Urban Ecosyst (2014) 17:761–773
DOI 10.1007/s11252-014-0343-6

How do people perceive urban trees? Assessing likes and dislikes in relation to the trees of a city

Morelia Camacho-Cervantes · Jorge E. Schondube · Alicia Castillo · Ian MacGregor-Fors

Published online: 23 January 2014

Abstract Cities are systems that include natural and human-created components. When a city grows without proper planning, it tends to have low environmental quality. If improving environmental quality is intended, people's opinion should be taken into account for a better acceptance of urban management decisions. In this study, we assessed people's perception of trees by conducting a survey with a controlled sample of citizens from the city of Morelia (west-central Mexico). Citizens liked both native and exotic tree species and rejected mainly exotic ones. Preference for trees were related to tree attributes; such as size. Trees that dropped leaves or tended to fall were not liked. The most-mentioned tree-related benefits were oxygen supply and shade; the most mentioned tree-related damages were accidents and infrastructure damage. The majority of respondents preferred trees near houses to increase tree density. Also, most respondents preferred trees in green areas as well as close to their houses, as they consider that trees provide oxygen. The majority of the respondents thought more trees were needed in the city. In general, our results show that although people perceive that trees in urban areas can cause damages, they often show more interest for the benefits related to trees and consider there should be more trees in cities. We strongly suggest the development of studies that broaden our knowledge of citizen preferences in relation to urban vegetation, and that further policy making takes their perception into account when considering creating new urban green areas, regardless of their type or size.

Keywords Social perception · Urban planning · Citizens benefits · Morelia · México

M. Camacho-Cervantes
Centre for Biological Diversity, University of St Andrews, Sir Harold Mitchell Building, KY16 9TF Fife, UK

J. E. Schondube · A. Castillo
Centro de Investigaciones en Ecosistemas, Universidad Nacional Autónoma de Mexico, Campus Morelia, Antigua Carretera a Pátzcuaro 8701, Col. ExHacienda de San José de la Huerta, Morelia 58190 Michoacán, Mexico

I. MacGregor-Fors (✉)
Red de Ambiente y Sustentabilidad, Instituto de Ecología, A.C. Carretera antigua a Coatepec 351, El Haya, Xalapa 91070 Veracruz, Mexico
e-mail: ian.macgregor@inecol.edu.mx

Introduction

Urban areas are modified systems systems that aim to satisfy human needs. The changes implied in the process of urbanization result in strikingly different environmental conditions when compared to preexistent ones (Czech et al. 2000; Berkowitz et al. 2003). Among the most contrasting changes imposed by urbanization, cities are well known for having high proportions of built cover and high population densities (Marzluff et al. 2001; Miller et al. 2001; Pickett et al. 2001). Cities pose important environmental demands at different scales, reason why urbanization is often related to major global change components, such as climate change, land-use conversion, introduction of invasive species, and shifts of biogeochemical cycles (Grimm et al. 2008). In addition, the proportion of humans that dwell within cities is currently growing at accelerated rates, especially in developing countries (Garza 2002; Turner et al. 2004; United Nations 2005; Grimm et al. 2008; Montgomery 2008; Pisanty et al. 2009).

Cities are complex systems with multiple dimensions. Within their limits, social and biophysical components converge, reason why their comprehension requires multi and transdisciplinary approaches (Berkowitz et al. 2003; Ávila García 2006; Carranza Cárdenas 2006). Social studies carried out in urban areas are generally separated from their ecological component (Berkowitz et al. 2003; Turner et al. 2004). This division has driven some scientists to perceive biodiversity as the basis of urban ecosystem services (Mack et al. 2000; Lyytimäki et al. 2008), while others tend to perceive lifestyle as the motivation for them (Costanza et al. 1997; Lyytimäki et al. 2008).

Living in urban areas can generate dramatic changes in people's lifestyle, perception, and sociability (Berkowitz et al. 2003; Tapia and Vargas Uribe 2006). Within cities, trees play a crucial role as providers of ecosystem services, which enhance human well-being directly and indirectly (Grahn and Stigsdotter 2003; Sanesi and Chiarello 2006; Escobedo and Chacalo 2008). Four examples of the main functions that trees fulfill in urban areas are: (1) ecological: provision of habitat for other wildlife species (MacGregor-Fors et al. 2009, 2011), (2) temperature: their presence and density mitigates the urban heat island at different scales (Grimm et al. 2008), (3) economic: their shadow helps reduce some urban infrastructure maintenance costs (Conway and Urbani 2007), and (4) social: trees help to reduce stress and are often used to divide socioeconomic sectors (Solecki and Welch 1995). Although urban trees have been widely perceived as decorative in the past, they have taken new values and functions in modern cities (Sanesi and Chiarello 2006). Additionally, it has been suggested that urban trees and green areas are elements capable of enhancing stability and familiarity, plus conveying the idea of cleaner and healthier environments (Henwood and Pidgeon 2001).

