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Facultad de Ciencias Forestales y Conservación de la Naturaleza

Magíster en Áreas Silvestres y Conservación de la Naturaleza

JARDINES DE VEREDA Y CONSERVACIÓN BIOLÓGICA EN LAS CIUDADES: MOTIVACIONES Y PREFERENCIAS QUE GUÍAN LA COMPOSICIÓN FLORÍSTICA DE UN ESPACIO POCO EXPLORADO EN SANTIAGO DE CHILE

Proyecto de grado presentado
como parte de los requisitos
para optar al grado de Magíster en Áreas
Silvestres y Conservación de la Naturaleza.

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Abstract

Plants biodiversity in large cities has recently become a subject of intense biological research. It is widely accepted that urban green spaces improve people's quality of life. They are also important for biological conservation. In contrast to wilderness areas, in urban ecosystems plants develop in spaces strongly managed by human activity and form dissimilar compositions to the natural landscape. Under this scenario, will it be possible to reconcile conservation objectives with the motivations and preferences of urban residents? To answer this, we apply a semi-structured survey to 100 homes that have a sidewalk garden in Santiago de Chile. Our results show that these gardens are perceived as an essential part of the home and its environment. We recognized three groups of citizens: the utilitarian group, native group and neutral group. This last group does not stand out for preferring any particular attribute of plants, which could be an indicator of the extinction of the experience with nature. We detect that people do not correctly recognize the origin of the species they grow. However, even when the knowledge about native flora is limited (mean = 0.96; max = 3.0), citizens are willing to conserve in their sidewalk gardens (mean = 4.35; max = 7.0), motivated by the set of benefits that native plants provide and not just for their origin. These results show that sidewalks gardens can become a strategic alternative to help reduce the loss of biodiversity and, simultaneously, reestablish the link of people with native flora through familiarity.

Keywords	attitudes; easement gardens; ex situ conservation; native gardening; socio-ecological system; urban flora
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July 24, 2020

Dear Editors,
Landscape and Urban Planning

We are pleased to submit our newest manuscript entitled "**Sidewalk gardens and biological conservation in the cities: Motivations and preferences that guide the floristic composition of a little-explored space in Santiago de Chile**".

In this study we analyze the potential role of sidewalk gardens in *ex situ* conservation of native flora in Santiago de Chile, through a survey of citizen perceptions and preferences. This is one of the first studies to recognize the strategic importance of sidewalk gardens to guide the urban floristic composition towards more native characteristics and, simultaneously, as providers of social welfare. Our results provide useful information for urban landscape planning, as they allow us to predict whether future biodiversity management initiatives are compatible with the interests of citizens.

We send our contribution in the form of Research Paper, declaring that our results have not been published previously and our paper has not been submitted to another journal.

We hope our manuscript is welcomed in Landscape and Urban Planning,
Best regards.

Nicole Guerrero-Leiva
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Highlights

- Sidewalk gardens are perceived as part of the environment.
- Relational values are important in the appreciation of plants grown in gardens.
- People born outside the RM have a greater knowledge and willingness to conserve.
- Sidewalk gardens can promote a feeling of familiarity with native flora.
- The results provide useful information to guide future urban conservation actions.

Abstract

Plants biodiversity in large cities has recently become a subject of intense biological research. It is widely accepted that urban green spaces improve people's quality of life. They are also important for biological conservation. In contrast to wilderness areas, in urban ecosystems plants develop in spaces strongly managed by human activity and form dissimilar compositions to the natural landscape. Under this scenario, will it be possible to reconcile conservation objectives with the motivations and preferences of urban residents? To answer this, we apply a semi-structured survey to 100 homes that have a sidewalk garden in Santiago de Chile. Our results show that these gardens are perceived as an essential part of the home and its environment. We recognized three groups of citizens: the utilitarian group, native group and neutral group. This last group does not stand out for preferring any particular attribute of plants, which could be an indicator of the extinction of the experience with nature. We detect that people do not correctly recognize the origin of the species they grow. However, even when the knowledge about native flora is limited ($\overline{X}$ 0.96; max = 3.0), citizens are willing to conserve in their sidewalk gardens ($\overline{X}$ = 4.35; max = 7.0), motivated by the set of benefits that native plants provide and not just for their origin. These results show that sidewalks gardens can become a strategic alternative to help reduce the loss of biodiversity and, simultaneously, reestablish the link of people with native flora through familiarity.

Keywords: attitudes; easement gardens; ex situ conservation; native gardening; socio-ecological system; urban flora.

Sidewalk gardens and biological conservation in the cities: Motivations and preferences that guide the floristic composition of a little-explored space in Santiago de Chile

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1. Introduction

Biology experts and researchers have recently focused their attention on cities, as they represent a little explored field regarding the role of people in modeling biodiversity, ecological functions, and ecosystem services (Gómez-Baggethun & Barton, 2013; Romero-Duque, Trilleras, Castellarini, & Quijas, 2020). Cities are more complex than other biological systems since their shaping and development rely mostly upon people's actions. (Grimm, Faeth, Golubiewski, Redman, Wu, *et al*., 2008). Political and administrative structures make decisions that influence the biodiversity of public spaces (Alberti, Marzluff, Shulenberger, Bradley, Ryan, & Zumbrunnen, 2003). While, at the residential level, each citizen modifies their immediate environment based on their own decisions and preferences (Cameron, Blanusa, Taylor, Salisbury, Healstead, *et al*., 2012). Accordingly, residential gardens reflect these decisions through different structures and floristic compositions (Loram, Warren, Thompson, & Gaston, 2011; Marco, Barthelemy, Dutoit, & Bertaudière-Montes, 2010).

The space allocated to gardens and gardening as an activity produce important benefits that improve life quality in cities (Camps-Calvet, Langemeyer, Calvet-Mir, & Gómez-Baggethun, 2016; Dunnett & Qasim, 2000; Gómez-Baggethun & Barton, 2013). For example, they can regulate microclimate, increase the sense of privacy, produce food and medicine, improve neighborhood aesthetics, and provide a habitat for other living beings (Shackleton, Chinyimba, Hebinck, Shackleton, & Kaoma, 2015; Shaw, Miller, & Wescott, 2017). Most plants that grown in gardens are mainly chosen by their ornamental characteristics and, secondarily, by their ability to adapt to particular environmental conditions, such as water shortages (Kendal, Williams, & Williams, 2012). However, people's level of education and their experience with

nature may favor a choice based on geographical origin or other ecological aspects of the plants (Kendal *et al*., 2012). Thus, residential gardens are an indicator of the potential of urban biodiversity (Acar, Acar, & Eroğlu, 2007; Gaston, Warren, Thompson, & Smith, 2005; Smith, Thompson, Hodgson, Warren, & Gaston, 2006) and inform how sociocultural factors influence its composition (Loram *et al*., 2011; Marco *et al*., 2010).

Flora grown in gardens typically include a great variety of exotic species (Smith *et al*., 2006). These may considerably exceed native species and produce community assemblage that do not represent the surrounding natural landscape (Freire-Moro, Westerkamp, & Soares, 2014). For example, 40% of plants grown in South Africa gardens are native and 60% exotic (Molebatsi, Siebert, Cilliers, Lubbe, & Davoren, 2010). While in the UK only 31% of the species are native (Smith *et al.,* 2006). The incidence and dominance of exotic species pose a potential threat to native biodiversity, since in many cases this type of flora has an invasive behavior (Smith *et al.*, 2006). In other words, they may easily colonize other habitats in the city, escaping from the urban range to spread to natural ecosystems (Zagorski, Kirkpatrick, & Stratford, 2004). This behavior is the main cause of biotic homogenization in the world, due to the substitution of the local species by exotic cosmopolitan plants (Davis, 2003; McKinney, 2006).

In recent times, a growing number of authors have emphasized the need to reduce the exotic flora dominance in cities, guiding gardens composition towards more native characteristics (*e.g.* Freire-Moro *et al*., 2014; Oldfield, Warren, Felson, & Bradford, 2013; Shaw *et al*., 2017; van Heezik, Dickinson, & Freeman, 2012). This, not only to help to reduce pressure over natural ecosystems, but also to promote concrete conservation actions. For example,

promoting *ex situ* conservation of native species of local interest, implementing biological corridors to attract other organisms, and connecting isolated habitat patches in the urban matrix (Dearborn & Kark, 2010; Goddard, Dougill, & Benton, 2010). Despite their reduced area, the great amount of residential gardens turns them into a key elements to promote growth and propagation of native species (Gaston *et al*., 2005; van Heezik *et al*., 2012) as well as incorporation of ecological values to the population (Acar *et al*., 2007; Goddard *et al*., 2010; Miller, 2005). Previous studies have shown that contact with nature plays a fundamental role in encouraging urban residents to conserve biodiversity (Kowarik, 2011; Shaw *et al*., 2017), especially when they do not have economic resources or motivation to visit wilderness areas (Dearborn & Kark, 2010).

