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Article

Exploring perceived wellbeing from urban parks: Insights from a mega-city in Latin America

Andrea Parra-Saldívar[1], Sebastián Abades[2], Juan L. Celis-Diez[3,*] and Stefan Gelcich[1,4]

[1] Departamento de Ecología, Facultad de Ciencias Biológicas, Pontificia Universidad Católica de Chile, Santiago, Chile; aparra2@uc.cl
[2] GEMA Center for Genomics, Ecology & Environment, Facultad de Ciencias, Universidad Mayor, Santiago, Chile; sebastian.abades@umayor.cl
[3] Pontificia Universidad Católica de Valparaíso, Escuela de Agronomía, Quillota, Chile; juan.celis@pucv.cl
[2] Center of Applied Ecology and Sustainability (CAPES) & Centro de Conservacion Marina, Pontificia Universidad Católica de Chile, Santiago, Chile; sgelcich@bio.puc.cl

* Correspondence: juan.celis@pucv.cl; Tel.: +56-9 9228-4640 (J.L.C-D.)

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Abstract: Urbanization has impacted biodiversity and ecosystems at a global scale. At the same time, it has been recognized as a driver of the gap between humans and nature. The lack of direct contact with nature can deteriorate several aspects of human wellbeing, and change knowledge and attitudes of people towards the environment. However, this phenomenon is still poorly understood in Megacities outside developed countries. Here, we explore the relationship between ecological knowledge and self-reported wellbeing in an important urban park in Santiago, Chile. We conducted semi-structured surveys to park users to explore their notions, preferences, ecological knowledge of plants and birds and self-reported wellbeing. Citizens associated urban parks mainly with "nature", and particularly with the presence of trees and plants. Trees were recognized as the most relevant elements of urban parks, in turn, birds were ranked as the less relevant. Regarding ecological knowledge, respondents correctly identified an average of 2.01 plants and 2.44 birds out of a total of 10 for each taxon, and exotic species were more likely to be recognized. Park users also reported high scores for self-reported wellbeing. Interestingly, variance of self-reported wellbeing scores tended to increase at low levels of ecological knowledge of trees, but no significant relationship was detected with knowledge of birds, nor native species. These results suggest that parks can positively contribute to bring people closer to nature. Ecological knowledge was related to self-reported wellbeing. Improving ecological knowledge can be critical to restore the relationship between humans and nature in megacities.

Keywords: Urban ecology; ecological knowledge; socio-ecology; urban birds; urban vegetation; exotic species; Biocultural homogenization

1. Introduction

"Urban systems remained under studied by ecologist for most part of the last century" [1]. Only few decades ago, scientists recognized cities as both drivers and responders of global change [2,3]. Today, urbanization is known to impact biodiversity and ecosystem functions worldwide by processes such as biotic homogenization and the progressive loss of native species [4-6]. As cities represent for a great part of the population the main nexus with its territory [7] (pp. 719-746), urbanization have been considered a key driver of the gap between humans and nature [8-10]. The lack of direct experiences with nature can jeopardize several aspects of human wellbeing [11-13] such as cognitive restoration, emotional attachment and sense of identity developed with natural places. This is of special concern, since the gap between humans and nature can change the attitudes

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and emotions of people towards the environment [10,14-17] which in turn fuels this cycle of disconnection [10,18].

Few studies have assessed the specific components of nature that affect human wellbeing. For instance, Dallimer et al. [12] found that perceived rather than actual species richness was correlated with self-reported wellbeing. Cameron et al. [19] also reported this relationship between wellbeing and perceived biodiversity in urban parks and suggested that other factors as the ability to 'notice beauty in nature' may modulate this relationship. This can also be attributed to the limited ability of people who live in cities to recognize local animal and plant species [20-23]. In fact, a generalized loss of ecological knowledge in urban dwellers has been reported in several wealthy cities [24]. Knowledge has also been negatively related with income within urban areas [25]. This loss of ecological knowledge is worrying, as it has been reported to drive fewer desirable attitudes and emotions towards nature. For instance, Cox and Gaston [26] reported a strong correlation between the number of correctly identified bird species and a self-reported connection to nature. This evidence suggests that ecological knowledge may be a crucial factor underpinning the relationship between human wellbeing and nature [13]. Exploring how these factors interact can shed a light on how to restore the relationship between humans and nature in urban areas.

Most research on extinction of experience -the increasing lack of direct contact between humans and nature [10]- and the links between local knowledge and wellbeing have been conducted in developed countries. This is unfortunate as the urbanization processes in Latin American have occurred in different socio-cultural contexts, and therefore followed different trajectories and paces [27] (pp. 217-234). As two thirds of megacities are emerging in middle- and low-income countries [28], the focus on developed countries could eventually present several biases in the design of future solutions. By contrast, understanding perceived wellbeing drivers in urban parks of low- and middle-income countries presents an opportunity to create future regionally based research platforms focused on different urbanization processes. Here, we address the relationship between ecological knowledge and self-reported wellbeing in a middle-income country megacity as a baseline through which insights on this issue can be drawn.