Despite the importance of trees in urban areas, their cover is often limited, with modern urbanization strategies paying little attention to them (Ezcurra 1990). Although the role that urban trees play for wildlife species is well documented (Chace and Walsh 2006; Hamer and McDonnell 2008), people's views regarding trees has been less examined (MacGregor-Fors and Ortega-Alvarez 2011). Perceptions and behavior toward trees and urban areas is complex and multidimensional; citizens use green spaces with relevant social implications (Sanesi et al. 2006). Acknowledging people's perceptions towards their surroundings and how their preferences shape the environment is critical for policy making and implementation (Bonnes et al. 2011; Zheng et al. 2011).

In this study we assessed how trees are perceived in a medium-sized Mexican city (Morelia, Michoacán). Our main conceptual referent was social perception, as we were interested in understanding the opinions of people focusing mostly on their likes and dislikes regarding trees, as well as their perceived advantages and disadvantages. Although the study of human perception varies across the literature, from psychology to geography, we use the notion of

social perception in a wide sense, as the process that allows to have and express a view regarding an object or situation (Arizpe et al. 1993; Lazos and Paré 2000), including the sensory aspect raised by psychologists (considering the individual mental process of giving meaning to what is perceived; Ardila 1980), as well as the social process through which people's worldviews are constructed (O'Brien and Kollock 2001). Perceptions and views should be regarded as dynamic since people are continuously receiving stimulus and information from different sources which constantly molds their perception of the environment (Whyte 1985).

Methods

Study area

We conducted this study in Morelia, a colonial city founded in the 16th century. It is the largest city in, and state capital of, Michoacán, located in west-central Mexico (19° 42′ 07″ N, 101° 11′ 33″ W; ~1,925 m asl). Morelia covers an area of ~100 km^2 and has a human population that exceeds one million (Vargas Uribe 2008). The economy of the city relies almost entirely on the service sector, such as tourism, with some industry in its peripheries (e.g., paper and flour factories; Vargas Uribe 2006, 2008; Ávila García 2007). The city has 350 neighbourhoods, of which the majority have scattered trees in gardens, side-walks and median strips, comprised primarily of weeping figs (*Ficus benjamina*), Mexican ash (*Fraxinus udhei*), and gum trees (*Eucalyptus* sp.) (Conejo 2011).

Data collection

Our main research instrument were surveys, which were designed to allow us documenting people's perceptions regarding the trees of the city of Morelia (Table 1). Although our surveys included closed-ended questions in order to quantify particular aspects about people's perception, most questions were open since we were interested in documenting as many details as possible. It was essential for us that respondents had the opportunity to detail their views in

Table 1 Questions included in the survey used for this study

1. Which are your favorite trees in the city of Morelia? (if you do not recall their names, please describe them in as much detail as possible).
2. List the traits of these trees that you like the most.
3. Which are the trees that you dislike the most in the city of Morelia? (if you do not recall their name, please describe them in as much detail as possible).
4. List the traits of these trees that you dislike the most.
5. Do you think that the trees in your city offer any benefits? If so, please specify which.
6. Do you think that the trees of your city cause any harm? If so, please specify which.
7. Where do you like trees to be planted? Options: (a) near my house, (b) in green areas, (c) near my house and in green areas. Please specify why?
8. From the following urban management actions that could be performed with public resources, which are the three most important for you? Options: (a) street garbage recollection, (b) fixing broken side-walks, (c) reduction of vehicle traffic, (d) detection and elimination of water leaks, (e) reduction of urban noise, (f) tree planting in side-walks and median-strips, (g) public transport improvement.
9. In which of the following houses would you prefer to live? (see Fig. 1)

their own words. In this sense, our research can be considered within a qualitative approach (Maxwell 2013).

To assess the perception of urban trees in a sample of citizens of the city of Morelia, we distributed a three-page survey to kindergarten parents in August 2010. We chose to focus on the school system due to current insecurity and people's distrust to provide information to unknown people in the streets, as occurs with conventional surveys. We handed a total of 1,118 surveys in 10 kindergartens of Morelia. In order to have variability regarding gender and socioeconomic status, we: (1) sent surveys to both parents marked distinctively (i.e., blue for fathers, pink for mothers) to identify them, as they were completely anonymous, and (2) selected five tuition-free kindergartens and other five with monthly average tuition-fees (average fee: 1,700 Mexican pesos; ~130 USD; referred to as private kindergartens hereafter). Following these procedures, we were able to narrow our sample to citizens ranging from 30 to 37 years old (average age of parents provided by school directives). This age range corresponds to part of the population that has been independent for some years and are starting to raise a family. Thus, their preferences can play a crucial role in molding the city.

Surveys were handed to parents by teachers in sealed envelopes to take home and dedicate as much time as they needed to respond it. Due to people's unwillingness to share personal information for security reasons, all respondent identities remained anonymous and no personal data, such as age or income, were requested. Surveys were delivered to parents as any other school-related document, but it was not mandatory to turn them back. Parents had between 5 and 8 weeks to fill the surveys at home and were asked to return them to teachers. As well, teachers were asked by kindergarten directives to remind parents about the surveys.