Even though the relationship between individual preferences and garden composition has been widely documented (*e.g.* Kendal *et al.,* 2012; Shackleton *et al*., 2015; Zagorski *et al*., 2004), there are fewer studies about particular perceptions towards native flora. This is a key factor since forestation initiatives with native species could fail if they are not in alignment with the urban residents' interest. A recent study collected the perception of the inhabitants of Melbourne (Australia) on their willingness to grow native flora in their gardens. Results showed that 80% of the participants already cultivated these species in their gardens or they were willing to do so in the future. In addition, it was observed that the cultivation of native flora was closely related to other conservation attitudes, such as the protection of wild animals, the attraction of pollinators and the removal of exotic weeds (Shaw *et al*., 2017). This illustrates how garden composition is influenced by factors consistent with the conviction of the people (Zagorski *et al*., 2004). Therefore, it is essential to acknowledge the role of urban residents regarding the

70 management of biodiversity, and the need to incorporate them into the political and
71 administrative decision-making process.
72
73 In the current context of accelerated urbanization, the high demand for housing and the
74 reduction of garden spots are the main limitations to carrying out conservation actions in cities
75 (Oldfield *et al.,* 2013). Nonetheless, the use of informal spaces appears to be a promising
76 alternative. These sites are distributed all over the city and do not play any function until people
77 take charge of its management (Pellegrini & Baudry, 2014; Rupprecht & Byrne, 2014). One of
78 them is sidewalk gardens that share similar characteristics with residential gardens. These
79 gardens are located in the easement areas and are perceived as an extension of the property
80 (Hunter & Brown, 2012; Marshall, Grose, & Williams, 2019, 2020). The possibility to conserve
81 native flora in these spaces could help mitigate the loss of local biodiversity and, at the same
82 time, reestablish the connection between urban residents and the typical flora of the natural
83 landscape (Miller, 2005). In this way, sidewalk gardens could contribute to valuing these
84 elements both inside and outside cities. But the question is: are urban residents willing to
85 conserve native flora in their sidewalk gardens?
86
87 Exploring the reasons behind the creation of a sidewalk gardens and the factors that
88 influence the selection of species are key to understand to what extent people's motivations and
89 preferences are compatible to future conservation initiatives (Acar *et al*., 2007; Shaw *et al*.,
90 2017). In order to study these factors, we analyzed the potential role of sidewalk gardens in *ex*
91 *situ* conservation of native plants in Santiago de Chile. Specifically, the aims of this study are to
92 (i) determine the main motivations that influence the creation of a sidewalk garden, (ii) define

93 the characteristics and functional roles that different people seek in the plants they grow, (iii)
94 analyze what benefits provide some native species of local interest and (iv) evaluate knowledge
95 and willingness to conserve native flora in sidewalk gardens. These objectives represent useful
96 tools for urban landscape planning since they allow for the prediction of whether future
97 biodiversity management initiatives could be sustained in these spaces.
98
99 To our knowledge, this is one of the first studies to acknowledge the importance of
100 sidewalk gardens as potential spaces for biodiversity conservation and, simultaneously, as social
101 welfare providers (see Marshall *et al*., 2019, 2020). This, under a generalized scenario of
102 growing urban expansion, which hinders the creation of new public and private green areas.
103 Whereas, at a local level, this is the first study to explicitly analyze the role of the human
104 component in the urban flora composition in Santiago de Chile.

105 **2. Methods**

106 **2.1 Study Area**

107 Santiago de Chile is the capital of the country and it is located in the Metropolitan region (RM
108 hereafter). (33°26'16" S - 70°39'01" W; Figure 1). Currently, it has an approximate area of 641
109 km^2 with a population of around 6,1 million inhabitants (INE, 2017). It has a Mediterranean
110 climate, characterized by a prolonged warm, dry summer and a cold, rainy winter (Luebert &
111 Pliscoff, 2006). It is located in the biodiversity *hotspot* of the Mediterranean region, where
112 sclerophyllous forest and scrub are the most common vegetation formations (Luebert & Pliscoff,
113 2006; Rodríguez, Marticorena, Alarcón, Baeza, Cavieres, *et al*., 2018). However, the high
114 diversity of flora species that characterizes natural areas is poorly represented in Santiago. Flora
115 in public spaces includes more than 500 species, from which most of them are ornamental exotic
116 (Castro, Guerrero-Leiva, Bolados, & Figueroa, 2018; Figueroa, Teillier, Guerrero-Leiva, Ray-
117 Bobadilla, Rivano, *et al*., 2016). In the sidewalk gardens there are about 200 different species, of
118 which 11% are native and 89% exotic (XXX., unpublished data; masked_for_blind_review).
119 (Insert_Figure_1_here)
120
121 **2.2 Sampling and Survey**
122 To assess the motivations and preferences of citizen regarding flora grown in their sidewalk
123 gardens, we conducted a survey of 100 households randomly distributed in residential areas of
124 Santiago (Figure 1). To standardize the sample, we considered gardens that shared the following
125 criteria: (a) they were located in the sidewalk easement area, at the front or side of a house and
126 (b) composed to at least five different species of plants, in addition to turfgrass. Criteria (a)
127 describe the most common type of easement gardens in residential areas in Santiago (curb-side,

128 middle and sidewalk; see Hunter & Brown, 2012), and criteria b) establishes a minimum species
129 richness to capture a greater variety of plants characteristics. Turfgrass was excluded from the
130 richness of garden because it is a composed of a mixture of various species that share similar
131 characteristics and is used as the same functional entity. Each one of the sites was visited and
132 georeferenced during 2019.
133
134 The survey included three sections and 35 questions that allowed addressing the
135 objectives of this study. Section I consisted of a series of open-ended, closed-ended, and
136 multiple-choice questions. Here, we ask participants about their reasons for creating a sidewalk
137 garden, general aspects about garden management, their preferred characteristics and functional
138 roles of plants and their perception about native and exotic species. In the survey, the concept
139 "native" was referred to as "original species to Chile", explaining participants that these were
140 grow naturally upon the country, especially in forests, hills, and other natural areas. While the
141 concept "exotic" was defined as "original species to other countries". Participants were provided
142 with a list of 26 standardized possible attributes related to their plants, grouped into nine
143 categories for further analysis: alimentary, ecological, emotional, medicinal, ornamental, social,
144 structural, symbolic, and native (modified from Kirkpatrick, Davison, & Daniels, 2012 and
145 Molebatsi *et al*., 2010).
146
147 Section II included a list of 15 native species frequently grown in sidewalk gardens in
148 Santiago (XXX, unpublished data; masked_for_blind_review). In addition to 5 other species
149 classified under different threat levels, according to the Nómina de Especies según Estado de
150 Conservación of the Ministry of the Environment (MMA, 2020). The 20 evaluated species are

native of Central Chile and correspond to seven trees, five shrubs, six herbs and two succulents (see below). To facilitate identification, the list included full-color illustrations of each species. This tool serves as a visual stimulus, validated in the scientific literature (*e.g*. Cerda, Silva-Rodríguez, & Briceño, 2019; Tahvanainen, Tyrväinen, Ihalainen, Vuorela, & Kolehmainen, 2001), that highlights the distinctive morphologic features for each species, such as flowers, fruit, or leaves. After showing the illustrations to the survey respondents, they were instructed to identify which species from the list they were growing in their sidewalk gardens and what benefits or attributes they considered to be important. To do so, participants were required to place the nine types of attributes in descending order of importance (9 to 1). When necessary, they were shown the species from the list that they could not recognize but were present in their gardens.

Finally, section III collected personal information from the survey respondents, safeguarding their anonymity. This section reported on their demographic and socio-economic background as well as their experience with nature. The complete survey is available through the correspondence author.

2.3 Data analysis

Data collected through surveys was systematized in an Excel spreadsheet. Variables were identified from the structured questions and were complemented with answers from the open-ended questions. All statistical analyses were performed using XLSTAT software (Addinsoft, 2014 version).

174 *2.3.1 Motivations to maintain a sidewalk garden*

175 We asked participants the open-ended question: *What are your motivations for having a sidewalk*
176 *garden*? Since most of the responses consisted of a combination of reasons of different nature,
177 they were disaggregated into all the reasons mentioned. Next, similar motives were grouped
178 together to construct composite variables, until frequencies greater than 10% were reached. After
179 that, we classified each answer according to the set of variables gathered (see examples in
180 Appendix A).

181

182 *2.3.2 Characteristics and functional roles*

183 A hierarchical cluster analysis (HCA) was conducted to explore the characteristics and functional
184 roles that the different residents in Santiago prefer in the plants they grow. Categorical variables
185 were the different attributes categories (see above). For each the average frequency was
186 calculated as [number of present attributes × total number of category attributes $^{-1}$]; whereas the
187 native origin was expressed in binary form. Ward's method was used as a clustering method and
188 the Euclidian distance as a dissimilarity measure.

189

190 Then, the groups of participants were then characterized according to their social
191 variables. For this, aspects about management of the sidewalk garden, demographic and
192 socioeconomic indicators and environmental experience of the participants were considered. The
193 qualitative variables were contrasted using Pearson's Chi-squared test with Yates' correction (X^2).
194 Whereas the quantitative variables were analyzed from the mean, using the Kruskal-Wallis
195 analysis and the Dunn test to determine significant differences between the groups.

196

197 *2.3.3 Native species of local interest and benefits they provide*

198 To determine the most preferred benefits of native flora among participants, percentage
199 frequency was calculated for each category of attribute as $[(\Sigma\ n \times N^{-1}) \times 100]$; where n
200 corresponds to the number of species that met the attribute and N corresponds to the number of
201 species effectively grown in gardens. Also, the importance of each attribute was calculated by
202 clustering all the species as $[\Sigma$ importance value $\times n_1^{-1} \times n_2^{-1} \pm$ S.D$]$; where n_1 corresponds to the
203 number of participants that indicated the attribute and n_2 corresponds to the number of species
204 that met this attribute.

205

206 *2.3.4 Knowledge and willingness to conserve*

207 Based on the preferences declared in the survey, we established two scoring scales. The first
208 scale, from 0 to 3 points, measured participants' specific knowledge about native flora of Chile.
209 For that purpose, the following questions were posed: *Do you know what is the origin of the*
210 *species you are growing? Do you know which of your plants are native? Do you know if any of*
211 *native species listed are threatened?* To confirm effective knowledge about geographic origin,
212 participants were required to show their native species. This information was contrasted with the
213 floristic composition observed in each garden, which allowed to verify or correct the answers
214 used in the scoring scales. Similarly, the response on threatened species was also verified.

215

216 The second scoring scale, from 0 to 7 points, was used to infer how willing are the citizen
217 to conserve native flora in their sidewalk gardens. To obtain this information, the following key
218 questions were posed: *Is native origin a desirable characteristic in your plants? Would you like*
219 *to grow more native plants in the future? Would you replace the exotic species you now grow*

220 *with native ones?* Regarding the list of native species of local interest: *Do you grow any of the*
221 *species on the list? Does the native origin justify your decision to grow them? Would you like to*
222 *grow any of them in the future?* and *Do you think it is important to conserve native flora in the*
223 *cities?* Then, the T-test was used to compare the relationship between participants' knowledge
224 and their willingness to conserve.
225
226 To determine the influence of the participants' sociocultural variables two analyses of
227 variance (ANOVA) were applied. The factors of both analyzes were selected by previously
228 exploring the most significant variables through a multiple regression ($P \leq 0.1$; see Appendix B).
229 First, we conducted a two-factor analysis of variance, where the dependent variable
230 corresponded to the knowledge about native flora reflected in the score. The first factor was
231 'region of origin', with two levels: RM and other regions. And the second factor was 'age',
232 expressed in seven levels: 18-29, 30-39, 40-49, 50-59, 60-69, 70-79 and >80 years. Then, a four-
233 factor analysis of variance was performed, where the dependent variable corresponded to the
234 score assigned to willingness to conserve. In this case, the first factor was 'region of origin'. The
235 second factor was 'natural dispersion', with two levels: tolerant and non-tolerant. The third
236 factor was 'lifestyle', with two levels: close to nature and urban life. And the fourth factor was
237 'income', expressed in five levels: <310, 310-620, 620-930, 930-1,240 and >1,240 USD. Finally,
238 the Tukey test was used on both cases to detect differences between levels of the significant
239 factors.

3. Results

3.1 Description of the participants

Out of a sample population of 100 people, 51% were women and 49% men. Participants' age ranged from 18 to 88 years old (median = 57 years old). Most participants were born in RM (57%), while the remaining ones were raised in other regions of the country (43%), especially in Central Chile (Appendix B).

Regarding the socioeconomic status of the participants, most of them attained higher education (46%), 37% attended high school and the remaining 17% attended primary school only. Most survey respondents were workers (51%), followed by retired people (28%), housewives (13%), and students (8%). The most frequent professional areas were commerce (13%), health (13%), and education (12%). More than half of the participants stated that their household income was lower than 620USD (65%) and only 6% earned more than 930USD. The 80% of the survey respondents were homeowners, with a residence time of mostly greater than 10 years (67%), while 15% lived in the place less than 5 years ago (Appendix B).

Regarding the participants' environmental experience, 95% stated that they reported on environmental issues through mass media and only 24% of them received environmental education during their formal studies. Most survey respondents used to visit urban parks (77%), while 57% had visited wild areas. Besides, 81% of them declared that family traditions were their source of knowledge about nature. Finally, 52% identified themselves with an urban lifestyle and 48% close to nature (Appendix B).

263 **3.2 Characteristics of the sidewalk gardens**

264 Sidewalk gardens studied ranged in size from 3 to 35 m^2 (median = 8 m^2). Some of them were
265 created more than 50 years ago and others less than a year ago (median = 12 years). The 87% of
266 the survey respondents took the initiative to create the garden and 93% were in charge of its
267 maintenance. The 54% only grew plants they had planted themselves, while 46% tolerated the
268 appearance of naturally dispersed species. Even though exotic species were dominant in all
269 studied gardens, 75% they had at least one native species (Appendix B).

270

271 **3.3 Motivations to maintain a sidewalk garden**

272 We identified 16 motivations for creating and maintaining a sidewalk garden. The fascination for
273 plants and gardening, along with having a beautiful house with its own identity were the main
274 motivations (38% each). In 20% of cases, the sidewalk garden was the only garden in the house.
275 The search for nature was stated by 28% of the participants, while the observation of biodiversity
276 reached 14%. The least frequent reasons were to share benefits with the community and to avoid
277 parking cars on the sidewalks (11% each) (Figure 2). (Insert_Figure_2_here)

278

279 **3.4 Characteristics and functional roles**

280 The most preferred characteristics in plants were the attraction of birds and insects (78%), the
281 presence of large and colorful flowers (77%), and shade producing (70%). Drought tolerant and
282 environmental dust retention reached 53% and 47%, respectively. Also, 21% of the participants
283 preferred to grow species of native origin, while 10% were looking for variety for their gardens.
284 The least preferred attributes were trendy, hallucinogenic properties, and flaunt higher economic
285 status (Table 1). In general, the attributes that responded to the alimentary category reached the

highest average frequency (56%), followed by the structural (49%) and ecological (43%) categories. On the other hand, the emotional and social categories were the least frequent (18% and 10% respectively). Regarding plant growth habit, 91% of the participants preferred a mixture of forms, being more common to find shrubs and herbs in gardens (Table 1).

(Insert_Table_1_here)

According to the type of attributes preferred in plants, we recognize three groups of participants: utilitarian, native, and neutral (Figure 3). The utilitarian group represented 19% of the participants and was characterized by preferring alimentary, ornamental, and medicinal attributes. This group was mainly composed of women (74%), who learned about nature throughout family traditions (90%) and who had less than five years of residence in the home (26%) (Table 2). All the people who preferred to grow native species were included in the native group, gathering 21% of the participants. This group shows high preferences for emotional, ecological, symbolic, and structural attributes (Figure 3). They were mostly men (67%) who migrated to Santiago from other regions of the country (57%), with a profession related to environment (14%). Their environmental experience was mainly based on visiting wild areas (86%) and a lifestyle close to nature (81%). On the other hand, most of them were homeowners (95%), with more than ten years of residence (81%) (Table 2). Finally, the neutral group was characterized by low preference values for all attributes type studied and bringing together 60% of the participants (Figure 3). Most of these people had an urban lifestyle (65%) and were retired (32%). Furthermore, they only had the garden in the sidewalk (27%) (Table 2).

(Insert_Figure_3_and_Table_2_here)

309 **3.5 Native species of local interest and benefits they provide**

310 Fifteen of the 20 native species listed in the survey were present in the sidewalk gardens of
311 Santiago. The most common species were *Cestrum parqui* (palqui, shrub; 21%), *Dysphania*
312 *ambrosioides* (paico, herb; 18%), and *Oxalis rosea* (vinagrillo, herb; 18%). Instead no
313 individuals were found to *Beilschmiedia miersii* (belloto del norte, tree), *Jubaea chilensis* (palma
314 chilena, tree), *Avellanita bustillosii* (avellanita, shrub), *Alstroemeria spp* (mariposas del campo,
315 herbs) or *Sisyrinchium striatum* (huilmo, herb). Among the benefits provided by native species,
316 ornamental attributes were preferred (87%). Then, the ecological attributes (67%), native (60%),
317 structural and emotional (53% each). On the other hand, less frequently the medicinal attributes
318 (27%), alimentary (20%) and symbolic (13%) were mentioned. Whereas social attributes were
319 not indicated for any of the species. On the other hand, highlights the importance value assigned
320 to emotive, native (8.3 each), ornamental (8.2), structural and symbolic (8.1 each) attributes
321 (Table 3).
322
323 At a species level, *Aristotelia chilensis (*maqui, tree*), Cryptocarya alba* (peumo, tree),
324 *Quillaja saponaria* (quillay, tree) and *Echinopsis chiloensis* (quisco, succulent) were highly
325 valued by their native status. Whereas *Caesalpinia gilliesii (*barba de chivo, shrub), *Escallonia*
326 *rubra* (ñipa, shrub), *Carpobrotus chilensis* (doca, succulent) and *Nassella spp* (hierba pluma,
327 herb) was highlighted by their ornamental value. Structural attributes were the most valued in
328 *Schinus areira* (pimiento, tree) as a shade-producer tree and *Dichondra sericea* (oreja de ratón,
329 herb) as groundcover plant. *Acacia caven* (espino, tree) and *O. rosea* were linked to the emotive.
330 Finally, *Baccharis linearis* (romerillo, shrub), *C. parqui* and *D. ambrosioides* were highlighted

by their alimentary, symbolic, and medicinal attributes, respectively (Table 3).

(Insert_Table_3_here)

3.6 Knowledge and willingness to conserve

Preferences stated by the participants showed that most of them were unaware of the origin of the species they grew (89%). For that reason, they were not able to identify native species in their gardens (70%). Only 21% of them indicated the native origin of plants as a desired attribute. However, 85% were interested in growing more native species in the future and they were willing to replace the exotic species (54%). Regarding list species, 70% of the participants cultivated some of them, although only 17% did so due to its origin. 27% were aware of the threatened status of some of the species in conservation category, mainly *J. chilensis* (VU) and *B. miersii* (VU). Nonetheless, all of the participants showed interest in growing some of these species in the future, since they considered it important to conserve native flora in cities (86%).

Participants' knowledge of native flora ranged between 0 and 3 points, with a median of 1 point and average of 0.96. When disaggregating data, it was found that the native group scored higher ($\overline{X}$ = 1.8; median = 2), followed by the utilitarian group ($\overline{X}$ = 1.0; median = 0) and the neutral group with the lowest score ($\overline{X}$ = 0.6; median = 0) (Figure 4a). Whereas, willingness to conserve in sidewalk gardens ranged between 1 and 7 points, with a median of 4 points and average of 4.3 points. Again, native group reached higher scores ($\overline{X}$ = 5.9; median = 6) than the utilitarian group ($\overline{X}$ = 4.3; median = 4) and neutral group ($\overline{X}$ = 3.8; median = 4) (Figure 4b). The T-test revealed a significant correlation between knowledge about native flora and participants'

353 willingness to conserve ($R = 0.437$, $P < 0.0001$), showing that the greater the knowledge, the
354 greater the willingness to conserve and vice versa. (Insert_Figure_4_here)
355
356 The analysis of variance (ANOVA) regarding sociocultural variables showed that
357 knowledge about native flora depends on both the 'region of origin' factor ($F = 7.8$, $P = 0.006$)
358 as well the 'age' factor ($F = 2.8$, $P = 0.014$). People from regions other than the RM, aged 60-69
359 and 30-39 years, differed from the other participants and achieved greater knowledge (Tukey
360 test; $D = 2.8$, $P < 0.05$ and $D = 4.3$, $P < 0.05$, respectively). The second ANOVA indicated that
361 the willingness to conserve mainly depended on the factors 'region of origin' ($F = 4.4$, $P =$
362 0.039) and 'income level' ($F = 2.4$, $P = 0.044$). However, only 'other regions' level differed
363 significantly from the other groups (Tukey test; $D = 2.8$, $P < 0.05$) and was related to a greater
364 score. Additionally, the factors 'natural dispersion' ($F = 3.6$, $P = 0.060$) and 'lifestyle' ($F = 3.0$, P
365 = 0.084) had a partially significant effect.

4. Discussion

4.1 Socio-ecological importance of sidewalk gardens

Sidewalk gardens are not only an expression of biophilia (*i.e*. fascination for plants and gardening; Camps-Calvet *et al*., 2016), but the consequence of a series of interconnected cognitive constructs: nature relatedness, sense of community, strength and consequences of barriers, strength and consequences of behavioral beliefs, strength of normative beliefs, and motivation to comply with them (Marshall *et al*., 2020). Our results showed that sidewalk gardens are an essential part of the house. But unlike the inner courtyards and gardens that are perceived as an exclusive part of the domestic world (Clayton, 2007), sidewalk gardens were also viewed as part of the ecosystem. The need to create a more natural landscape, incorporating "green over gray" is a common motivation of urban gardening, highlighting the psychological and spiritual benefits that this action provides (Dearborn & Kark, 2010; Dunnett & Qasim, 2000; Gómez-Baggethun & Barton, 2013).

The possibility of modifying the immediate environment through gardening strengthens the sense of belonging and identity of the household, allowing breaking the homogeneous patterns characteristic of residential sectors (Clayton, 2007). Neighborhood development date, property size, presence of other gardens, and social disadvantage are related to the unequal distribution of easement areas in cities (Marshall *et al*., 2020), which could limit the expansion of the sidewalk gardens. However, small spaces do not appear to be a disincentive to building a garden (although it may discourage growing large trees). Here, social contagion is a common phenomenon, since all plants are visible to neighbors (Hunter & Brown, 2012, Marshall *et al*., 2019). This implies that certain gardening styles and floristic composition are replicated,

encouraging other neighbors to intervene in public space to create more gardens (Marshall *et al*., 2020). This suggest that sidewalk gardens are satisfying a series of needs relevant to people's quality of life, which justify the decision to invest time and money in an informal urban space.

At the ecological level, sidewalk gardens generate patches of vegetation with a complex and highly variable composition, which favor the biological and functional diversity of the urban ecosystem (Alberti *et al*., 2003). While biodiversity observation did not occupy a prominent position among the reasons for building a garden (although it was relevant in the selection of species), this and other environmental benefits would arise as a result of its management. Sidewalk gardens as a whole gather the characteristics of a discontinuous biological corridor (Hunter & Brown, 2012), which facilitates the natural or assisted propagation of native flora. In turn, these spaces could act as temporary refuges for fauna that ventures into cities (Goddard *et al*., 2010; Gómez-Baggethun & Barton, 2013; van Heezik, Freeman, Porter, & Dickinson, 2014). However, urbanized areas require more flexible and perhaps less ambitious ecological strategies (Dearborn & Kark, 2010; Kowarik, 2011), such as taking conservation actions in places where people live or work, to turn native species into everyday elements (Miller & Hobbs, 2002). For this to work, a key challenge is for community initiatives to be recognize by the public sphere in order to change the normative beliefs that discourage the propagation of this type of garden (Marshall *et al.,* 2020).

4.2 Social and floristic diversity - multiple benefits of urban flora

Plants with large, colorful flowers attract a greater diversity of pollinators, which is a sign of a resource-rich habitat (Conway, 2016; Kendal *et al*., 2012; Kirkpatrick *et al*., 2012). For that

412 reason, it is not surprising that these attributes are the most preferred by people. However, other
413 characteristics and functional roles of plants are not restricted. For example, in Santiago low
414 rainfall and long drought periods are a major problem, especially during the summer. To this is
415 added the air pollution (WHO, 2016) originated, among other sources, from vehicle emissions.
416 Despite the size of the sidewalk gardens, most participants included at least one tree to the
417 garden to regulate thermal sensation, preferring shade producing or drought-resistant plants.
418 Whereas, shrubs were effectively used as a barrier to street dust, helping to reduce a load of
419 suspended particles at the local level (Guerrero-Leiva, Castro, Rubio, & Ortiz-Calderón, 2016).
420
421 In this study we also evaluated some intangible attributes of plants that, interestingly,
422 were related to the appreciation of the native origin. This shows that the decision to grow a
423 particular species is influenced by personal experiences, which define types of citizens more or
424 less inclined to acknowledge the importance of biodiversity (Marco *et al*., 2010). These
425 tendencies are determined by factors such as preferences, principles, memories, interpersonal
426 values and social norms, which constitute relational values (Chan, Balvanera, Benessaiah,
427 Chapman, Díaz, *et al*., 2016; Chan, Gould, & Pascual, 2018, Marshall *et al*., 2020). These values
428 differ from the classic utilitarian or intrinsic arguments which, although useful for environmental
429 management, they are often excessively reductionist. Exploring the multiple dimensions of
430 preference for species that make up gardens (*e.g.* childhood memories or symbolic importance)
431 may be a more appropriate approach to understanding the underlying complexity of these
432 choices. In fact, the heterogeneity of benefits expressed by a single respondent could indicate
433 that the different attributes of the plants were influential on each other and that their joint
434 appreciation was formed through relational processes.

435

436 Some of the most prominent differences between the utilitarian group and the native
437 group were gender, environmental experience, and residence time at home. Obtaining food and
438 medicine were associated with the female gender and family traditions, especially in housewives.
439 Instead, men had more contact with the natural landscape. This suggests that in Chilean society
440 the environmental experience is still conditioned by gender roles. However, this tendency could
441 be biased by the age of the participants (over 50 years old), so it would not be reflecting recent
442 socio-cultural changes in terms of equality. Beyond gender and age distinctions, our results
443 showed that the sidewalk gardens were used as a support to the household economy, especially
444 during the first years of residence. Whereas people who preferred to grow native plants had a
445 longer residence. This is consistent with studies that indicate that it takes at least five years for
446 people to decide which type of plants they prefer to grow (Kendal *et al*., 2012). Meanwhile, they
447 often redesign the garden until they achieve a floristic composition that meets both their
448 immediate needs and the expression of their ideology (Kirkpatrick *et al*., 2012; Shackleton *et al*.,
449 2015; van Heezik *et al*., 2014).

450

451 The participants' region of origin and their lifestyle were key factors in the assessment of
452 native flora. We hypothesize that people from regions other than RM reached greater knowledge
453 and willingness to conserve native species because they may have been more in contact with
454 them during their childhood. This greater contact may be causing a higher level of familiarity
455 with native species, influencing the willingness to conserve. People who identified with an urban
456 lifestyle only expressed preferences for a limited number of attributes. This, together with the
457 high number of participants in the neutral group, could be indicators of the extinction of the

458 experience that occurs in large cities, where the low interaction with nature limits the ability to
459 perceive and actively access its potential benefits (Camps-Calvet *et al*., 2016; Lin, Gaston,
460 Fuller, Wu, Bush, & Shanahan, 2017; Miller, 2005)
461 .

462 **4.3 Perceptions of native and exotic species**

463 Even though the role of native and exotic flora in cities has been widely discussed, there is a
464 consensus that none of these origins can be completely excluded (Kowarik, 2011; Oldfield *et al*.,
465 2013; van Heezik *et al*., 2014). Even under a conservation approach, exotic species are
466 necessary to increase the complexity and functional diversity of the urban ecosystem, thus
467 ensuring the provision of multiple benefits for citizens (Dearborn & Kark, 2010). Our results
468 show that people maintain an emotional bond with their plants, were they native or exotic, so
469 they would not be willing to discard them. However, the representation of both origins in
470 Santiago is far from balanced (Castro *et al*., 2018; Figueroa *et al*., 2016). Although some people
471 declared a preference for native species, all gardens were dominated by exotic plants, as
472 *Cynodon dactylon* (bermuda grass) and *Poa annua* (annual bluegrass) in the turfgrass, or
473 *Ligustrum ovalifolium* (California privet) on living fences. Public street trees that cohabit the
474 easement areas with sidewalk gardens were also dominated by exotic species, such as *Acer*
475 *negundo* (box elder) and *Robinia pseudoacacia* (black locust) (XXX, unpublished data;
476 masked_for_blind_review).
477

478 People who cultivated native plants believed that this flora was part of their cultural
479 heritage. Whereas those who only cultivated exotic plants did not know Chilean species, did not
480 know where to buy them or had never questioned the origin of their plants. The actual

481 composition of sidewalk gardens revealed that many survey respondents misidentified native
482 species as exotics, and vice versa. Indeed, native species were in most gardens, but only 30% of
483 the participants were able to recognize them. On the other hand, 5% of people strongly believed
484 that all their plants were native since they knew them of childhood and were common throughout
485 the city. This shows that both knowledge and individual experience condition people's perception
486 and attitude towards biodiversity and are key to native flora being recognized and valued in cities
487 (Zhang & Jim, 2014).
488
489 The motivation to cultivate native flora was not based only on origin. In fact, in six of the
490 fifteen species analyzed the native origin was irrelevant to people, but their other types of
491 attributes received a high rating. Being able to perceive these "secondary" benefits in native flora
492 could facilitate their incorporation into gardens, gradually replacing the functions dominated by
493 exotic species (Shaw *et al*., 2017; Zhang & Jim, 2014). A fundamental condition for this is that
494 people are free to choose which species to cultivate because, as our results showed, the
495 perception of the benefits they provide, and their importance is different and individual. For
496 example, images of *C. alba* evoked for some childhood memories regarding the sclerophyllous
497 forest. While for others this species it was seen as an efficient alternative to shade.
498
499 **4.4 Endangered species in gardens**
500 In this study we only identified the presence of *E. chiloensis* (NT) among threatened species in
501 sidewalk gardens. Although its native status was the most valued attribute, the participants did
502 not know that it was under a conservation category. Instead, 27% of people knew that *J. chilensis*
503 (VU) and *B. miersii* (VU) are threatened. These two species are emblematic of Central Chile, so
504 it was to be expected that some people would be familiar with their conservation status.

505 However, the idea of cultivating a specimen of *B. miersii* in the future was not attractive,
506 probably due to its dimensions. In contrast, *E. chiloensis* (19%), *J. chilensis* (17%), and
507 *Alstroemeria spp*. (16%; VU, EN) had a better acceptance and could be successfully
508 incorporated into future conservation actions. *A. bustillosii* (EN), meanwhile, only aroused the
509 interest of two people. This shrub is an occasional species to the sclerophyllous forest and lacks
510 attractive characters. This could explain why participants' perception of *A. bustillosii* was
511 considerably less favorable than towards the emblematic species.
512
513 In general terms, participants were willing to conserve native flora in their sidewalk
514 gardens ($\overline{X}$ = 4.35; max = 7.0), even though they showed limited specific knowledge ($\overline{X}$ = 0.96;
515 max = 3.0). These results suggest that it could be possible to bridge the gap between
516 conservation needs and citizen preferences. This study evidences an explicit concern for the
517 environment, which went beyond the boundaries of the property. In this sense, the people who
518 currently maintain a sidewalk garden would already be promoting the recovery of the link with
519 biodiversity, so they would be receptive to incorporating threatened species into these spaces.

5. Conclusions

In light of our results, we can conclude that the sidewalk gardens meet minimum conditions sufficient to conserve native flora in the future, and that this objective is potentially compatible with the motivations and preferences of their owners. Even though the willingness to conserve was not optimal, an explicit rejection of native flora was not observed. Thus, conservation initiatives could increase their support, fostering citizens' familiarity, knowledge, and commitment to native species (Miller & Hobbs, 2002; Miller, 2005).

We identified at least five favorable aspects that justify our conclusions. First, creating sidewalk gardens was motivated by the need to incorporate nature into the environment. Second, the species were selected for a series of attributes, including the native origin and certain ecological traits consistent with local environmental problems. Third, preferences for native flora was related to a greater knowledge and willingness to conserve. Fourth, native species were already present in most sidewalk gardens and were valued for different types of attributes, not just their origin. And fifth, people stated an explicit interest in growing more native species in the future, either by replacing exotic species or by combining both origins.

Although sidewalk gardens are an undervalued resource in cities, they represent strategic spaces for managing biodiversity. Urban planning with a socio-ecological approach must consider these types of community initiatives, where ecosystem health and human well-being can be actively and synergistically related.

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Table captions

Table 1. Preferred attributes in plants grown in sidewalk gardens (n = 100) and their categories ($\overline{X}$ ± SD). Attributes marked with asterisks (*) were added during data analysis, based on participants' innate response to the open-ended question: *What characteristics must a plant have to be incorporated into sidewalk gardens?*

Table 2. Social descriptors of the groups of participants (frequency %). Asterisks next to the qualitative variables indicate a significant contrast of proportions ($X^2 > 2.072$; $P < 0.15$). While the letters next to the quantitative variables ($\overline{X}$ ± S.D.) indicate statistically different groups (Dunn test).

Table 3. Frequency of native species of local interest and importance value of their attributes in the sidewalk gardens of Santiago ($\overline{X}$ ± SD) (1: alimentary, 2: ecological, 3: emotional, 4: medicinal, 5: ornamental 6: social, 7: structural, 8: symbolic, 9: native).

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Attributes	Frequency %	Attributes	Frequency %
Aromatic condiment	59	$\overline{X}$ **Ornamental**	32.3 ± 2
Edible	53		
$\overline{X}$ **Alimentary**	56.0 ± 4	Uncommon	26
		Trending	4
Attraction birds and insects	78	Economic status	1
Drought tolerance	53	$\overline{X}$ **Social**	10.3 ± 14
Environmental dust retention	46		
Weed suppression	22	Shade provision	70
Pest repellent	17	Ground cover	66
$\overline{X}$ **Ecological**	43.2 ± 25	Live fence	57
		Reduced size	49
Childhood memory	35	Low maintenance	45
Express who I am	15	Ordered (*)	7
Memory of loved ones (*)	5	$\overline{X}$ **Structural**	49.0 ± 23
$\overline{X}$ **Emotional**	18.3 ± 15		
		Energy protection	42
Medicinal	60	Religious or cultural value	9
Hallucinogenic	3	$\overline{X}$ **Symbolic**	25.5 ± 23
$\overline{X}$ **Medicinal**	31.5 ± 40		
		Native to Chile	21
Large and colorful flowers	77		
Leaves with textures and colors	55	**Growth Habit**	
Seasonal flowers	25	Shrubs	80
Evergreen foliage	16	Herbs	79
Combines with the garden (*)	11	Trees	68
Brings variety to the garden (*)	10	Succulents	63

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Variable type	Variables	Level	Utilitarian group ($n = 19$)	Native group ($n = 21$)	Neutral group ($n = 60$)
Demographic	Gender	Woman	73.7*	33.3*	50.0
Socioeconomic	Residence	< 5 years	26.3*	14.3	11.7
	Occupation	Student	21.0*	4.8	5.0
		Housewife	21.0*	19.0	8.3
Environmental experience	Family tradition		89.5*	71.4*	81.7
Demographic	Gender	Man	26.3*	66.7*	50.0
	Region of origin	Other regions	47.4	57.1*	38.3
Socioeconomic	Owners	Yes	73.7	95.2*	76.7
	Residence	> 10 years	63.2	80.9*	63.3
	Profession	Environmental	0.0	14.3*	5.0
	Income	310-620USD	31.6	52.4*	33.3
Environmental experience	Visit wilderness areas		78.9	85.7*	63.3*
	Lifestyle	Close-to-nature	52.6	80.9*	35.0*
Garden management	Garden creator	Yes	89.5	66.7*	93.3*
	Garden years	Yes	19.9 ± 16^b	18.4 ± 13^b	10.4 ± 6^a
	Unique garden	Yes	10.5	9.5	26.7*
Socioeconomic	Residence	5-10 years	10.5	4.7*	25.0*
Environmental experience	Lifestyle	Urban life	47.4	19.0*	65.0*

Table 3. Frequency of native species of local interest and importance value of their attributes in the sidewalk gardens of Santiago ($\overline{X}$ ± SD) (1: alimentary, 2: ecological, 3: emotional, 4: medicinal, 5: ornamental 6: social, 7: structural, 8: symbolic, 9: native).

Species	F %	1	2	3	4	5	6	7	8	9
Acacia caven	4		7.0 ± 0	8.5 ± 1		7.8 ± 2				8.3 ± 1
Aristotelia chilensis	7	7.8 ± 1	7.0 ± 1	8.0 ± 0	8.0 ± 0	7.7 ± 1				9.0 ± 0
*Beilschmiedia miersii***	0									
Cryptocarya alba	5	5.5 ± 1		8.0 ± 1	7.0 ± 1	7.0 ± 1		7.5 ± 1		8.8 ± 0
*Jubaea chilensis***	0									
Quillaja saponaria	2					8.5 ± 1		7.0 ± 0		9.0 ± 0
Schinus areira	9		8.0 ± 0			7.9 ± 1		8.9 ± 0		
*Avellanita bustillosii****	0									
Baccharis linearis	2	9.0 ± 0				7.5 ± 1				8.5 ± 1
Caesalpinia gilliesii	4		8.0 ± 1	8.0 ± 0		8.8 ± 1				
Cestrum parqui	21		8.0 ± 1	8.0 ± 0	7.0 ± 1	7.4 ± 1		8.3 ± 1	8.6 ± 1	8.3 ± 1
Escallonia rubra	2		7.0 ± 0			9.0 ± 0		8.0 ± 0		6.0 ± 0
Carpobrotus chilensis	2					9.0 ± 0		8.0 ± 0		
*Echinopsis chiloensis**	9		8.0 ± 0	9.0 ± 0		8.6 ± 1			7.5 ± 1	9.0 ± 0
Alstroemeria spp	0									
Dichondra sericea	6							9.0 ± 0		
Dysphania ambrosioides	18		8.0 ± 0	8.0 ± 0	9.0 ± 0					7.7 ± 1
Nassella spp	3		8.0 ± 0			9.0 ± 0				
Oxalis rosea	18		7.0 ± 0	9.0 ± 0		8.8 ± 0		8.1 ± 0		
Sisyrinchium striatum	0									
	n	3	10	8	4	13		8	2	9
	%	20	67	53	27	87		53	13	60
	$\overline{X}$	7.4 ± 2	7.6 ± 1	8.3 ± 1	7.8 ± 1	8.2 ± 1		8.1 ± 0	8.1 ± 1	8.3 ± 1

*NT: Near Threatened; **VU: Vulnerable; ***EN: Endangered.

Figure captions

Figure 1. Geographic location of Santiago de Chile and distribution of sampling sites.

Figure 2. Main motivations for maintaining a sidewalk garden (n = 100).

Figure 3. Plant attributes preferred by participants (frequency %) in the utilitarian (n = 19), native (n = 21) and neutral (n = 60) groups.

Figure 4. Scores of (a) knowledge and (b) willingness to conserve native flora in the sidewalk gardens of Santiago.

Figure 1.

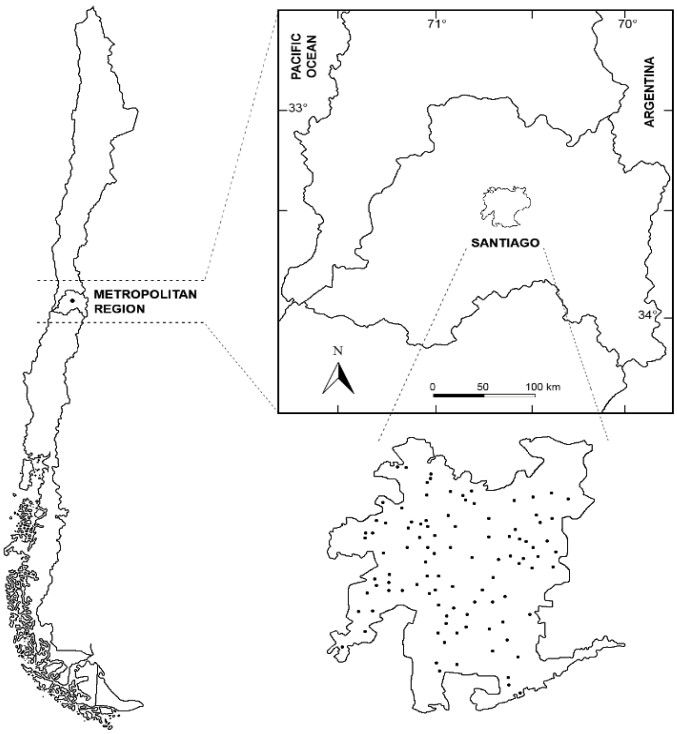

METROPOLITAN
REGION
PACIFIC
OCEAN
ARGENTINA
71°
70°
33°
34°
SANTIAGO
N
0
50
100 km

Figure 2.

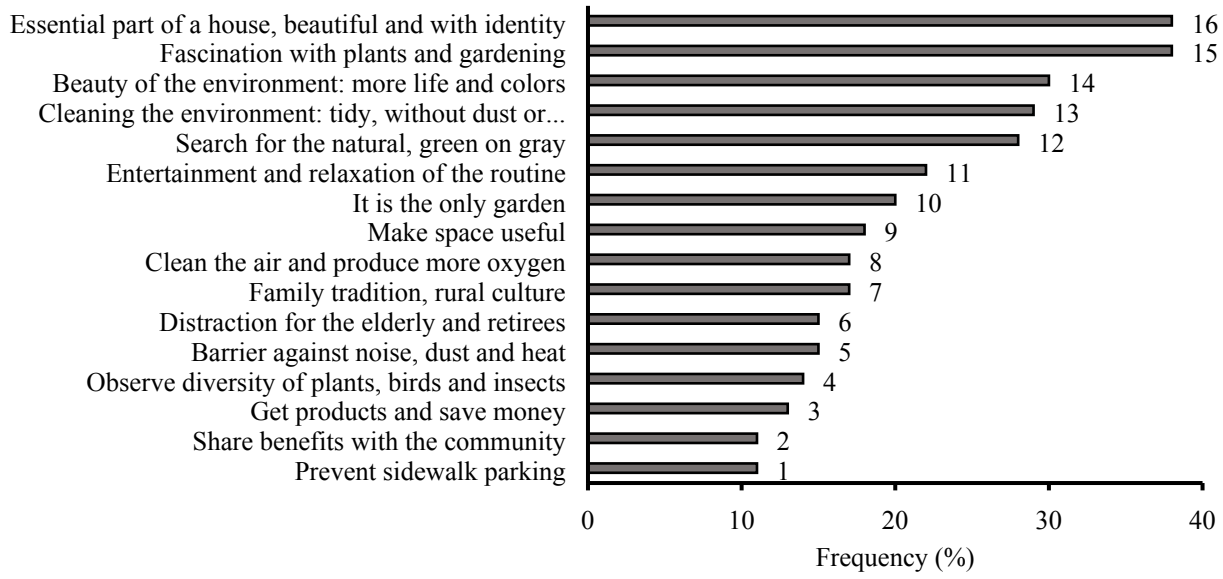

Essential part of a house, beautiful and with identity
Fascination with plants and gardening
Beauty of the environment: more life and colors
Cleaning the environment: tidy, without dust or...
Search for the natural, green on gray
Entertainment and relaxation of the routine
It is the only garden
Make space useful
Clean the air and produce more oxygen
Family tradition, rural culture
Distraction for the elderly and retirees
Barrier against noise, dust and heat
Observe diversity of plants, birds and insects
Get products and save money
Share benefits with the community
Prevent sidewalk parking
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
10
20
30
40
Frequency (%)

Figure 3.

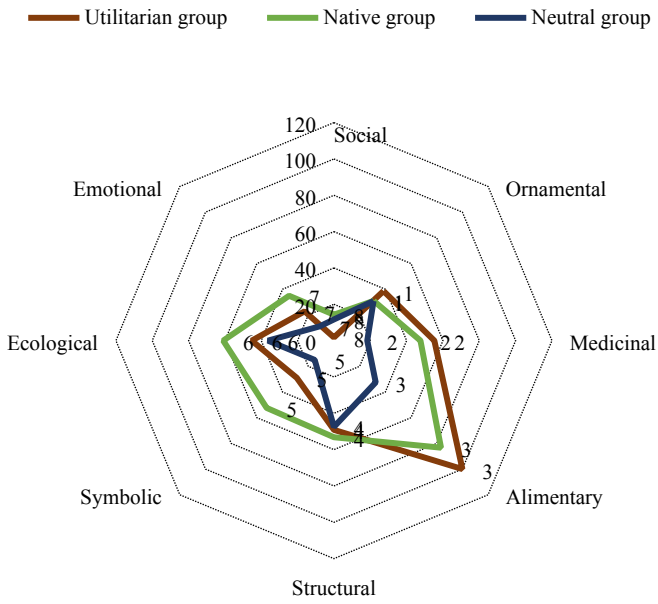
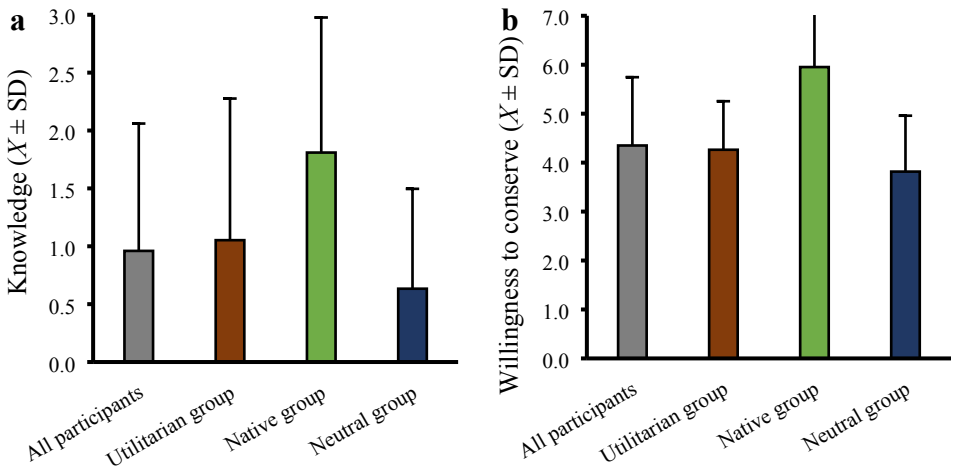

Utilitarian group
Native group
Neutral group
Social
Ornamental
Medicinal
Alimentary
Structural
Symbolic
Ecological
Emotional
120
100
80
60
40
20

Figure 4.


a
Knowledge (X ± SD)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
All participants
Utilitarian group
Native group
Neutral group
b
Willingness to conserve (X ± SD)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
All participants
Utilitarian group
Native group
Neutral group

Appendices captions

Appendix A. Construction of variables and classification of the open-ended question: *What motivates you to maintain a garden on the sidewalk?* (a: fascination with plants and gardening, b: get products and save money, c: family tradition, rural culture, d: search for the natural, green on gray, e: diversity of plants, birds and insects, f: clean the air, produce more oxygen)

Appendix B. Sociocultural variables of the participants and characteristics of the sidewalk gardens (n = 100). All variables were included in the statistical analysis (multiple regression for the ANOVA), except 'species origin'.

Appendix A. Construction of variables and classification of the open-ended question: *What motivates you to maintain a garden on the sidewalk?* (a: fascination with plants and gardening, b: get products and save money, c: family tradition, rural culture, d: search for the natural, green on gray, e: diversity of plants, birds and insects, f: clean the air and produce more oxygen).

Interviewed/Answers	a	b	c	d	e	f
N° 6. I like plants and vegetables, everything that helps the kitchen. That is how it was when I lived in the countryside. We should do the same with the plants here, especially with what is natural.	1	1	1	1	0	0
N° 15. To see little birds and for oxygen. I love plants, every time I have time I am gardening or with my seedlings. I love taking products from my own garden and bringing them to the table.	1	1	0	0	1	1
N° 31. It is part of my lifestyle. My mother and grandmother were herbalists and taught me to recognize medicinal plants. I like to see diversity; I think because I am southern, and I was born in the countryside.	1	1	1	0	1	0

Appendix B. Sociocultural variables of the participants and sidewalk gardens features (n = 100). All variables were included in the statistical analysis (multiple regression for the ANOVA), except 'species origin'.

Variable type	Variables	Level	Frequency	Variable type	Variables	Level	Frequency
Garden management	Garden creator	Interviewed	87				
		Woman	50		Residence (years)	< 5	15
		Man	46			5 – 10	18
		Unknown	4			> 10	67
	Garden maintainer	Interviewed	93		Education	Primary	17
		Woman	53			High school	37
		Man	47			University	46
	Garden area (m^2)	3 – 10	64		Profession	Administration	9
		11 – 20	29			Artisan	6
		21 – 30	5			Commerce	13
		> 30	2			Computing	2
	Garden years	< 1	3			Construction	7
		1 – 5	20			Education	12
		6 – 10	26			Electric	4
		11 – 15	19			Environmental	6
		16 – 20	19			Health	13
		> 20	14			Hostelry	4
	Unique garden	Yes	20			Housework	13
		No	80			Sports	2
	Natural dispersion	Tolerant	46			Transport	9
		Non-tolerant	54		Current occupation	Student	8
	Species origin	Native	75			Housewife	13
		Exotic	100			Employee	51
Demographic	Gender	Woman	51			Retired	28
		Man	49		Income (USD)	< 310	28
	Age (years)	18 – 29	9			310 - 620	37
		30 – 39	14			620 - 930	21
		40 – 49	14			930 – 1,240	2
		50 – 59	19			> 1,240	4
		60 – 69	14			Does not say	8
		70 – 79	16	Environmental experience	Formal environmental education		24
		80 - 89	14		Mass media information		95
	Children at home	Yes	63		Visit urban parks		77
		No	37		Visit wilderness areas		71
	Region of origin	RM	56		Family tradition		81
		Other regions	44		Lifestyle	Urban life	52
Socioeconomic	Owners	Yes	80			Close-to-nature	48
		No	20				

ACKNOWLEDGMENTS

The authors wish to thank the residents of the city of Santiago who participated in the survey, for their kindness and tolerance. And to two anonymous reviewers for critical review of the manuscript and its translation into English.

Encuesta

“JARDINES DE VEREDA Y CONSERVACIÓN BIOLÓGICA EN LAS CIUDADES: PERCEPCIONES Y PREFERENCIAS QUE GUÍAN LA COMPOSICIÓN FLORÍSTICA DE UN ESPACIO POCO EXPLORADO EN SANTIAGO DE CHILE”

Esta consulta es realizada por la Facultad de Ciencias Forestales y Conservación de la Naturaleza, de la Universidad de Chile, y busca conocer su opinión acerca de los jardines residenciales y su contribución en las ciudades. Su opinión y percepción acerca de ellos es clave para la gestión urbana, ya que entregará información acerca de la importancia que estos espacios tienen para los habitantes de Santiago. Las preguntas que se presentan a continuación tienen como objetivo conocer su opinión, no su conocimiento, por lo que no existen respuestas buenas o malas. Su participación es anónima, voluntaria, no tiene ningún costo ni beneficio para usted, y puede retirarse en el momento que lo estime conveniente.

I. Sobre el jardín de vereda y las plantas que cultiva

1. ¿Hace cuántos años fue construido el jardín de vereda?
   - _____
   - No lo sabe, el jardín estaba previamente en la casa.

2. ¿De quién fue la iniciativa de crear el jardín de vereda?
   - Entrevistado/a
   - Hombre
   - Mujer
   - No lo sabe, el jardín estaba previamente en la casa.
   - Edad: _____

3. ¿Quién se encarga actualmente de la mantención del jardín de vereda?
   - Entrevistado/a
   - Hombre
   - Mujer
   - Edad: _____

4. ¿Qué lo motiva a mantener un jardín de vereda?
   - _____
     _____
     _____

5. Además del jardín de vereda, ¿tiene otro espacio en la casa destinado al cultivo de plantas?
   - Sí
   - No

6. ¿Las plantas que tiene en el jardín de vereda fueron sembradas o crecieron naturalmente?
    - Todas fueron sembradas
    - Todas crecieron naturalmente por dispersión
    - Algunas fueron sembradas y otras crecieron naturalmente
    - No lo sabe, el jardín estaba previamente en la casa

7. ¿Qué características debe tener una planta para que decida incorporarla al jardín de vereda?
    - _____
      _____
      _____

8. Señale qué palabras describen las características deseadas y los roles funcionales de las plantas que eligió para su jardín de vereda.

Ornamental
- No muy grande
- Color y textura de las hojas
- Color y tamaño de las flores
- Flores de temporada
- No bota las hojas

Medicinal
- Medicinal
- Alucinógena

Alimenticia
- Comestible
- Aromática

Estructural
- Produce sombra
- Recubre el suelo
- Forma barrera

Simbólico
- Protección energética
- Valor religioso o cultural

Ecológico
- Tolerante a la sequía
- Suprime las malezas
- Atrae pájaros y polinizadores
- Repele plagas
- Retiene el polvo ambiental
- Poco mantenimiento

Emotivo
- Recuerdo de la infancia
- Expresa quién soy

Social
- Poco común
- Status económico
- Moda

Origen
- Originaria de Chile

Otro
- _____

9. ¿Qué forma de las plantas prefiere cultivar en el jardín de vereda?
    - Árboles
    - Arbustos
    - Hierbas
    - Suculentas
    - Una mezcla de ellas.
    - No lo considero relevante.

10. ¿Conoce el origen de las especies que cultiva? Es decir, ¿en qué lugar crecen naturalmente?
    - Sí
    - No
    - Algunas

11. ¿Cuál es el principal origen de las plantas que cultiva en el jardín de vereda?
    - Todas son originarias de otros países.
    - La mayoría son originarias de otros países y algunas chilenas.
    - La mayoría son plantas originarias de Chile.
    - No estoy seguro/a del tipo de plantas que tengo.

12. ¿Sabe cuáles de estas plantas son originarias de Chile? (por favor, indicar)
    - _____
      _____
      _____

13. ¿Por qué tiene/no tiene plantas originarias de Chile en el jardín de vereda?
    - _____
      _____
      _____

14. ¿Le gustaría tener más plantas originarias de Chile en el futuro?
    - Sí
    - No

15. ¿Estaría dispuesto a reemplazar las plantas originarias de otros países que actualmente tiene en su jardín por plantas chilenas?
    - Sí
    - No
    - Algunas

16. ¿Por qué?
    - _____
      _____
      _____

17. ¿Qué especies chilenas le gustaría tener en su jardín? (mencione 3 conocidas y/o preferidas)
    - _____ _____ _____

II. Sobre las especies nativas

18. Del siguiente listado de especies (imágenes anexas), ¿hay alguna que usted tenga en su jardín de vereda u otro espacio de la casa?

Árboles
- espino (*Acacia caven*)
- maqui (*Aristotelia chilensis*)
- belloto del norte (*Beilschmiedia miersii*)
- peumo (*Cryptocarya alba*)
- palma chilena (*Jubaea chilensis*)
- quillay (*Quillaja saponaria*)
- pimiento (*Schinus areira*)

Arbustos
- barba de chivo (*Caesalpinia gilliesii*)
- avellanita (*Avellanita bustillosii*)
- romerillo (*Baccharis linearis*)
- palqui (*Cestrum parqui*)
- ñipa (*Escallonia rubra*)

Suculentas
- doca (*Carpobrotus chilensis)*
- quisco (*Echinopsis chiloensis*)

Hierbas
- mariposa del campo (*Alstroemeria spp.*)
- oreja de ratón (*Dichondra sericea*)
- hierba pluma (*Nassella spp.)*
- paico (*Dysphania ambrosioides*)
- vinagrillo rosado (*Oxalis rosea*)
- huilmo (*Sisyrinchium striatum*)

19. ¿En qué grado los atributos de estas especies son importantes para usted y justifican su decisión de cultivarlas? Señale como “1” el principal atributo que usted valora de cada especie, seguido por “2”, “3”, etc., a medida que disminuyen su importancia. Utilice el valor “0” para los atributos que no considera relevantes o le resultan indiferentes. Considere sólo las especies que usted cultiva en su jardín.

- 1. Ornamental (ej. plantas con flores, hojas o frutos llamativos, floración invernal; 2. Medicinal (ej. plantas para tratar o prevenir enfermedades, o con propiedades alucinógenas); 3. Alimenticio (ej. plantas con hojas, frutos, semillas o tubérculos comestibles, plantas culinarias); 4. Estructural (ej. cerco vivo, tapizantes, cortaviento, para sombrear); 5. Simbólico (ej. plantas esotéricas, de valor religioso o cultural); 6. Ecológico (ej. plantas tolerantes a la sequía, que atraen polinizadores, que repelen plagas o insectos); 7. Emotivo (ej. recuerdo de la infancia,

conmemoración de un ser querido); 8. Social (ej. planta de moda, fina, poco común); 9. Origen (nativo de Chile).

Especies	Ornamental	Medicinal	Alimenticio	Estructural	Simbólico	Ecológico	Emotivo	Social	Origen
espino									
maqui									
belloto del norte									
peumo									
palma chilena									
quillay									
pimiento									
barba de chivo									
avellanita									
romerillo									
palqui									
ñipa									
doca									
quisco									
mariposa del campo									
oreja de ratón									
hierba pluma									
paico									
vinagrillo rosado									
huilmo									

20. ¿Le gustaría tener en el futuro alguna de las especies mencionadas?

Árboles

- espino (*Acacia caven*)
- maqui (*Aristotelia chilensis*)
- belloto del norte (*Beilschmiedia miersii*)
- peumo (*Cryptocarya alba*)
- palma chilena (*Jubaea chilensis*)
- quillay (*Quillaja saponaria*)
- pimiento (*Schinus areira*)

Arbustos

- barba de chivo (*Caesalpinia gilliesii)*
- avellanita (*Avellanita bustillosii*)
- romerillo (*Baccharis linearis*)
- palqui (*Cestrum parqui*)
- ñipa (*Escallonia rubra*)

Suculentas

- doca (*Carpobrotus chilensis*)
- quisco (*Echinopsis chiloensis*)

Hierbas

- mariposa del campo (*Alstroemeria spp.*)
- oreja de ratón (*Dichondra sericea*)
- hierba pluma (*Nassella spp.*)
- paico (*Dysphania ambrosioides*)
- vinagrillo rosado (*Oxalis rosea*)
- huilmo (*Sisyrinchium striatum*)

21. ¿Qué característica de estas especies lo motivan a querer incorporarlas en su jardín?
    - _____
      _____
      _____

22. ¿Sabe si alguna de las especies mencionadas se encuentra amenazada, o en riesgo de extinción, producto de actividades humanas o por fenómenos naturales?, ¿Cuáles?
    - _____
      _____
      _____

23. ¿Cree que es importante conservar especies de plantas chilenas en las ciudades? ¿Por qué?
    - _____
      _____
      _____

III. Información del entrevistado

24. En el siguiente cuadro se agrupan preguntas relacionadas con su experiencia ambiental. Señale si su respuesta es Sí o No, según corresponda.

Preguntas	Sí	No
a. Durante sus estudios formales, ¿tuvo alguna asignatura relacionada con temas de Educación Ambiental o Conservación de la Naturaleza?		
b. ¿Suele leer sobre temas ambientales en diarios, revistas, internet u otros medios de difusión masiva?		
c. ¿Suele visitar parques urbanos, plazas o áreas verdes dentro de Santiago?		
d. ¿Ha visitado algún Área Silvestre, como un Parque Nacional, Santuario de la Naturaleza, sector de cordillera, bosques o quebradas cerca de Santiago?		
e. ¿Y en otras regiones del país?		
f. El conocimiento que usted tiene sobre naturaleza ¿Lo ha adquirido por tradiciones familiares?		

25. Sexo

- o Femenino
- o Masculino

26. Edad: _____

27. Nivel de estudios

- o Educación básica
- o Educación media
- o Educación superior
- o Postgrado

28. Profesión u oficio: _____

29. Ocupación actual: _____

30. Ciudad de origen: _____

31. ¿Usted se siente como una persona de hábitos urbanos o de contacto con la naturaleza?

- o Hábitos urbanos
- o Contacto con la naturaleza

32. Nivel de ingresos mensuales del grupo familiar

- Menos de $300.000
- Entre $300.000 y $500.000
- Entre $500.000 y $750.000
- Entre $750.000 y $1.000.000
- Entre $1.000.000 y $3.000.000
- Más de $3.000.000
- Prefiere no mencionarlo

33. Número de hijos (o niños que habitan en la casa)

- 0 y 5 años _____
- 5 - 15 años _____
- Mayor a 15 años _____

34. ¿Son propietarios de la casa?

- Sí
- No

35. ¿Cuántos años llevan viviendo en la casa?

- Menos de 1 año
- Entre 1 y 5 años
- Entre 5 y 10 años
- Más de 10 años

¡Muchas gracias! su opinión será de gran ayuda para nuestro estudio.

Láminas de especies nativas

ÁRBOLES


espino


peumo


pimiento


palma chilena


quillay


maqui


belloto del norte

ARBUSTOS


barba de chivo


romerillo


avellanita


palqui


ñipa

SUCULENTAS


doca


quisco


mariposas del campo


oreja de ratón


vinagrillo rosado

HIERBAS


hierba pluma


paico


huilmo