We explore the relationship between ecological knowledge and self-reported wellbeing in a highly concurred urban park in downtown Santiago, Chile. We assessed the main perceptions about nature and green areas, as well as the preference of visitors. Then, we measured the ability to recognize and name different plant and bird species present in the park. Finally, we measured the self-reported wellbeing of visitors and explored how it related to their ecological knowledge. We hypothesized that knowledge is positively related to self-reported wellbeing, and this relationship might be reflected on people's notions and preferences. We predicted that ecological knowledge is lost, particularly for the native biota. We also predicted that a higher level of self-reported wellbeing relates to greater ability to recognize species.

2. Materials and Methods

2.1. Research Setting

Over 87% of Chilean population inhabits in urban areas [29], and 7,112,808 people (40,47% of the country population) live in the Metropolitan area of Santiago, the capital of Chile. This is considered as a Megacity, as it holds a population density of 8,495 habitants per km2. Santiago is placed within the Central Chile Biodiversity Hotspot [30]. But even though the urban area has developed towards the most biodiverse Mediterranean zone of Chile, urban parks are not remnants from natural areas since they were built during the last century during the centenary celebrations, using exotic flora from Europe and Asia [31,32]. Additionally, the urban zone possesses a total of 3825 ha of green areas, but only 3% (n=358) have a size of 1 ha or more [33]. Although there is no consensus, WHO uses as an indicator of accessibility the criteria of "percentage of citizens living within 300 m from a public open area of minimum size 0.5 hectares" [34]. In the case of Santiago, only 19.6% inhabitants with low-level incomes meet this criterion, in contrast with the 74.1% of the wealthier population [33]. Additionally, the average of urban green areas is 3.2 m^2 per capita, but

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this value also varies with income, showing between 0.9-2.9 m²/habitant in the low-income areas, to 6.7-18.8 m²/habitant in the wealthier areas of the capital [35]. Therefore, urban green areas are not evenly distributed across the city, and there is a high socioeconomic segregation in the accessibility and the size of green areas in Santiago [33].

2.2. Study site

Research was performed in one of the most cosmopolitan and visited parks of downtown Santiago city, Parque Forestal (33°26′ S 70°38′ O). It harbors 17 ha and was officially inaugurated in 1905. Its flora is dominated by conspicuous exotic species like oriental plane (*Platanus orientalis*) and cherry plum (*Prunus cerasifera*), and some native ones as such as *Acacia caven*, *Maytenus boaria* and *Cryptocarya alba*. Regarding the avian fauna, some common native species are the Austral Thrush (*Turdus falcklandii*) and the House Wren (*Troglodytes musculus*), which nest in this park. Because of its extension and accessibility Parque Forestal is considered one of the most important public green areas of the city.

2.3. Sampling

A total of 222 park users where surveyed between March 2016 and April 2017, during weekends. We roamed across the park between 3 pm and 7 pm, and chose people that were sitting on the grass, talking in groups or using the public facilities. We did not ask people that were passing by or working (such as peddlers), to prevent obtaining biased data from not park users. An average response rate of 75% was achieved. The distribution of the sample included Chileans (n= 216, 97.29%), aged 18-29 years (n= 152, 68.48%), women (n= 112, 50.45%) and had higher educational level (n= 113, 50.9%).

2.4. Survey and statistical analysis

To survey the park users, we designed a 3 item semi-structured questionnaire, including free elicitation of word association, short-answered questions, Likert Scale and closed-ended questions. The instrument was piloted and adjusted several times. The survey had sections on perceptions, knowledge, wellbeing and some basic socio-economic variables (see Supplementary Material S1).

To evaluate users' unbiased ideas and notions about nature, we first asked them to mention the first three concepts or words they related to parks [36]. These words where categorized a posteriori in five major areas: Nature, as every idea related to environment; Attachment, as the sense of belonging and emotion; Reflection, as the capacity of meditate or think; Equipment, as every resource or implement of a park; and Others for every idea that could not be classified into these groups. Some of these areas were subdivided when possible into different categories. Results were presented as a word cloud to highlight the most repeated concepts using the package "wordcloud2" from R v4.0.0 software [37] on RStudio v1.2.5042 [38].

We assessed ecological knowledge based on Pilgrim et al. [24] and Celis-Diez et al. [23], considering it as the ability to recognize or name different urban plants (n=10) and birds (n=10) present in our studied urban park. For each taxon, we included native and exotic species commonly found in urban environments in Central Chile. For plants, we used pictures of 5 native and 5 exotic species; for birds, we used pictures of 7 native and 3 exotic species. We followed the method performed by Celis-Diez et al. [23]. We asked users to look at photos of different species for a maximum time of 1 minute and name them. To facilitate the recognition of plants, we included images of the tree, its leaves, flowers and fruits. Every answer was recorded as "correct" or "incorrect" (which included wrong answers and omissions), so every respondent had a total number of correct answers, and a ratio of native/exotic species recognized. Additionally, we asked respondents if they would like to see each species on a hypothetical park.

To assess users' preferences, we presented five attributes from a park and asked them to rank them, giving the first position to the most important element and the fifth place to the less relevant.

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The features were "bird abundance and diversity", "tree abundance and diversity", "infrastructure", "illumination and security" and "recreation infrastructure".

To assess users' wellbeing, we used the Feel Good Factor approach of Dallimer et al. [11], in which three main dimensions are described: (i) attachment, (ii) reflection and (iii) continuity with past. We built a 7-statement matrix, adapted from Dallimer et al. [11], and asked respondent to recognize the degree of agreement with each one. We used the scale proposed by Marin et al. [39] in which respondents score in a 20-point continuous scale their agreement or disagreement with different statements. We calculated the overall Feel Good Factor as the average of the score values obtained for the three dimensions enquired.

To explore the relationship between ecological knowledge variables and users' wellbeing, we ran a quantile regression to analyze the effects at the extremes of the distribution of answers instead of the means. We chose to use quantile regression because it allows for the estimation of the minimum wellbeing achieved as a function of ecological knowledge. We analyzed whether self-reported wellbeing was related to knowledge of birds and trees separately, with special focus on the knowledge of native species. All analysis was performed using the R v4.0.0 software [37] on RStudio v1.2.5042 [38].

3. Results

3.1. People's Notions

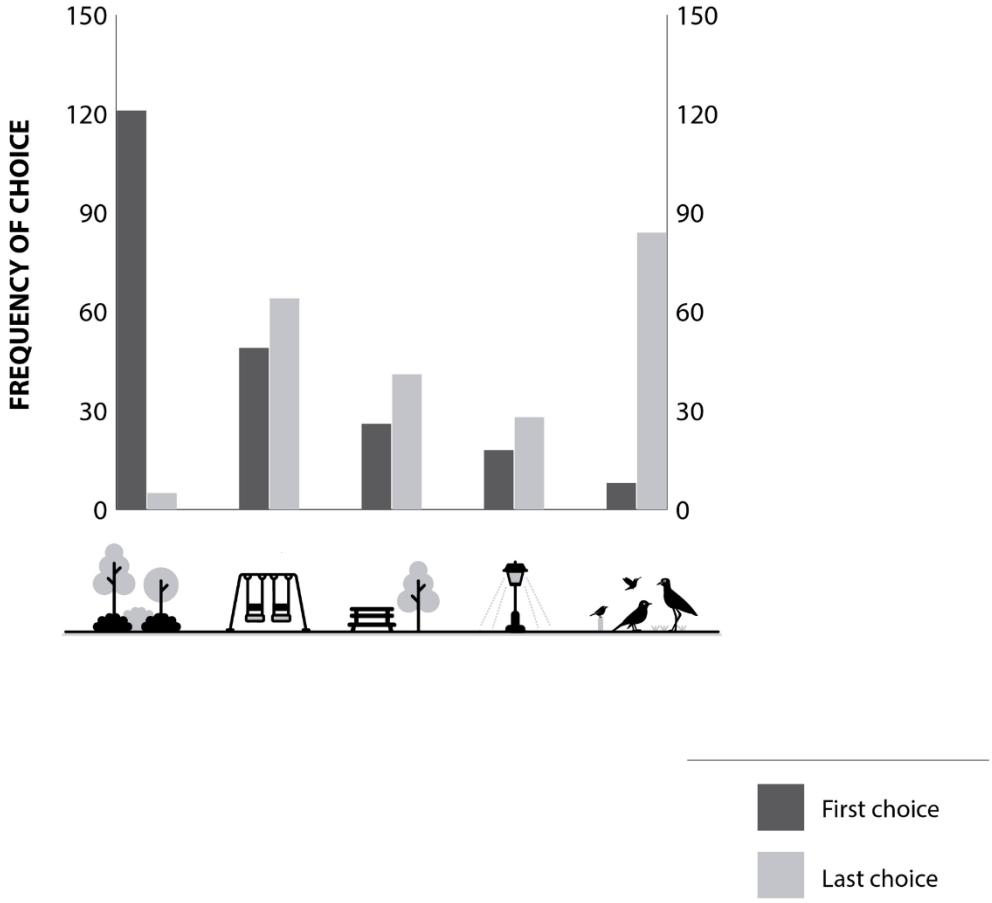
Citizens associated urban parks mainly with Nature (Figure 1). This was the most frequently named category with 48.05% (n=320 out of 666 mentions). The second category was Attachment, with 37.99% (n=253), meanwhile Equipment (12.16%, n= 81), and Reflection (4, 0.006%). Specifically, the three most repeated concepts where "trees" (n=100, 15.02%), "grass" (n=55, 8.26%) and "nature" (n=49, 7.36%), and together represent the 30.63% (n=204) of the total mentions. Interestingly, only 1.77% mentions related to birds (n=11). Other ecosystem features represented only 6% (n=40) of the total mentions, including concepts as "air", "clouds", "water" and "soil".

Figure 1. Word cloud containing the concepts mentioned by the participants. Sizes represent the frequency of mentions. Each word is also colored according to the respective category as follows: Nature (green), Attachment (red), Reflection (blue), Equipment (orange) and Others (grey).

3.2. Park attributes and preferences

Users were asked to identify and rank 5 attributes of a park by sorting them from the most to the least important. They tended to place trees as the first preference (Figure 2). Meanwhile "tree abundance and diversity" was given first preference on 54.5% of the cases, and only 5 people (2.25%) assigned it on the least important place. Interestingly, "bird abundance and diversity" was considered on first preference only by 8 (3.6%) users and assigned to the fifth place by 37.84% of

179 them, being the most frequent attribute ranked in the last place (Figure 2). These results show a
180 generalized valuation of trees as relevant elements of urban parks, followed by diverse implements
181 and infrastructure.



182

183 **Figure 2.** Park attributes preference ranking. Here, we show preference distribution for each five
184 elements presented to users, in order from left to right; "tree abundance and diversity", "recreation
185 infrastructure", "infrastructure", "illumination and security", and "bird abundance and diversity".
186 Dark grey bars represent the number times each attribute was ranked in first position (most
187 important), meanwhile light grey bars represent the last ranking position (least important).

188 *3.3. Ecological knowledge*

189 Regarding both trees and birds, respondents tended to recognize more exotic species (Figure 3).
190 Native plants had an identification level of 0.65 correct answers (13%) out of 5, while exotic species
191 reached 1.38 correct answers (27.6%) out of 5. For birds, native species had an identification level of
192 1.08 (15.43%) of 7, and the exotic species had 1.43 (47,67%) of 3. These results show a generalized lack
193 of knowledge of the native species in relation to the exotic ones (Figure 3).

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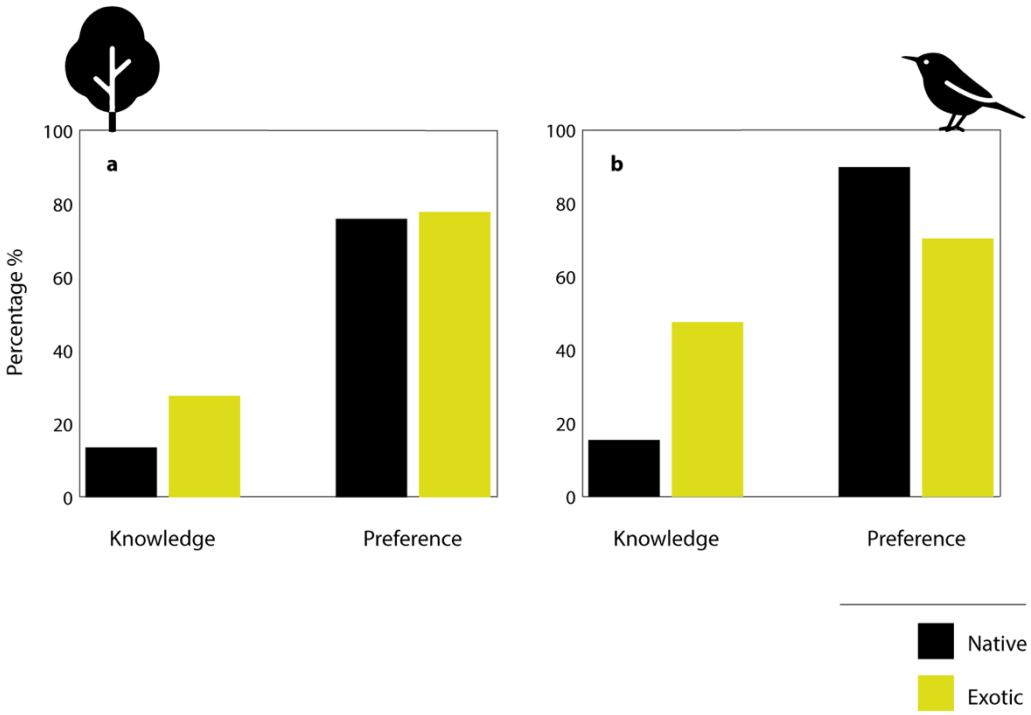

Figure 3. Ecological knowledge as percentage of correct identification, and preference for trees (**a**) and birds (**b**) species. Native species are in black bars and exotic species are in yellow bars.

Urban park users gave a low number of correct responses to questions regarding the identification of species, with an average of 2.01 correct answers for plants and 2.44 for birds, out of a total of 10 questions. Additionally, 43 participants (19.37%) were not able to identify any of the tree species presented. On the other hand, only 2 people (0,9%) correctly identified 9 species of plants and 1 (0,45%) could identify 9 species of birds. No respondent was able to identify all the species in both taxa (see Appendix A, Figure A1).

Regarding the flora, the cherry plum (*Prunus cerasifera*), an exotic species, was the most well-known plant, identified by 143 people (64.41%). It was followed by a native tree, the roman cassie (*Acacia caven*), with 100 (45.05%) and the exotic and invasive silver wattle (*Acacia dealbata*) with 73 (32.88%) correct answers. The rest of species did not surpass a 30% of correct identification (see Appendix A, Figure A1). The less well-known species was the native Mayten tree (*Maytenus boaria*), correctly identified only by 4 (1.8%) people (see Appendix A, Figure A1).

In the case of birds, the Rock dove (*Columba livia*), an exotic species, was the only bird correctly identified by every surveyed person. It was followed by two native species: The Eared dove (*Zenaida auriculata*), correctly identified by 85 respondents (38.29%), and the Austral thrush (*Turdus falcklandii*), correctly identified by 64 respondents (28.83%). The less well-known species was the native Tufted tit-tyrant (*Anairetes parulus*) identified only by 4 people (1.8%) (see Appendix A, Figure A1).

With respect of user's preferences, a great proportion of surveyed people responded positively for most of the species of trees and birds, either native or exotic. When we analyzed preferences by origin, plants had an average preference of 79.87% and 82.1% for native and exotic species respectively (Figure 3a). The most preferred species was Peruvian pepper (*Schinus molle*) with 94,14% of positive answers, and the least one was the Roman cassie (*Acacia caven*), with 50.45%, both native species (see Appendix A, Figure A1).

On the other hand, respondents preferred native birds above exotic ones (Figure 3b). An average preference of 89.89% and 70.42% for native and exotic species was reported, respectively (Figure 3b). The two most preferred species were the Austral thrush (*Turdus falcklandii*) and the rufous-collared Sparrow (*Zonotrichia capensis*), both native, and presented 95.05% of positive answers. The least one was the rock dove (*Columba livia*), with only 37.84% of positive answers (see Appendix A, Figure A1).

3.4. Exploring the relationship between knowledge and wellbeing

We measured self-reported wellbeing, respondents showed an average score (mean ± SD) of 15.974±3.690 out of 20 points for "Reflection", 16.959±3.637 for "Attachment" and 15.315±3.649 for "Continuity with past". The mean value for our sample was 16.083±2.794 points. This value corresponded to the percentile 0.776 of a distribution of values between 0 and 20 points.

We explored how ecological knowledge related to self-reported wellbeing. When plotting the values of ecological knowledge of trees (Figure 4a) and birds (Figure 4b), we found that the variance of self-reported wellbeing tended to be greater when people showed low ecological knowledge scores and diminished as the knowledge score increased. This scatter pattern showed a marked exclusion zone, where no observations were found. The lower limit of this area represents the minimum value of wellbeing reported for each score of ecological knowledge. This resulted in a positive relation between ecological knowledge and wellbeing that was suited to be described by quantile regression analyses. This pattern was consistent between both tree and bird knowledge (Figure 4a, b).

We found a significant relationship between ecological knowledge of trees (without a distinction of its origin) and self-reported wellbeing (n=222, $F_{1,443}$=8.344, p = 0.004) for the lower quantile (tau=0.05) of the distribution (Figure 4a). However, this pattern was not significant for bird ecological knowledge (n=222, $F_{1,443}$=2.365, p = 0.125) (Figure 4b). We also found no significant relationship between the self-reported wellbeing and ecological knowledge of native trees (n=222, $F_{1,443}$=0.103, p= 0.748) and native birds (n=222, $F_{1,443}$=1.094, p = 0.296) related to self-reported wellbeing (All dataset are available in Figshare repository https://doi.org/10.6084/m9.figshare.12609941.v1).

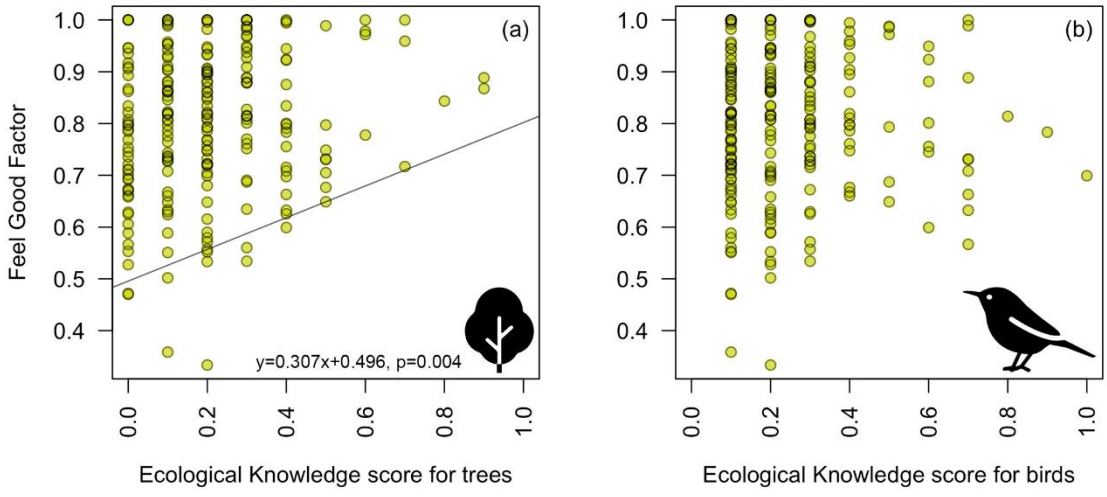

Figure 4. Self-reported wellbeing (Feel good factor) by Ecological Knowledge. (**a**) Tree Ecological Knowledge. Curve represents a quantile regression (tau=0.05, p=0.004). (**b**) Bird Ecological Knowledge. No significant relation was found (tau = 0.05, p=0.125).

4. Discussion

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The present study showed that people consistently associated urban parks with nature. It was the most frequently named category in the survey with 40% of all the concepts. Specifically, the words "nature", "trees and vegetation" and "green" where the most named concepts, placing plants as the main association interviewees have with the word "park". This result matches with the valuation of trees as the most important feature of the park when ranked against other five attributes. On the other hand, there were only few mentions related to birds (n=11, 1.65%). This is consistent with the fact that "abundance and diversity of birds" was ranked in the least place more frequently than any other attribute.

Trees have been shown to contribute disproportionately towards nature experiences in socio-economically deprived neighbors with high-density housing, such as many urban neighborhoods in Latin America. Some studies have shown that trees are highly valued because of its provision of shading and cooler surroundings [40], as well as the positive effects on people's mental health [14]. Thus, it is likely that people tend to be more aware of the immediate ecosystem services provided by plants. In fact, some concepts such as "air purification" and "shadow availability" were mentioned during the survey. As people become more conscious of these benefits, it is more likely for them to recognize the importance of vegetation.

While respondents associated urban parks with nature, when we evaluated people's ability to recognize and name plant and bird species, we found low scores for both taxa. This lack of ecological knowledge is consistent not only with the pattern found in recent studies in other parks of Santiago [23], but also with what other authors have found in other cities of across the world [12,13,22,25]. However, drivers of ecological knowledge loss may differ between high- and low- income countries. Pilgrim et al. [24], compared the ecological knowledge between high- and low-income countries and showed that UK presented lower scores for ecological knowledge than some developing countries. But contrary to what Pilgrim [24] pointed out, Bermúdez [21] found that wealthier sectors in Argentina were able to recognize a greater number of species compared to low-income ones, as well as Perelman et al. [41] suggested a positive relation between educational level and ability to recognize species. These apparently contradictive results are related and could be a result of the importance of direct contact with nature on the acquisition of ecological knowledge [14,23]. Latin American megacities show high socio-economic segregation, as wealthier sectors also have wider green areas and an increase opportunity to experience nature, such as the spatial distribution of urban parks in Santiago [33]. Therefore, reporting that the ecological knowledge loss is also present in developing countries may also reflect the impacts of a drastic urbanization process as well as the consequences of restricting direct nature experiences mediated by socio-economic factors. Chile, despite having a high GDP-per-capita (25,222.5 USD for 2018) in contrast to other Latin American countries, has a high inequality in the income distribution (GINI Index 2018 = 45,9%), since 80% of the population receives a salary fewer than 1000 USD [42].

Identification rates were low for both native and exotic species (for both, plants and birds), but exotic species were more likely to be identified. One possible explanation relates to the under representation of native species on the green infrastructure of Santiago city. For example, Rozzi et al. [31] found that nearly 95% of trees present in urban parks of eight major cities of Chile were exotic species, which contrasts with 40% of the flora of central European cities [43]. Exotic species are more prevalent in populated areas of the city (see Rozzi et al. [31] and Celis-Diez et al. [23] for trees and birds respectively), thus, people are more exposed to them more often. Also, in the case of birds, common urban species, such as exotic ones in Santiago, tend to have less fear of humans so can be more easily spotted [44]. Therefore, it is more likely for exotic species to be part of the collective imaginaries. This is a symptom of the "Shifting baseline syndrome" [15], a progressive change in how people conceive the natural environment and its condition, due to lack of past information or lack of experience of past state. As people are more exposed to exotic biota, it is frequent to consider them as native to that place [25].

Despite of the lack of formal biological knowledge about the species, interviewees showed in average high levels of self-reported wellbeing (over percentile 70) and a great variability in those scores. This variability increased as the scores of ecological knowledge dropped (Figure 4). This

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pattern was consistent for both trees and birds. However, when running a quantile regression, we found that relationship was only statistically significant for tree ecological knowledge (n=222, $F_{1,443}=8.344$, $p = 0.004$). These suggests that increasing levels of ecological knowledge of trees are related to higher and less variable scores of self-reported wellbeing, but there is no significant relation with bird knowledge or knowledge by species origin. However, our study was limited by the visual recognition of taxa and it is important to consider that other sensory stimuli such as audition [45], are relevant to understand the links between biodiversity, knowledge and wellbeing.

In our results, as in those of Muratet et al. [46], urban dwellers tend to value plants due to aesthetic criteria, but biodiversity and ecological functions are not often considered. This can be explained by the generalized lack of knowledge of plants in the first place. If people cannot correctly identify trees and plants in general, it is less likely that they are aware of the characteristic features and ecological role of each species hence, the difference between native and exotic species is meaningless. In Poland, Suchocka et al. [47] found that the overall perception of trees tended to be positive and the benefits of green infrastructure can mask any possible harm caused by them, and according to this, Shanahan et al. [48], found that Australian people with a greater orientation towards nature, tend to travel further to visit more vegetated parks.

These results also suggest that interviewees perceive trees as a homogenous attribute. Wandersee and Schussler [49] named this phenomenon as “plant blindness”, as people tend to overlook plants and perceive them as a bulk rather than single organisms. However, these authors proposed that education is a key factor that enhances the acknowledgment of trees and the ecosystem services they provide, for example a suitable habitat for other native taxa. This can also be useful in urban environments, where knowledge can help mitigate conflicts related to urban green infrastructure. However, future research should aim to discriminate preferences between different vegetative life forms (i.e., grasslands, shrubs or trees), as recent studies have shown that spatial heterogeneity of urban green areas may be related to psychological response [19]. Therefore, assessing this relationship is crucial to better understand the case of Chile, since most of the urban parks of the metropolitan area are of the "Savanna type": a simple structure with grass and isolated trees.

The relationship between wellbeing and biodiversity is not equal between taxa. For instance, a study conducted in Australia showed that personal wellbeing was related to Normalized Difference Vegetation Index (NDVI) but not to bird species richness [50]. However, other authors have shown a positive relationship between birds and wellbeing [12]. In our study, birds knowledge did not seem to be related to the self-reported wellbeing. But unlike some developed countries (e.g. the United Kingdom, New Zealand and North America), the behavior of feeding birds [51], is not common in Chile. It is important, however, to address the fact that the rock dove (*Columba livia*) was recognized by every single participant. Given that this is a (i) synanthropic exotic species, (ii) extremely conspicuous in urban habitats, (iii) vector of zoonotic diseases such as *Salmonella* [52], and (iv) often associated with dumpsters and dirty areas, the association is likely to impact the notion of birds in general, in a similar way as the ‘plant blindness’ phenomenon occurs. Even when people may perceive songbirds separately from non-songbirds, or when some species, such as *Columba livia*, disproportionately increase in abundance, could provide a cultural disservice to urban residents [44], which may also extrapolate this perception to all birds. This phenomenon was described by Belaire et al. [53] as people’s valuation was linked to perceived bird richness rather than actual richness, which in turn is biased towards the most conspicuous species [54]. This perception only included a few common urban species that presented several negative qualities that may have influenced the overall perception of birds. This result suggests again the critical role of knowledge as a mediator of the relationship between humans and nature.

More research is needed to understand the mechanisms underpinning the relationship between knowledge and wellbeing. Knowledge allows us to make better decisions that acknowledge the relevance of green areas as a key component of urban residents’ wellbeing cities. But knowledge can also reshape perceptions and attitudes towards the environment, letting people acknowledge the value of urban green areas and possibly helping restore this gap between humans and nature. In

fact, people who perceive biodiversity more accurately are more likely to present higher wellbeing rates [54]. Hence, we can expect that the extinction of the experience produced by living in cities can be reduced by providing platforms where civil society can engage with ecological knowledge. This engagement provides opportunities to also enhance traditional knowledge and other forms of local ecological knowledge [55], thus extending the knowledge base beyond the "names" of different components of the ecosystem, and towards ecosystem functions, management and ethics related to them. Thus, it is crucial to incorporate biodiversity and ecosystem function in policy making and planning to improve people's wellbeing in urban areas [56]. It is also relevant to enhance direct contact with nature and everyday perceptions of biodiversity [57], through the development of specific programs, campaigns and community-based learning communities within Megacities.

In conclusion, we explored the state of and the relationship between ecological knowledge of trees and birds and self-reported wellbeing in Santiago, a Megacity of a developing country. Our results suggest that even though a loss of ecological knowledge is present, knowledge of trees may be positively related with self-reported wellbeing. Although this lack of ecological knowledge is a phenomenon reported for several high- and low- income countries, drivers may be different, as cities have been formed at a different scale and pace. Latin American countries as well as other developing regions present dramatic urbanization rates on the last decades. Therefore, understanding the drivers of ecological knowledge loss in low- and middle-income countries is crucial. Future research must assess this issue in order to mitigate the effects of urban sprawl in high biodiversity areas and promote local-based strategies for biological and cultural conservation. Additionally, other factors related to the socio-economic aspects of urban dwellers should be assessed, since segregation represents a critical issue in low- and mid-income developing countries.

Supplementary Materials: The following are available online at www.mdpi.com/xxx/s1, Supplementary Material S1: Survey and informed consent translated into English and in the original language (Spanish).

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Appendix A

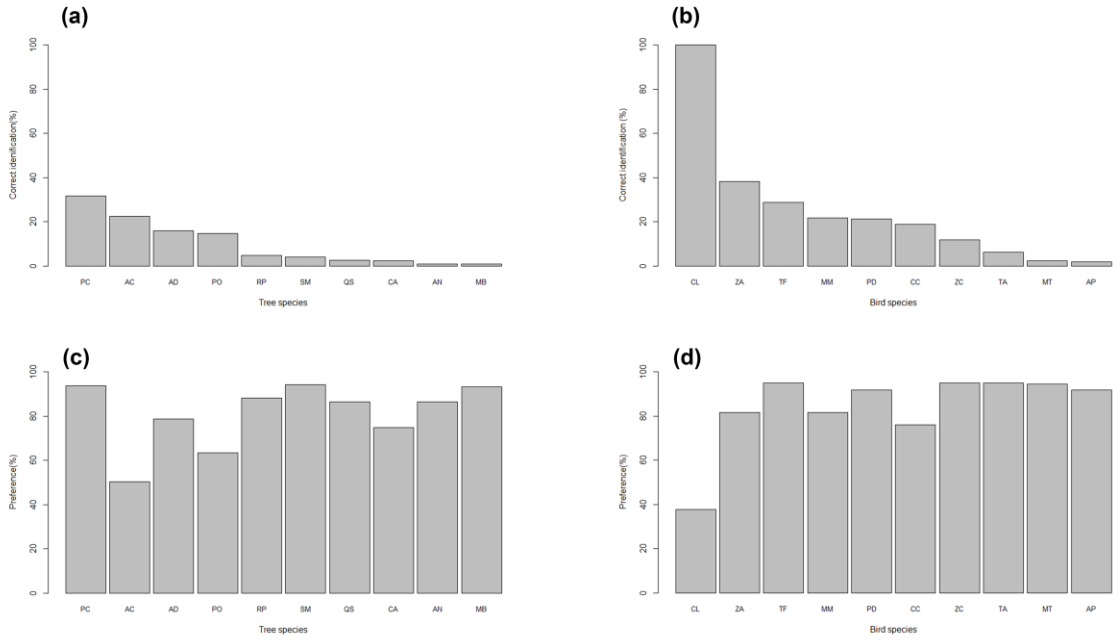

Figure A1. Ecological knowledge (a, b), as correct identification percentage, for trees (a) and birds (b) species, and preference (c, d) for trees (c) and birds (d) species. Tree species abbreviation and its origin within parenthesis were: PC *Prunus cerasifera* (exotic); AC *Acacia caven* (native); AD *Acacia dealbata* (exotic); PO *Platanus orientalis* (exotic); RP *Robinia pseudoacacia* (exotic); SM *Schinus molle* (native); QS *Quillaja saponaria* (native); CA *Cryptocarya alba* (native); AN *Acer negundo* (exotic); MB *Maytenus boaria* (native). Bird species abbreviation and its origin within parenthesis were: CL *Columba livia* (exotic); ZA *Zenaida auriculata* (native); TF *Turdus falcklandii* (native); MM *Myiopsitta monachus* (exotic); PD *Passer domesticus* (exotic); CC *Curaeus curaeus* (native); ZC *Zonotrichia capensis* (native); TA *Troglodytes aedon* (native); MT *Mimus thenca* (native); AP *Anairetes parulus* (native).

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