The survey consisted of two parts, one written, and one visual; both including several questions (Table 1). We inquired about: (1) favorite and disliked trees and the traits about them they liked and disliked (questions 1–4, Table 1), (2) benefits and harms that trees can cause (questions 5–6, Table 1), and (3) preferences of the places in which urban trees should be planted (question 7, Table 1). We also included a section to evaluate the relative importance that the respondents awarded to some of the major urban problems in the city, including the lack of trees in sidewalks and median-strips as one of the main problems. Finally, we asked them to select a scenario, from four possible options, where they would like to live. We did this by presenting simple line house drawings with trees placed in different parts of a hypothetical residential area. It should be noted that we used simple line house drawings to focus respondents on tree presence and location and not on the house (Fig. 1). At the end of all surveys, we included a blank space for the parents to freely express any other comment they felt was important for us to know regarding their perception of the trees of the city.

As mentioned before, we used open and closed-ended questions. Open questions gave respondents the opportunity to mention any types of trees and benefits or disadvantages that could come to their minds allowing us to acquire unbiased information. On the other hand, closed-ended multiple-choice questions gave us the opportunity to quantify and homogenize on a given scale respondents feelings towards city issues.

Data analysis

We analyzed closed questions using descriptive statistics, modes (referred as majorities in the results) and percentages in relation to the analyzed sample group (i.e., total, gender, socioeconomic status). For open questions, with an unlimited number of possible answers, we used the program Atlas.ti version 4.2 (Frazonsi et al. 2013), which is a tool for analyzing qualitative data, such as texts. We transcribed all open answers, imported them to the program and then

coded the main ideas in each answer (following Miles and Huberman 1994; Mayring 2000). We created as many categories as needed to synthesize the information provided in the surveys. Afterwards, we merged similar categories to find patterns. We performed the categorization process in pairs and decided to include or not an answer to a previously created category under consensus. Due to the nature of our survey, some respondents gave more than one answer for a single question. As one of our main goals was to represent the complexity of the respondent's answers, we included all of them in our analyses. Thus, our results do not necessarily add 100 %. To compare between socioeconomic status and genders we performed contingency table chi-squared (x^2) and Fisher's tests, depending on the nature of the data.

Results

From the 1,118 surveys delivered, we received 300 of them answered. Most of them were returned by parents within the first week (we received no survey after the eighth week). Of them, 51 % were from tuition-free kindergartens and 49 % from private ones, while 56 % were from mothers and 44 % from fathers, representing almost half-and-half for both socioeconomic status and gender. Most respondents mentioned common names for trees, reason why their descriptions were crucial for further identification to species level (whenever possible). Twenty eight percent of the respondents did not provide information about a preferred tree; space for the answer was left blank or was crossed out. We assumed that, for these cases, they had no preferred tree. The remaining 72 % provided information related to 32 tree species, of which three were the most common, representing 41 % of our survey: (1) "jacaranda" (identified as jacaranda–*Jacaranda mimosifolia*), "pino" (identified as coast sheoak–*Casuarina equisetifolia*), and (3) "fresno" (identified as Mexican ash–*Fraxinus uhdei*; Table 2). Regarding disliked trees, 64 % of the respondents did not provide enough information to identify the species or left this answer blank. We assumed that, for these cases, they had no disliked tree. The remaining 36 % of the respondents provided information related to 23 tree species, of which three were the most frequent answers, representing 24 % of our survey: (1) "eucalipto" (generic name for gum trees–*Eucalyptus* spp.), "ficus" (identified as weeping fig–*Ficus benjamina*), and "pino" (identified as coast sheoak; Table 3). Respondents mentioned size, shade, color, and leafiness as the main traits associated with their favorite trees (Table 4). Regarding disliked trees, respondents mentioned garbage generation, dangerousness, and age as the main traits associated to them (Table 5).

Almost all respondents (98 %) agreed that trees are beneficial for them personally, as well as for the city; no respondent differenced between benefits to them or the city. Oxygen supply was the most common answer, followed by shade, aesthetics, weather regulation, and environmental quality improvement (Table 6). Regarding the question focused on potential damage

Table 2 Tree species mentioned by respondents as the "most liked" trees

Species	Respondents (n=300)
Jacaranda mimosifolia D. Don	50 (16.8 %)
Casuarina equisetifolia L.	45 (15 %)
Fraxinus uhdei (Wenz.) Ligelsh	29 (9.5 %)
Eucalyptus sp.[a]	23 (7.7 %)
Ficus benjamina L.	20 (6.7 %)
Other	48 (16 %)
No answer	85 (28.3 %)

[a]There are two common gum trees in Morelia; blue gum (*Eucalyptus globulus*) and red gum (*E. camaldulensis*), the latter being the most common

Table 3 Tree species mentioned by respondents as the "most disliked" trees

Species	Respondents (n=300)
Eucalyptus sp.[a]	49 (16.2 %)
Ficus benjamina (Warb.)	13 (4.3 %)
Casuarina equisetifolia L.	12 (4 %)
Other	34 (11.5 %)
No answer	192 (64 %)

[a]There are two common gum trees in Morelia; blue gum (*Eucalyptus globulus*) and red gum (*Eucalyptus camaldulensis*), the latter being the most common

of trees in the city, only 22 % of the total respondents stated that trees could have negative effects, of which almost half (45 %) underlined accidents as the most important reason to dislike trees, followed by infrastructure damage, such as side-walk cracking (41 %; Table 7).

Regarding the visual part of the survey, which included simple line house drawings with trees in different locations, 9 % of the respondents chose no scenario, 65 % chose the house with trees all over the area (Fig. 1d), 18 % chose the house with trees only in front (Fig. 1b), 7 % chose the house trees only in the back (Fig. 1c), and only three respondents (1 %) chose the scenario with no trees. For the most popular scenario (Fig. 1d), respondents gave the following reasons for choosing it: (1) it has lots of trees, (2) enhances the view/landscape, and (3) promotes cooler conditions (Table 8). Closely related to the latter, most respondents preferred trees in both green areas and near their houses because, according to their answers, they provide oxygen, improve environmental quality, and provide shade (Table 9). Finally, when respondents were asked to choose the three most important among seven solutions for major urban problems of Morelia, the most common answer was planting trees along side-walks and median-strips, followed by the detection and elimination of water leaks, and street garbage recollection (Table 10). We found no statistically significant relationships between socioeconomic status or gender for any of the answers of the survey.

Discussion

The accelerated growth of cities has generated important environmental negative effects. In order to improve the environmental quality of cities, it is imperative to consider the perception of local people when taking decisions regarding urban green spaces (Bonnes et al. 2011; Zheng et al. 2011). In general, our results agree with previous studied finding links between the environment, life quality, and human behavior (Kinzig et al. 2005; Schroeder et al. 2006; Fuller et al. 2007; Gidlof-Gunnarsson and Ohrstrom 2007; Escobedo and Chacalo 2008; Leslie et al. 2010; Pluhar et al. 2010; Schipperijn et al. 2010). Considering the perception of citizens

Table 4 Tree traits of the most liked tree species

Traits	Respondents (n=300)[a]
Size	104 (34.7 %)
Shade	102 (34 %)
Color	79 (26.3 %)
Leafiness	73 (24.3 %)
Flowers	65 (21.7 %)
Prettiness	36 (12 %)
No answer	9 (3 %)

[a]There were other 23 traits mentioned by less than 10 % of the respondents each. Because some of the respondents mentioned more than one trait and we accounted for all of them, they add different than 100 %

Table 5 Tree traits of the most disliked tree species

Traits	Respondents (n=300)[a]
Garbage generation	49 (16.3 %)
Dangerousness	39 (13 %)
Oldness	37 (12.3 %)
Shadeless	31 (10.3 %)
Side-walk damage	30 (10 %)
No answer	89 (29.7 %)

[a]There were other 20 traits mentioned by less than 10 % of the respondents each. Because some of the respondents mentioned more than one trait and we accounted for all of them, they add different than 100 %

of the city of Morelia, between 30 and 37 years old, using the notion of social perception in a wide sense, we show that people prefer tall, leafy, shady trees (Table 4) of which the most liked are exotic to Mexico (i.e., *Jacaranda mimosifolia,* ICRAF 2013; *Casuarina equisetifolia,* ISSG 2013) and one is native (*Fraxinus uhdei,* ISSG 2013). The majority of the respondents preferred tall trees that provide shade (Table 4). The most frequent answers regarding benefits from trees were oxygen and shade provision (Table 4).

The most disliked trees were those that lose their leaves constantly, because, as respondents commented, they "produce garbage" (Table 5). Also, accidents due to fallen trees were a recurrent reason among respondents for disliking some tree species (Table 5). The most mentioned benefits that trees bring to the city were that they improve aesthetics and purify air (Table 6); while the most mentioned damages were infrastructure damage and accidents (Table 7). The majority of respondents preferred houses with trees in the front and in the back because "there would be a lot of trees" and it would "look better" (Table 8). Also, respondents thought there should be trees near their houses and in green areas because there would be "more oxygen" (Table 9). Lastly, the majority of respondents included the lack of trees in avenues as one of the most important urban problems (Table 10).

Among the answers retrieved in our survey, respondents mentioned the increase in the aesthetic value that trees bring to their houses. Some authors, as Nassauer et al. (2009) assert that aesthetics are not just based on a personal perception basis, but on a collective one. For example, people tend to decorate their homesteads with certain influence from the surrounding ones; for example, neighbors could potentially plant the same species of tree in the front of their houses. In the ecological design of households, cultural norms play a crucial role (Kinzig et al. 2005; Nassauer et al. 2009). Such an increase in aesthetics (e.g., a better looking house) may be translated to an increase in economic value (Donovan and Butry 2010) and a positive

Table 6 Potential tree benefits mentioned by the respondents

Benefits[a]	Respondents (n=295[b])
Oxygen supply	229 (77.6 %)
Shade	83 (36.9 %)
Aesthetics improvement	99 (33.6 %)
Regulation of temperature	43 (19.3 %)
Environmental quality improvement	31 (10.5 %)
No answer[c]	10 (3.4 %)

[a] There were other 14 traits mentioned by less than 10 % of the respondents each. Because some of the respondents mentioned more than one trait, and we accounted for all of them, they add different than 100 %
[b] Five respondents answered "trees do not provide benefits"
[c] Respondents who state that trees provide benefits, but did not specify which ones

Table 7 Potential tree damages mentioned by the respondents

Damages[a]	Respondents (n=66[b])
Accidents	30 (45.5 %)
Infrastructure damage	27 (40.9 %)
Garbage generation	8 (12.1 %)
Electric service damage	7 (10.6 %)
No answer[c]	29 (43.9 %)

[a] There were another six mentioned traits by less than 10 % of the respondents each. Because some of the respondents mentioned more than one damages, and we accounted for all of them, they add different than 100 %
[b] Two hundred and thirty four respondents answered trees do not cause damage
[c] Respondents who said trees cause damage but did not say which ones

effect in commercial areas (Joye et al. 2010). Nevertheless, Donovan and Butry (2010) point out the fact that if citizens had to pay the cost of trees in their surroundings, very few would agree to have them, even if this would increase the value of their properties. In our study, most respondents stated that the government should cover such costs. This result is similar to that reported by Bonaiuto et al. (1999) who suggest that green areas are more appreciated by citizens if they are well kept by the local government.

More than 20 % of the respondents stated they do not have any disliked tree. Of the three most disliked trees, two (i.e., *Ficus benjamina, Eucalyptus* sp.), are exotic to Mexico (ISSG 2013). A previous study showed that *F. benjamina* and one of the gum tree species (*E. camaldulensis*) are two of the most common trees on sidewalks and median-strips of Morelia (Conejo 2011). Also *F. benjamina* is recognized as one of the trees that break more sidewalks in the city (Conejo 2011). It is noteworthy that the two most disliked tree in this study are the most common trees in sidewalks and median-strips of Morelia (Conejo 2011).

Our results show that most disliked trees where those that "make garbage", "generate accidents", "are ugly", or "are unmaintained". This result shows the importance of management activities (e.g., raking leaves, pruning, logging, sanitizing), which can greatly influence the perception of trees in urban areas. A study carried out in Italy showed that dead trees in the city are perceived as risky and unpleasant by citizens (Nali and Lorenzini 2009). This agrees

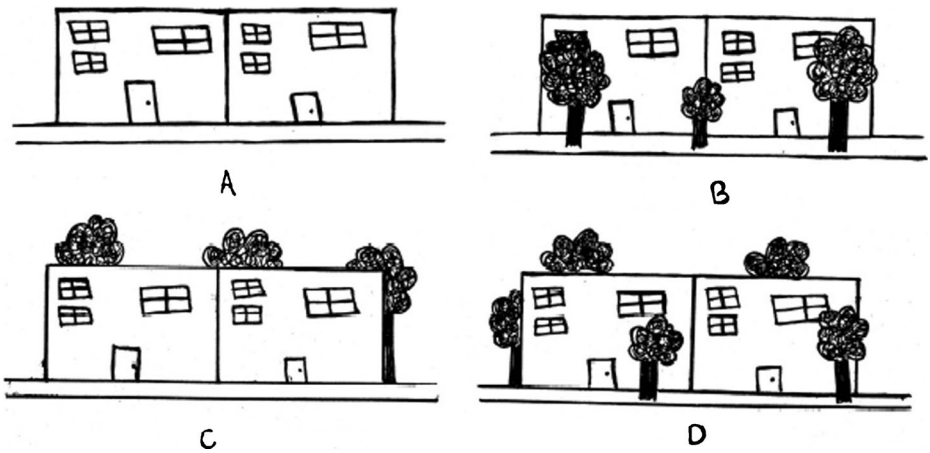

Fig. 1 Drawing used for the survey (see Table 1 for details)

Table 8 Preferred scenario from Fig. 1. Percentages next to each scenario (letter) are from the total respondents of the survey (n=300), while percentages next to each reason given by the respondents are from the total of respondents who picked that scenario

Scenario – respondents (n=300)[a]	Reasons (respondents, percentage of respondents that chose the given scenario)
A – 3 (1 %)	There is no garbage (2, 66.7 %)
	Promote cooler conditions (1, 33.3 %)
	Less use of water (1, 33.3 %)
B – 54 (18 %)	Enhance the view (11, 20.4 %)
	Provide shade (8, 14.8 %)
	Right amount of trees (7, 13 %)
C – 22 (7.3 %)	No obstruction of the side-walk (9, 40.9 %)
	Trees behind instead of in front (3, 13.6 %)
	No side-walk damage (2, 9.1 %)
D – 194 (64.7 %)	Has lots of trees (74, 38.1 %)
	Enhance the view (52, 26.8 %)
	Promote cooler conditions (45, 23.2 %)
No answer – 27 (9 %)	

[a] Because some of the respondents mentioned more than one reason, the number of respondents giving a particular reason to pick the scenario might add different than 100 %

with some answers obtained in our survey regarding the damage that trees can cause, where the most mentioned damages were “they fall” and “cause accidents”. Nevertheless, ~29 % of the respondents that considered that trees were related to damages, mentioned that “it is not the tree’s fault”, and attributed the problem to “lack of maintenance” and the fact that they are placed were they should have been placed from the beginning. In a similar fashion, 4.5 % of the respondents who stated that trees cause damage commented that they can cause damage but still provide benefits. As in the study carried out by Schroeder et al. (2006), we found that citizens perceive more benefits than annoyances from trees. Undoubtedly, all damages and non-liked tree traits represent ecosystem disservices, which have not received enough attention

Table 9 Preferred location for trees in cities. Percentages next to each location are from the total respondents of the survey (n=300), while percentages next to each reason are from the total of respondents who picked that location

Tree location – respondents (n=300)[a]	Reasons (respondents, percentage of respondents that chose the given location)
Green areas – 23 (7.7 %)	It is their place to be (7, 30.4 %)
	Better for recreational activities (5, 21.7 %)
	Provide oxygen (3, 13 %)
Near houses – 1 (0.3 %)	No reasons
Both, near houses and green areas – 250 (83.3 %)	Provide oxygen (53, 21.2 %)
	Improve environmental quality (42, 16.8 %)
	Provide shade (40, 16 %)
No answer – 26 (8.7 %)	

[a] Because some of the respondents did not mention any reason for choosing a scenario, while others mentioned more than one reason, numbers might add different than 100 %.

Table 10 Scores for the three most important solutions to urban problems selected by the respondents

Solution to urban problems	Respondents (n=267[a])
Street garbage recollection	178 (59.3 %)
Fixing of broken side-walks	35 (11.7 %)
Reduction in vehicular traffic on streets	96 (32 %)
Detection of water leaks	179 (59.7 %)
Reduction of noise in cities	10 (3.3 %)
Tree planting in side-walks and median-strips	188 (62.7 %)
Improvement of public transportation vehicles	113 (37.7 %)

Because respondents were asked to choose three problems as the most important, the percentages add different than 100 %

[a] Thirty-three respondents did not provide and answer for this question

to date (Lyytimaki and Sipila 2009). Thus, it is imperative to consider them, as householders often decide to cut down trees within their properties and near their homesteads (personal observation in several Mexican cities).

The majority of the respondents in this study preferred a house with trees in the front and in the back. They also preferred trees near their houses and in green areas. The reasons they gave for this were similar to what was found in a previous study performed in Denmark, which showed that green areas in cities improve human health and well-being due to their contribution to diminishing mind tiredness and increasing physical activity in people (Schipperijn et al. 2010; Zheng et al. 2011). Also, as pointed out by Gobster (1995) and Sanesi and Chiarello (2006), some respondents of this study mentioned that trees play a crucial role in citizens to increase their willingness to carry out recreational activities and outdoor family reunions.

Although previous studies (Kinzig et al. 2005; Nali and Lorenzini 2009) have found differences in the environmental perception of urban-dwellers in relation to gender and socioeconomic status, among other traits (e.g., age), we did not find any association between gender or socioeconomic status in this study. Not finding statistical differences among genders and socioeconomic status could be due to the absence of differences in the controlled sample of citizens of Morelia or due to sample size. Thus, further investigations regarding the perception of urban trees in Morelia and other Mexican cities are needed to complement this study and provide the bases to conceive proper urban planning programs.

Conclusions

If urban managers and planners aim to improve the ecological quality and value of urban systems, it is crucial to understand what motivates people's decisions (Dwyer et al. 1991; Goddard et al. 2010). Conducting studies that consider what society perceives and thinks about the environment they dwell in provides an important opportunity to consider humans not only as responsible for species depletion and environmental destruction, but also as stakeholders and local decision makers (Castillo et al. 2009; Bonnes et al. 2011). Based on our results, we suggest that future tree planting activities in Morelia should consider including trees with one or more of the following traits: tall, leafy, shady, colorful flowers. We also suggest that tree planting activities should focus on native species due to the environmental effects that plating exotic species can pose environmentally (Mooney 2000). One good example of a native species that could be used in Morelia due to its traits is the Mexican ash (*Fraxinus udhei*),

which was one of the most liked trees in this study. On the other hand, greening activities should avoid using gum trees and weeping figs, as they have local negative effects on urban infrastructure (Conejo 2011), are exotic, and were two of the most disliked tree species in our study. Undoubtedly, further studies are needed to broaden our comprehension of human perception related to the ecology of urban areas. As our results show, people have diverse opinions, likes, and dislikes that should be taken into account while taking decision that could affect them directly. People's positive and negative opinions towards urban trees and green areas depend on their previous interactions with them (Bonnes et al. 2011). Results such as those presented here can be useful not only when making urban planning and management decisions, but also for creating effective local environmental education activities.

Acknowledgments We are grateful to A. Ken Oyama Nakagawa, Antonio Vieyra Medrano, and two anonymous reviewers for their valuable comments. We also thank the kindergartens and people who participated in this study, who preferred to remain anonymous, and acknowledge the participation of Hugo Camacho and Tania Arroyo in data collection. Also, we want to thank Dr. Amy Deacon for language corrections and comments on the manuscript. Finally, we greatly thank Lupita Cervantes and Oracio Camacho for partially funding the project.

References

Ardila A (1980) Psicología de la percepción (Psychology of perception). Trillas, México

Arizpe L, Paz F, Velazquez M (1993) Cultura y cambio global: Percepciones sociales sobre la deforestación en la selva Lacandona (Culture and global change: Social Perceptions on the deforestation of the Lacandona rainforest). Centro Regional de Investigaciones Multidisciplinarias. Porrúa, México

Ávila García P (2006) Hacía la construcción de un marco conceptual para el estudio de la relación ciudad-medio ambiente (Towards the construction of a conceptual frame for the study of the city-environment relationship). In: Tapia CE, Vargas Uribe G (eds) El impacto del desarollo urbano en los recursos naturales. CIDEM UMSNH, Morelia, pp 17–31

Ávila García P (2007) Agua, ciudad y medio ambiente: una visión histórica de Morelia, México (Water, city and environment: a historical vision of Morelia, México). CIDEM-UMSNH, Michoacán

Berkowitz AR, Nilon CH, Hollweg KS (2003) Understanding urban ecosystems. Springer, New York

Bonaiuto M, Aiello A, Perugini M, Bonnes M, Ercolani AP (1999) Multidimensional perception of residential environment quality and neighbourhood attachment in the urban environment. J Environ Psychol 19:331–352

Bonnes M, Passafaro P, Carrus G (2011) The ambivalence of attitudes toward urban green areas: between proenvironmental worldviews and daily residential experience. Environ Behav 43:207–232

Carranza Cárdenas JM (2006) El problema del crecimiento urbano y su impacto en los recursos naturales (The problem of urban growing and its impact in environmental resources). CIDEM-UMSNH, Michoacán

Castillo A, Corral Verdugo V, Gonzáles Gaudiano E, Paré L, Paz MF, Reyes J, Schteingart M (2009) Conservación y sociedad (Concervation and society). In: CONABIO (ed) Capital Natural de México, Vol. II: Estado de conservación y tendencias de cambio. CONABIO, México

Chace JF, Walsh JJ (2006) Urban effects on native avifauna: a review. Landsc Urban Plan 74:46–69

Conejo M (2011) Análisis de la relación entre las características de los árboles y el daño que causan sobre las banquetas y camellones de la ciudad de Morelia, Michoacán, México (Analysis of the relation between the trees' characteristics and their repercussion on sidewalks and boulevards in the city of Morelia, Michoacán, México). Dissertation, UMSNH, Morelia

Conway TM, Urbani L (2007) Variations in municipal urban forestry policies: a case study of Toronto, Canada. Urban For Urban Green 6:181–192

Costanza R, D'arge R, de Groot R, Farber S, Grasso M, Hannon B, Limburg K, Naeem S, O'Neill RV, Paruelo J, Raskin RG, Sutton P, van den Belt M (1997) The value of the world's ecosystem services and natural capital. Nature 387:253–260

Czech B, Krausman PR, Devers PK (2000) Economic associations among causes of species endangerment in the United States. Bioscience 50:593–601

Donovan GH, Butry DT (2010) Trees in the city: valuing street trees in Portland, Oregon. Landsc Urban Plan 94: 77–83

Dwyer JF, Schroeder HW, Gobster PH (1991) The significance of urban trees and forests: toward a deeper understanding of values. J Arboric 17:276–284
Escobedo F, Chacalo A (2008) Descontaminación atmosférica por el arbolado urbano de la Ciudad de México (Reduction in atmosphere pollution due to the urban trees in Mexico City). Interciencia 33:29–33
Ezcurra E (1990) De las chinampas a la megalópolis (From chinampas to the big city). Fondo de Cultura Económica, México
Frazonsi R, Doyle S, McClelland LE, Rankin CP, Vicari S (2013) Quantitative narrative analysis software options compared: PC-ACE and CAQDAS (ATLAS.ti, MAXqda, and NVivo). Qual Quant 47:3219–3247
Fuller RA, Irvine KN, Devine-Wright P, Warren PH, Gaston KJ (2007) Psychological benefits of greenspace increase with biodiversity. Biol Lett 3:390–394
Garza G (2002) Evolución de las ciudades mexicanas en el Siglo XX (Evolution of Mexican cities in the XX Century). Revista de Información y Análisis 19:7–16
Gidlof-Gunnarsson A, Ohrstrom E (2007) Noise and well-being in urban residential environments: the potential role of perceived availability to nearby green areas. Landsc Urban Plan 83:115–126
Gobster PH (1995) Perception and use of a metropolitan greenway system for recreation. Landsc Urban Plan 33: 401–413
Goddard MA, Dougill AJ, Benton TG (2010) Scaling up from gardens: biodiversity conservation in urban environments. Trends Ecol Evol 25:90–98
Grahn P, Stigsdotter UA (2003) Landscape planning and stress. Urban For Urban Green 2:1–18
Grimm NB, Faeth SH, Golubiewski NE, Redman CL, Wu JG, Bai XM, Briggs JM (2008) Global change and the ecology of cities. Science 319:756–760
Hamer AJ, McDonnell MJ (2008) Amphibian ecology and conservation in the urbanising world: a review. Biol Conserv 141:2432–2449
Henwood K, Pidgeon N (2001) Talk about woods and trees: threat of urbanization, stability, and biodiversity. J Environ Psychol 21:125–147
(ICRAF) World Agroforestry Centre (2013) AgroForestryTree Database. World Agroforestry Centre http://www.worldagroforestry.org/resources/databases/agroforestree Accessed 22 December 2013
(ISSG) Invasive Species Specialist Group (2013) Global Invasive Species Database. Invasive Species Specialist Group http://www.issg.org/database/welcome/ Accessed 22 December 2013
Joye Y, Willems K, Brengman M, Wolf K (2010) The effects of urban retail greenery on consumer experience: reviewing the evidence from a restorative perspective. Urban For Urban Green 9:57–64
Kinzig AP, Warren P, Martin C, Hope D, Katti M (2005) The effects of human socioeconomic status and cultural characteristics on urban patterns of biodiversity. Ecol Soc 10(1):23
Lazos E, Paré L (2000) Miradas indígenas sobre una naturaleza "entristecida": Percepciones del deterioro ambiental entre Nahuas del sur de Veracruz (Indigenous insights about a "saddened" nature: perceptions of the environmental detriment by Nahuas from the south of Veracruz). Plaza y Valdés Editores – IIS-UNAM, México
Leslie E, Sugiyama T, Ierodiaconou D, Kremer P (2010) Perceived and objectively measured greenness of neighbourhoods: are they measuring the same thing? Landsc Urban Plan 95:28–33
Lyytimaki J, Sipila M (2009) Hopping on one leg—the challenge of ecosystem disservices for urban green management. Urban For Urban Green 8:309–315
Lyytimäki J, Petersen LK, Normander B, Bezák P (2008) Nature as a nuisance? Ecosystem services and disservices to urban lifestyle. Environ Sci 5:161–172
MacGregor-Fors I, Ortega-Alvarez R (2011) Fading from the forest: bird community shifts related to urban park site-specific and landscape traits. Urban For Urban Green 10:239–246
MacGregor-Fors I, Ortega-Álvarez R, Schondube JE (2009) On the ecological quality of urban systems: an ornithological perspective. In: Graber DS, Birmingham KA (eds) Urban planing in the 21st century. Nova, Haupage
MacGregor-Fors I, Morales-Perez L, Schondube JE (2011) Does size really matter? Species-area relationships in human settlements. Divers Distrib 17:112–121
Mack RN, Simberloff D, Lonsdale WM, Evans H, Clout M, Bazzaz FA (2000) Biotic invasions: causes, epidemiology, global consequences, and control. Ecol Appl 10:689–710
Marzluff JM, Bowman R, Donnely R (2001) A historical perspective on urban bird research: trends, terms and approaches. In: Marzluff JM, Bowman JM, Donnely R (eds) Avian conservation and ecology in an urbanizing world. Kluwer, Boston
Maxwell JA (2013) Qualitative research design: an interactive approach 3rd Edition. Sage, U.S.A
Mayring P (2000) Qualitative content analysis. Qual Social Res 1(2):20
Miles MB, Huberman AM (1994) Qualitative data analysis 2nd Edition. Sage, Newbury
Miller JR, Fraterrigo JM, Hobbs NT, Theobald DN, Wiens JA (2001) Urbanization, avian communities and landscape ecology. In: Marzluff JM, Bowman JM, Donnely R (eds) Avian conservation and ecology in an urbanizing world. Kluwer, Boston

Montgomery MR (2008) The urban transformation of the developing world. Science 319:761–764
Mooney HA (2000) Invasive species in a changing world. Island Press, Washington, D.C
Nali C, Lorenzini G (2009) Residents' perception of tree diseases in the urban environment. Arboricult Urban For 35:87–93
Nassauer JI, Wang ZF, Dayrell E (2009) What will the neighbors think? Cultural norms and ecological design. Landsc Urban Plan 92:282–292
O'Brien J, Kollock P (2001) Essay: meaning is negotiated through interaction. In: O'Brien J, Kollock P (eds) The production of reality. Essays and readings on social interaction. Pine Forge Press, Boston, pp 189–205
Pickett STA, Cadenasso ML, Grove JM, Nilon CH, Pouyat RV, Zipperer RV, Costanza R (2001) Urban ecological systems: linking terrestrial ecological, physical, and socioeconomic components of metropolitan areas. Annu Rev Ecol Syst 32:127–157
Pisanty I, Mazari M, Ezcurra E (2009) El reto de la conservación de la biodiversidad en zonas urbanas y periurbanas. In: CONABIO (ed) Capital natural de México, Vol. II: Estado de conservación y tendencias de cambio. CONABIO, México
Pluhar ZF, Piko BF, Uzzoli A, Page RM, Dull A (2010) Representations of the relationship among physical activity, health and perceived living environment in Hungarian urban children's images. Landsc Urban Plan 95:151–160
Sanesi G, Chiarello F (2006) Residents and urban green spaces: the case of Bari. Urban For Urban Green 4: 125–134
Sanesi G, Lafortezza R, Bonnes M, Carrus G (2006) Comparison of two different approaches for assessing the psychological and social dimensions of green spaces. Urban For Urban Green 5:121–129
Schipperijn J, Stigsdotter UK, Randrup TB, Troelsen J (2010) Influences on the use of urban green space—a case study in Odense, Denmark. Urban For Urban Green 9:25–32
Schroeder H, Flannigan J, Coles R (2006) Residents' attitudes toward street trees in the UK and U.S. communities. Arboricult Urban For 32:236–246
Solecki WD, Welch JM (1995) Urban parks: green spaces or green walls? Landsc Urban Plan 32:93–106
Tapia CE, Vargas Uribe G (2006) El impacto del desarrollo urbano en los recursos naturales (The impact of the urban development in natural resources). CIDEM-UMSNH, Morelia
Turner WR, Nakamura T, Dinetti M (2004) