depending on the activity of the park visitor. For example, park visitors may visit the park to have a picnic or sit on the grass, go for a walk, or stand and talk to other park visitors while their children play nearby. The biodiversity a person directly encounters on the ground or in a low place might be different to what someone sees while standing, for example, they would be more likely to notice small, ground-dwelling invertebrates. To emulate this experience, our ecological survey included a 10-min point count of all animals and plants (tacit "biodiversity") seen from the vantage point of being first seated on the ground for 5 min, then standing for 5 min. All animals and plants were then noted while walking for 10–15 min along a 50-m transect, a common

method used to survey multiple taxa, such as birds (Watson, 2004). The presence and abundance of all animal and plant species seen above and around the researchers were recorded. The presence of humans within the park boundaries, excluding the two researchers, was also recorded. While not *all* species present during the point count and transect would have been seen and recorded, the intention was to imitate the species potentially witnessed during a park visitor's experience. Because facilities and other park traits could also motivate people to visit parks (Irvine et al., 2013), we also noted those during the transect. Only park traits that were within park boundaries and visible were noted prior to the commencement of the ecological survey, including open space, sparse trees, clusters of trees, urban forest, wetland, a river/lake/pond, paths, a playground, BBQ and/or picnic facilities, or manicured garden areas. The park traits were noted during both park visits but only used once and the second sighting used as verification, as in all cases there was no change in park traits between visits.

We invited adults (aged 18 and older) to participate in the interviews comprising questions that we developed. Potential respondents were advised the study was about "how people respond to urban parks" (i.e., no reference to biodiversity or nature), and that it only involved three short questions. The three-question interview was intentionally short to minimize the intrusion on people's park visit. For this reason, demographics were not recorded, nor were they assumed in a bid to avoid difficulties with assumptions (for example, regarding assumptions about gender identity, see Smith and Smith, 2016). Where respondents could have been under-age, we confirmed they were 18 or older before proceeding.

After verbally agreeing to participate, each participant was asked the following questions: (1) Why did you come to this park today? (2) What three things about this place do you notice? (3) What three words or phrases describe how being in this park makes you feel? This approach had two benefits: first, the questions were non-suggestive of biodiversity or nature so should not influence responses, and second, these questions allowed us to explore other, non-nature-related reasons for and experiences of park visitation. Because there is a precedent in the literature of links between urban residents' well-being and local nature, we are also interested in exploring how people feel while in the park. While how people feel is not a specific measure of psychological well-being, it may provide an indication of whether their experience of a park visit is beneficial. While this approach may not uncover subconscious or lower-priority observations about nature and biodiversity, it achieved a balance between participants' time and willingness to participate, unbiased responses, and depth.

Participants were chosen based on convenience sampling (Neuman, 2006), and in many instances, were the first seen or only people in the park. In some instances, the researchers had to wait for more people to visit the park to complete the park visit (for example, this was often the case at the dawn park visits as not all parks had people in them at that time). In two instances, study parks (Albert Jones Reserve in Melbourne, and Arch Hill Scenic Reserve in Auckland) were replaced because there were too few park visitors or available visitors (for example, Arch Hill Scenic

TABLE 1 | Park survey participants from each park across two park visits.

Auckland		Melbourne		Sydney		Wellington	
Parks	N.	Parks	N.	Parks	N.	Parks	N.
Albert Park	12	Carlton Gardens	13	Alison Park	14	Cummings Park	12
Cox's Bay Park	13	Croydon Park	12	Bicentennial Park	13	Ironside Reserve	11
Freyberg Park	13	Hannah Watts Park	12	Blackman Park	14	Mt Albert Park	13
Grey Lynn Reserve	13	Heidelberg Park	12	Enmore Park	12	Prince of Wales Park	10
Gribblehurst Park	13	Ivanhoe Park	12	Hyde Park	14	Waitangi Park	12
Point Erin Park	12	Merri Park	12	Light Horse Park	12	Wellington Botanical Gardens	12
Total	76		73		79		70

Reserve had a number of people riding bicycles through the park who were too fast to stop and talk to).

The researcher and volunteer individually recorded the presence and abundance of animals and plants, identified to species where possible, and noted down park visitors' responses as close as possible to verbatim during the interview. The two records of ecological and survey data were reconciled after the park visit.

Analysis

(1) A 10-min point count, (2) a transect to record the presence and abundance of all animal and plant species within 10–15 min, and (3) a social method of brief interviews with park visitors.

For each park, results from park visits were added together and a species list was produced (Section 2 of **Supplementary Material**), and species presence and abundance data were analyzed in JMP 13.0.0. We used the total number of species as an indicator for biodiversity. We used principal components analysis (PCA) to synthesize biodiversity observations and based on similarities and loadings greater than 0.40, two indices were created: avian and invertebrate species, and tree and ground cover species. We used linear regressions to test for relationships between the number of people present in parks with the principal components, biodiversity (total number of species), and number of trees.

Because we expected urban parks to be similar in comparable regions of each city (Catterall, 2009), both in terms of their park traits and their biodiversity, we tested for similarity among cities based on these two factors. We used PERMANOVA and pairwise tests in PRIMER 7, based on Bray–Curtis similarities calculated after a presence/absence transformation, to test for differences in the composition of biotic assemblages and park traits among cities (Clarke and Gorley, 2015). When a difference was found, we used SIMPER to identify the species or traits contributing most to the differences.

Across all parks, 298 park visitors participated in the interviews (**Table 1**). Park visitor interviews were transcribed and imported into NVivo 11 (QSR, 2012), where one researcher (LT) used thematic content analysis, a method often used to identify aspects of a participant's account (Green and Thorogood, 2004), to code interview responses into categories for each question. In line with the open questions used, we had no predetermined set of responses or expectations and used inductive method

to code responses, for example, in response to *Why did you come to the park today*, “For a walk” was coded as “exercise.” Where a comment included multiple reasons (e.g., “to visit the playground and have a picnic”), all reasons were coded, so there could be multiple codes for one comment. Once all comments had been coded, a frequency count was conducted (see Section 5 of **Supplementary Material** for more detail on coded themes and results).

RESULTS

Links Between Urban Park Biodiversity and Park Visitation

Overall, 288 species were identified, including two amphibians, 50 birds, four mammals (including people), 90 invertebrates, 81 trees, and 99 other plants (Section 2 of **Supplementary Material**). Section 3 of **Supplementary Material** includes the number of different species for each park, as well as the number of trees and number of human park visitors observed during the park visits. Assemblages of both animals (including amphibians, mammals, birds, and invertebrates) and plants (including trees, ground cover, and shrubs) significantly differed between cities [fauna PERMANOVA: Pseudo $F_{(3,20)} = 7.16$, $p = 0.001$; flora PERMANOVA: Pseudo $F_{(3,20)} = 2.51$, $p = 0.001$].

We tested for relationships between the number of people present in parks with the biodiversity (total number of species) and the number of trees and found no significant relationships (**Table 2**). We used PCA to identify similarities between taxa and generated two components, the first driven by the numbers of birds and insects and the second by trees and ground cover (Section 4 of **Supplementary Material**). There were no consistent associations between the numbers of people in parks and both principal components (**Table 2**).

Links Between Urban Park Traits and Park Visitation

To test whether park traits predicted a higher number of people visiting parks, we used PCA to simplify park traits into primarily open space and the number of trees (Section 4 of **Supplementary Material**). Overall, there were no correlations between park traits and visitation rates with the exception of the number of trees, which had a significant (negative) relationship with the numbers

TABLE 2 | We tested for relationships between the number of people present in parks with the biodiversity (number of species), two principal components (birds and invertebrates, trees and ground cover), and the number of trees and found no consistent relationships.

	Auckland				Melbourne				Sydney				Wellington				Total			
	β	F	P	R	β	F	P	R	β	F	P	R	β	F	P	R	β	F	P	R
Overall biodiversity	-0.11	0.01	0.935	0.04	1.53	2.64	0.18	0.63	0.17	0.04	0.85	0.10	-4.85	0.94	0.39	0.44	-0.59	0.64	0.43	0.17
PCA1: Birds and invertebrates	-13.11	8.36	0.045	0.82	6.41	0.92	0.39	0.43	-1.66	0.07	0.80	0.13	9.97	0.27	0.63	0.25	-3.80	1.26	0.27	0.23
PCA2: Trees and ground cover	-8.26	3.99	0.117	0.71	-4.43	3.37	0.14	0.68	1.79	0.07	0.80	0.13	-9.00	0.39	0.57	0.30	-4.76	1.43	0.24	0.25
Number of trees	-0.21	0.28	0.622	0.26	0.18	0.94	0.39	0.44	-0.28	1.28	0.32	0.49	-0.28	0.13	0.73	0.18	-0.21	1.08	0.31	0.22

Significant results are bolded. $N = 6$ for each city and $N = 24$ for total number of cities.

of people visiting parks ($P = 0.005$, $R = 0.55$). Parks in one of our study cities, Wellington, had fewer sparse or clusters of trees than the other cities' parks, but there too we found no relationship with the numbers of people visiting parks. There were no consistent relationships between the number of people visiting parks and either principal component when cities were analyzed separately.

Why People Visit Parks and How Do They Experience Park Visits?

Why Did You Come to This Park Today?

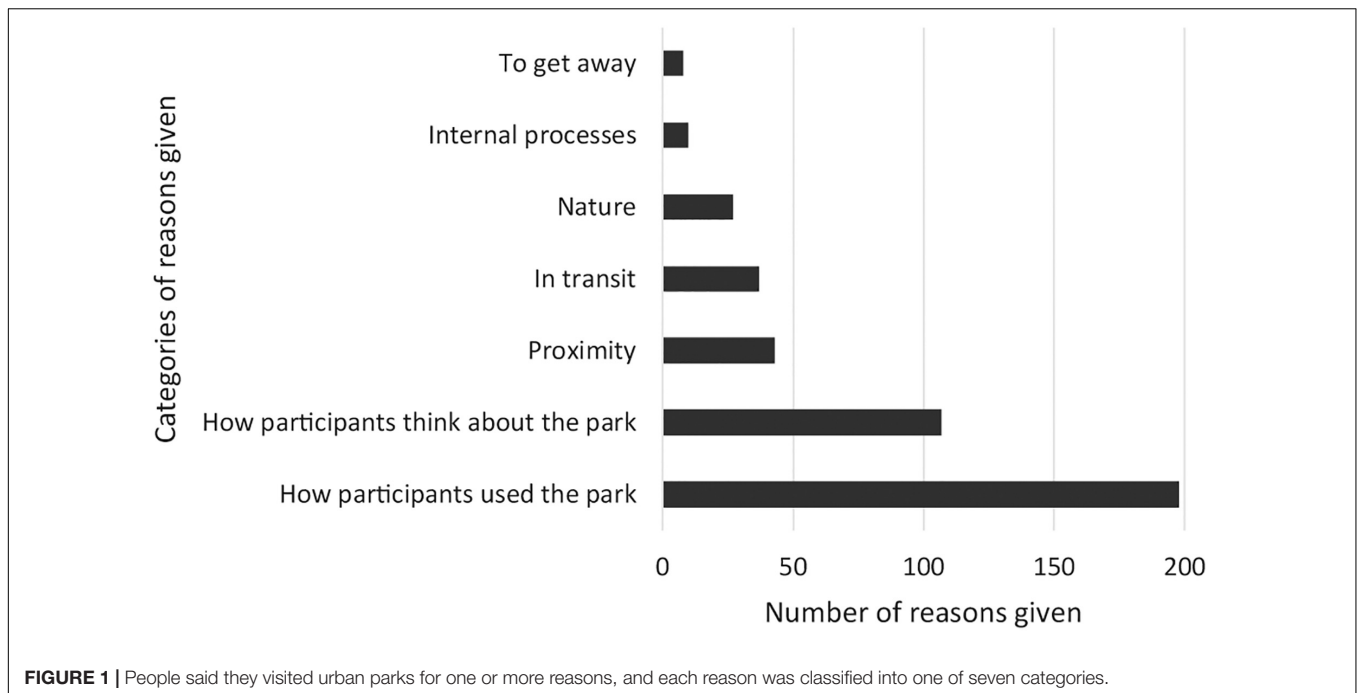
In response to the question about why participants visited the park, more than half (55%) of respondents gave more than one reason for being in the park. For example, "[I'm] in transit going to the Metro – I'm following the trees to keep away from the sun," which involved the person being in transit, and utilizing the shade and temperature regulation of natural spaces. There were seven categories in total (**Figure 1**): (1) *how people used the park*, for example, as a meeting place, as an extension of one's home, or to exercise; (2) *how people think about the park*, for example, people went to the park because they thought it was nice, safe, family-friendly, or dog-friendly; (3) *proximity*, for instance, if the park was close to their home or near the city; (4) *in transit*, for example, if people were walking through the park on the way to or from some shops or their home; (5) *nature*, for example, the view of the water, the birds, because it is sunny, or because it is shady and cooler than other places; (6) *internal processes* include to relax, to pray, to think, or for the quiet; and (7) *to get away*, including to have a break from work, to get out of the house, or to be away from cars. While some responses were explicit about going to the park to be around nature, such as "I come here to feed the ducks and get back to nature," others were not. For example, the following statement concerns being in transit, but notes that the participant went to the park because it is more pleasant than the street, "Waiting for a table so we can go for lunch – it's more pleasant here than to wait on the street." Statements such as these were not categorized as nature because it was not explicitly mentioned, but the natural setting of the park may have been the implied reason for it being more pleasant in the park. For that reason, it may be that nature-related reasons for participants being in parks are under-represented.

What Three Things About This Place Do You Notice?

Participants were asked to list three things in the park that they noticed. Some participants could only think of one or two things, so not all participants listed three things. Of the total 886 things that people mentioned, 29% responses concerned some form of nature, including vegetation, water bodies, wildlife, ecosystem services (e.g., fresh air, shade), and/or the sky (e.g., sunsets, sunrise). For each city, between approximately one-quarter and one-third of things noticed involved nature (Auckland 24%, Melbourne 37%, Sydney 25%, and Wellington 33%). Other key things that participants said they noticed included the park's facilities (such as playgrounds or gym equipment), other people, and how frequently or how well the park is maintained (Tables 5.1.1, 5.1.2 in Section 5 of **Supplementary Material**). There were 11 negative comments, five of which concerned pollution in the water (e.g., "the water ways are dirty"), three concerned a lack of shade, two concerned a lack of parking, and one referred to other people, in particular the campers who use the park. Participants noticed particular things that were associated with individual parks, for example, the 14% of cultural things noticed in Hyde Park in Sydney refer to a statue of Captain Cook and the ANZAC memorial. The 31% of things concerning the facilities in Gribblehurst Park in Auckland refer to the large children's playground, a sports field, and a flying fox/zipline.

What Three Words or Phrases Describe How Being in This Park Makes You Feel?

In each city, approximately one in eight participants said that being in the park made them feel relaxed, happy, peaceful, calm, or positive (Tables 5.2.1, 5.2.2 in Section 5 of **Supplementary Material**). Other common descriptions include feeling free, away (from the city, the pollution, home, or work etc.), engaged or interested, healthy, or in family- or dog-friendly environments. When looking at how people felt according to different parks (Table 5.2.2 in Section 5 of **Supplementary Material**), some differences were noted. For example, in Light Horse Park in Sydney, some participants had negative comments to make, such as, "[I feel] unhappy about the broken bottles," or "[I feel] sometimes scared of... people drinking alcohol," or "Early morning... [there are] sometimes people doing unnatural things



that makes me worried.” In Waitangi Park in Wellington, which is a primarily open space with few trees next to Wellington Harbor, participants felt exposed to sun and wind. Also in Wellington, of participants in Ironside-Ohariu Reserve mentioned struggling up the steep hills in the park, which are a feature of its topography. In Auckland’s Cox’s Bay Park, which includes park traits of playing fields and paths along trees and a river, participants said they felt healthy. Merri Park in Melbourne also featured playing fields and paths through urban forest and along a river, and participants also said they felt healthy when they were there, reflecting the common activities of park visitors. The negative responses to Ironside-Ohariu Reserve in Wellington referred to the steepness of the hill causing a fear of slipping over, and concern about safety at night because the vegetation is quite dense with a single paved path through it.

We tested for correlations between how people felt in the parks (peaceful, relaxed, happy, calm, negative, good, away, free, and in nature) and biodiversity (number of species), birds and invertebrates principal component, trees and ground cover principal component, number of trees, but found very few significant relationships and no consistent patterns. A possible exception could be the total number of species in Melbourne and Sydney parks which positively correlated with the proportion of participants who said that being in the park made them feel calm (Melbourne $P = 0.018$, $R = 0.89$; Sydney $P = 0.032$, $R = 0.85$).

Differences Between Parks and Community Use of Parks Among Cities

The composition of biodiversity in parks among cities was significantly different [PERMANOVA: Pseudo $F_{(3,20)} = 4.42$, $P = 0.001$]. Pairwise tests revealed that each city supported distinct biodiversity ($P \leq 0.005$ for all comparisons) (Figure 2).

SIMPER analyses revealed that biodiversity in parks within cities was strongly characterized by the abundances of locally common bird species. The major contributors to city faunal identity for Auckland (9% contribution each) were house sparrows (*Passer domesticus*) and kelp gulls (*Larus dominicanus*). In Melbourne, rainbow lorikeets (*Trichoglossus moluccanus*), Australian magpies (*Cracticus tibicen*), and Welcome Swallows (*Hirundo neoxena*) were key contributors of park fauna (11, 8, and 8%). In Sydney, these three species, along with noisy miners (*Manorina melanocephala*) were prominent (all contributing 7%), and in Wellington blackbirds (*Turdus merula*) and house sparrows (*P. domesticus*) were most common (both 15%).

Parks differed among cities based on the different traits recorded [PERMANOVA: Pseudo $F_{(3,20)} = 2.58$, $P = 0.019$]. Pairwise tests revealed that this difference was driven by the traits of parks in Wellington, which differed from those of the other cities (Figure 3). SIMPER revealed that Wellington parks featured fewer sparse trees or clusters of trees (20%) when compared with other cities’ park traits (between 27 and 36%).

Differences between parks were neither part of our research questions; however, we note that this information is presented in the **Supplementary Material**.

DISCUSSION

Previous studies have found a positive relationship between increased biodiversity and psychological well-being (Fuller et al., 2007), or that nature in general can benefit human well-being (see Taylor and Hochuli, 2015). We tested whether there was a relationship between the biodiversity (or species richness) of urban parks with the number of people visiting parks, but our data suggest that the biodiversity of urban parks is

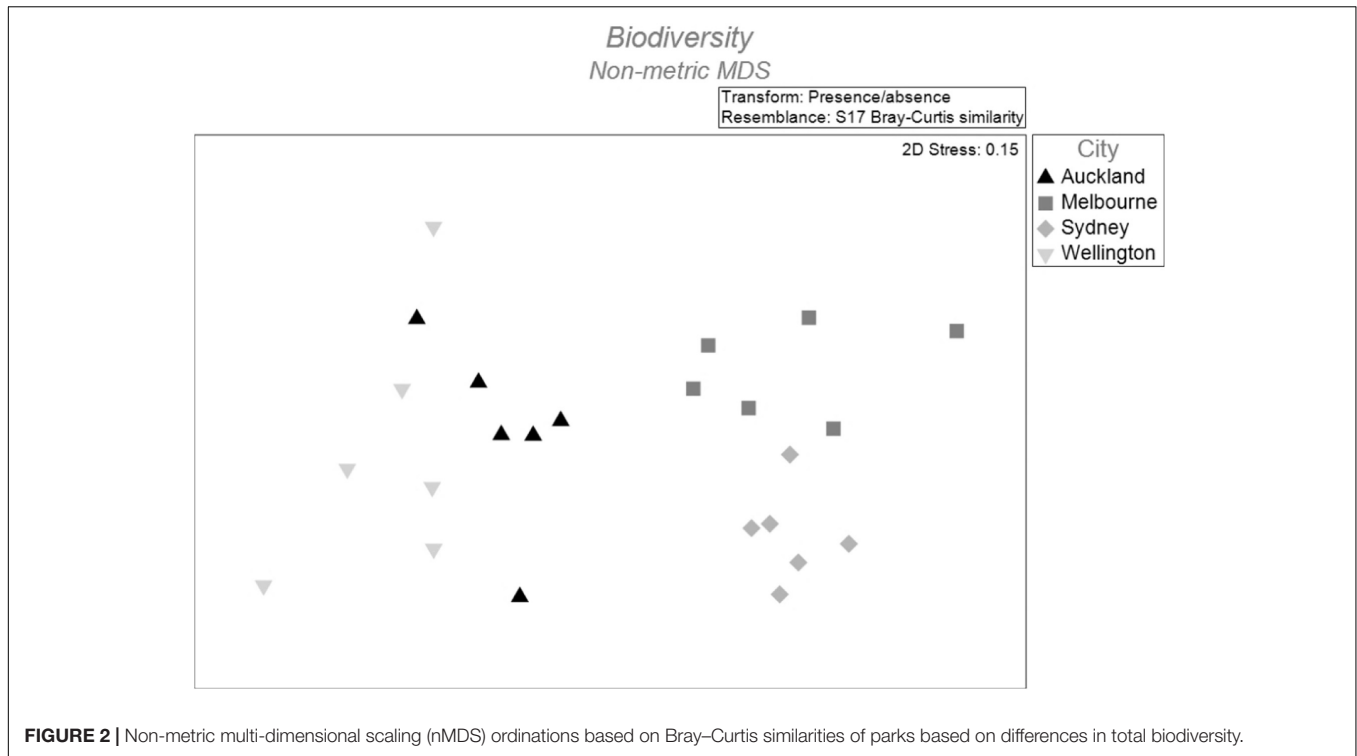


FIGURE 2 | Non-metric multi-dimensional scaling (nMDS) ordinations based on Bray–Curtis similarities of parks based on differences in total biodiversity.

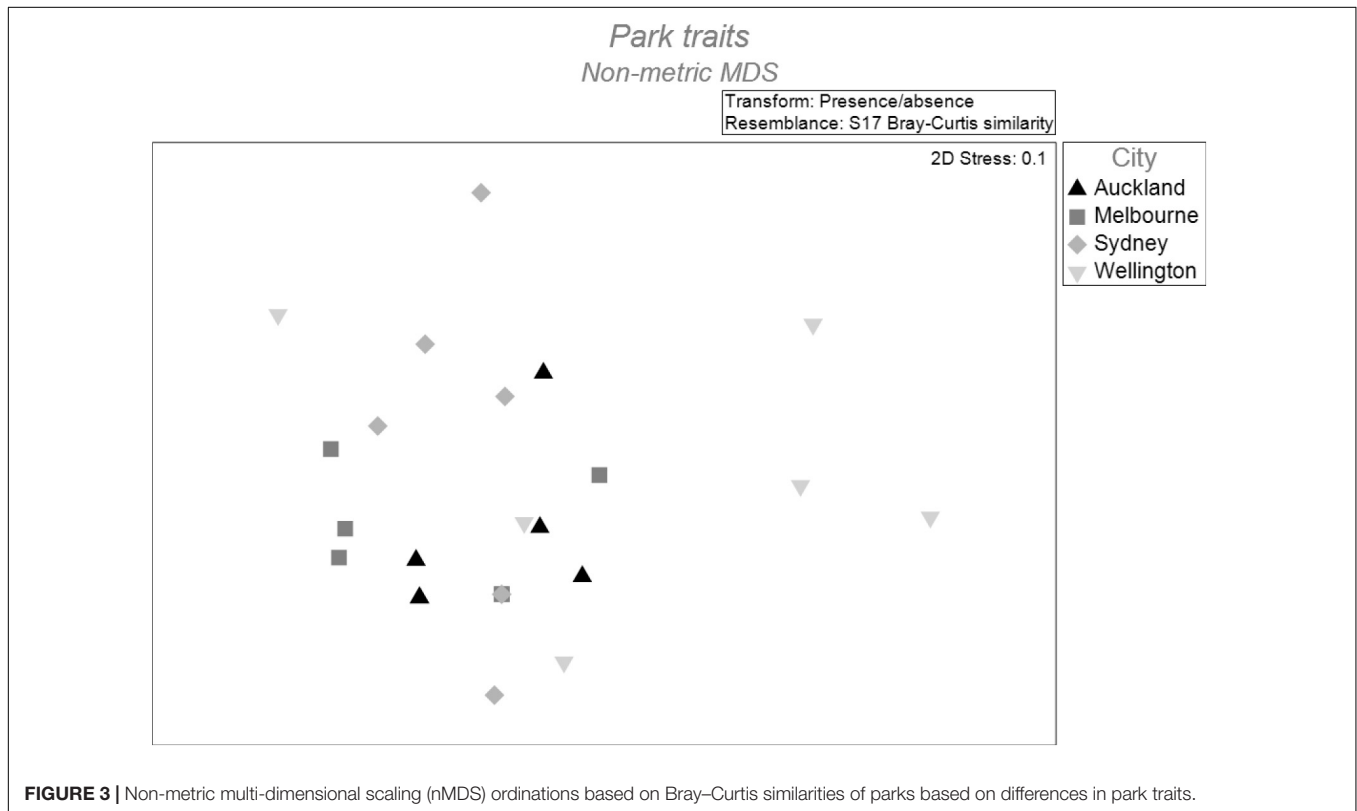


FIGURE 3 | Non-metric multi-dimensional scaling (nMDS) ordinations based on Bray–Curtis similarities of parks based on differences in park traits.

not linked with urban park use. We also asked interview participants why they were in the park, and few explicit reasons given suggested they visited the park for nature-related reasons (Figure 1). Based on these findings, neither park biodiversity

(whether participants were conscious of it or not), nor conscious decisions to experience nature were related to park visitation. Rather, we found that there are a range of experiences that visitors want from park visits. Being able to easily access

a park was also a common reason for its utilization (i.e., being in transit).

Associations between *perceived* (rather than actual) biodiversity and psychological well-being (Dallimer et al., 2012) suggest that the *perceptions* of park visitors affect the quality of their experience and their willingness to return to urban parks. Approximately one-third of participants in our study noticed nature while in an urban park. We acknowledge nature, as we have defined it, is not biodiversity, but rather a “tacit” biodiversity that is noticed without intervention. Nevertheless, most participants said that being in the park made them feel positive in some way. A more detailed questionnaire could reveal whether this positive impact is related to psychological well-being (Dallimer et al., 2012), or other benefits, such as recovery from stress (Ulrich et al., 1991).

Urban Parks Differ, but They Have Similar Functions for People

We had expected that urban parks would have similar structures and functions in all four cities due to common features found in urban ecological work. For example, more urban areas usually have a high proportion of introduced species (Catterall, 2009) and super-abundant species, such as rainbow lorikeets in Sydney (Taylor et al., 2013). While there is strong evidence of these trends for avian species (for instance, Marzluff, 2001; Clergeau et al., 2006), there is also evidence of homogenization for other taxa (for example, fungi and vegetation, respectively: Ross et al., 2012; Epp Schmidt et al., 2017). As such, homogenized biota (McKinney and Lockwood, 1999) was anticipated in the urban parks of this study. Contrary to what we expected, the urban parks in this study supported significantly different biodiversity, a pattern observed across multiple taxonomic groups. This is despite the presence of typically super-abundant species in all four cities, such as house sparrows and blackbirds (Catterall, 2009). Both local and introduced species contributed to the differences of assemblages. The park traits, which include both natural and human-focused traits, also showed a difference between parks in Wellington and those in other cities.

Participants cited multiple reasons for being in parks so, at least for the park visitors, the function of urban parks was similar among cities. Each of the seven categories identified (**Figure 1**) contained a range of reasons why people were in the park and many responses contained more than one reason, such as walking through the park for shade while in transit. This suggests that urban parks serve multiple purposes at all times, and that this range is desirable for urban residents. Urban parks would ideally cater for all demographics, including those who are interested in nature and those who are not. It is worth remembering that the use of the word, “park,” can variously refer to a natural space that is either wild or maintained for public recreation, a place for games and rides, and a place to store vehicles. The diversity of the use of the word mimics how urban residents wish to use parks.

In spite of the diversity of reasons identified for how people use parks, participants in this study told us that being in the

park made them feel relaxed (15–21% across all cities), happy (13–16% across cities), and peaceful (6–10% across cities). We acknowledge that due to the intentionally-short design of the human survey, we did not collect demographic information and participation may not be representative. Nevertheless, while people visit urban parks for different reasons, the similar outcome of positive affect is striking. This finding supports previous work that found the most common reason people visit urban parks in the northern hemisphere is to relax (Chiesura, 2004; Irvine et al., 2013). One might expect the parks in the most urban centers of each city to be the most ecologically simple and highly-maintained examples of parks, void of patches of endemic vegetation and showcasing international plant species or highly-maintained public spaces. Albert Park in Auckland, Carlton Gardens in Melbourne, Hyde Park in Sydney, and Waitangi Park in Wellington could all be described in this manner. Nevertheless, the park visitors in those most-urban parks said they generally felt peaceful and relaxed.

What of Biodiversity and Well-Being?

If park visitors are unable to identify whether a park has high or low biodiversity (Dallimer et al., 2012), and if most people are not attracted to parks because of biodiversity (this study), then one might conclude that cities do not need biodiverse parks. However, an explanation for the limited number of responses describing biodiversity in this study could be that biodiversity is a secondary benefit, or co-benefit, of park visitation (Raymond et al., 2017). For example, someone might visit a park to take their children to play on play equipment, and thus say they notice the playground, and the seat they use while they wait, but without further questioning, we may not be aware that they chose that park's play equipment rather than the local school's equipment because of the trees, sense of fresh air derived from the vegetation, or aesthetic response to the gardens. In other words, the presence of biodiversity may be a co-benefit of other aspects of the park, as suggested by a nature-based solutions framework (Raymond et al., 2017). In the same way that parks are considered multifunctional in that they contribute to a range of ecosystem services, the motivation for park visits may also be multifunctional (Connop et al., 2016). Results from our exploratory study suggest that further research regarding biodiversity and park visitation either requires a more targeted questionnaire, or a more complex approach, such as one aligning with the nature-based solutions framework (Raymond et al., 2017).

We note that the biodiversity of urban parks is important not only to the well-being of current urban residents, but also to future urban residents (Tagles and Idrovo, 2012; Taylor and Hochuli, 2015). There are two primary reasons for this, although there may be other reasons to preserve urban biodiversity in contexts other than urban parks, such as in private gardens (Cameron et al., 2012). First, our study suggested that park visitors value different aspects of nature. Between one-quarter and one-third of park visitor participants said they noticed nature in the park, but their observations varied from vegetation and wildlife to the weather or a view, and even described types of

ecosystem function (such as air cycling and extreme temperature mitigation). Some participants noticed the trees, others the birds, and others still noticed the overall vegetation structure of nature in a park. Despite not categorizing them as a reference to something natural, we suspect that references to shade, shelter, or beauty could also refer to nature. If that is the case, the reasons people visited parks and the things they noticed in the parks could be under-represented in our study because further clarifications were not sought in the park survey due to its intentionally short design. While biodiversity in the ecological literature may be synonymous with endemic and structurally rich nature, it can mean something else to urban residents (de Oliveira et al., 2011). Indeed how people perceive “naturalness” impacts the restorative benefits they receive from natural spaces (van den Berg et al., 2014). Diversity is important to urban residents when it comes to urban nature, including diversity in different park types, park traits, and even different areas or facilities within a park. It may be important then that there is open space and manicured gardens in a park *as well as* a patch of endemic urban forest. Ensuring different kinds of parks will ensure benefits for people with varying perceptions of “nature” – including the wild and biodiverse (van den Berg et al., 2014) – and will address desires for diversity.

The second reason for preserving urban park biodiversity is that ecosystem functioning contributes to the health and well-being of local residents, regardless of whether they have awareness of it (United Nations, 2005). Distinct features of parks, biodiversity, and ecosystem function are positively associated (Benayas et al., 2009). In cities where landscapes are highly modified, it is important to note that biodiversity loss diminishes ecosystem function (Luck et al., 2003). As mentioned above, some park survey participants mentioned ecosystem functioning as a reason for them visiting the park. Other participants may not have considered the fresh air or the cooling effect of the urban park but reported feeling relaxed or refreshed because of related reasons. Those who said they came to the park to be “away” from cars or the city could also be responding to ecosystem functions in urban parks, among other things such as safety or stress recovery (Ulrich et al., 1991). It is not as simple as planting diverse vegetation to ensure certain ecosystem functioning in cities because more established natural spaces can yield greater benefits, for example, older parks have greater soil organic carbon storage than newer ones (Wang et al., 2013). Ecologically restored areas are not as functionally productive as the original and intact, remnant areas and their biodiversity do not return to original levels (Benayas et al., 2009). Conserving original, or at least older parks and areas of remnant forest is important both for biodiversity and ecosystem services, thereby supporting the well-being of urban residents. Taking into account the benefits of older parks and conserved natural spaces suggests that how urban nature is managed now will also have ramifications for future urban residents. While “*any green will do*” for some residents in terms of conscious decision-making about visiting urban parks, it is worth conserving and managing urban nature for the sakes of biodiversity, ecosystem function, and human health and well-being (Taylor and Hochuli, 2015).

Parks Without People

In this study, there were more people in some parks than there were in others (Section 3 of **Supplementary Material**). This could be due to a limitation with the study design. For example, having a sunrise or sunset visit in addition to a daylight hours visit was intended to address the issue of different park visitation for human visitors and non-human species present, but further consideration in the study design could consider weekend visitation from local residents. However, other studies have interviewed a similar or fewer numbers of park visitors (for example, Talal and Santelmann, 2020 interviewed 43 park visitors in one city whereas we interviewed 70 or more park visitors per city). Further work should be done before concluding that less-visited parks should be abandoned. We argue that (1) because residents want a variety of things from parks and (2) because visitors found the proximity of parks important, that retaining multiple parks throughout an urban matrix is important.

We found a variety of reasons why people visited urban parks (**Figure 1**). Each of the seven categories includes multiple sub-categories, for example, “how people think about the park” included responses such as, “It’s nice,” “it’s safe and clean,” “I can bring my dogs,” showing that people think the park is a nice place, that it is safe and dog-friendly. As such, some of the categories summarized a plethora of reasons about why people visit parks. This diversity of reasons could inform how local governance bodies manage and maintain urban parks. In order to meet the needs of heterogeneous urban population with varying needs and perceptions of “naturalness” (van den Berg et al., 2014), multiple natural spaces are important. It could be that they might be managed in different ways to attract people, or that anthropocentric traits, such as paths or a playground, could be added. Nevertheless, urban parks would ideally reflect the multifarious needs of families, pet-owners, office workers, tourists, bird-watchers, walkers, runners, cyclists, and those looking for meeting places or spaces for other recreation.

Two key reasons why participants in this study said they were in the park involved serendipity: those who were in the park due to its proximity to other places and those who were in transit to other places (versus purposefully going to the park to walk). Those who said they were in the park due to its proximity to other places either lived or worked nearby, or had other business, such as shopping or waiting for an appointment or table at a café, in local shops. In many instances, those in transit involved a preference for walking through the park over more urban spaces. That preference had different drivers, such as avoiding vehicular exhaust, seeking shade from trees, or just being in a nicer place than surrounds. Future studies could factor this into the study design, prioritizing parks closer to other amenities. Removing parks that were found to have fewer people in them at any one time would remove the serendipitous park visits for people who are in transit or spending time at a nearby location. This outcome has implications for local governance bodies that manage the existence of current and potential natural spaces in urban areas. It may be that a short park visit, such as someone

walking through a park in transit to another location, would be sufficient to provide a benefit to well-being. For instance, one study has found that a 40-s glance at a green roof provides a more restorative “microbreak” than an equivalent glance at a concrete roof (Lee et al., 2015). If residents live in close proximity to a park, it is possible regular use or commute through a park can influence a commitment to conservation and other sustainable behaviors (Prévot et al., 2018). Keeping all parks, or even creating new ones, will increase the opportunities for urban residents to benefit from them in numerous ways.

CONCLUSION

We aimed to determine whether there was a link between the biodiversity of parks and the number of people visiting parks. We found no consistent results linking the numbers of people in parks and the presence and abundance of species found by ecological surveys. While the natural aspects of urban parks prompted *some* visits to parks, the main drivers of park use for urban residents were the diversity of experiences available and the accessibility and/or proximity of natural spaces to where people spend their time. Most park visitors who participated in the study said that being in the park helped them feel relaxed, happy, and peaceful, despite biodiversity being unrelated to how park visitors said being in the park made them feel.

Park visitors gave a range of reasons for being in parks, suggesting that parks can offer a range of benefits and uses for urban residents. We argued that for this reason, parks and biodiversity are important to maintain throughout the urban matrix to provide necessary ecosystem functioning to support human well-being.

Our findings have the potential to inform the management of existing parks and establishment of future parks, particularly understanding that there are lots of reasons for people to visit parks, and sometimes due to the placement being in proximity to other spaces. The placement and planning of parks in cities could afford serendipitous interactions with nature and potentially offer opportunities to benefit residents’ well-being and encourage more sustainable practices. Considering biodiversity in the planning and management of urban parks provides a range of nature-based solutions, and we expect further research would reveal whether and how co-benefits of biodiversity influence park visitation. Implications for local governance bodies are relevant in the four

study cities where we found distinct biodiversity profiles but may be useful in other cities in Oceania and beyond.

DATA AVAILABILITY STATEMENT

The original data analyses presented in the study are included in the article/**Supplementary Material**. Further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by The University of Sydney Human Research Ethics Committee (2015/803). The participants provided their informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LT and DFH designed the study. LT carried out all field work with either EHL or PJJ. LT led the collation and analysis, with contributions from DEH for the PERMANOVA analysis, and from EHL and PJJ on the species identification and qualitative analysis. LT drafted the manuscript and all authors provided edits to improve it.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fenvs.2020.595620/full#supplementary-material>

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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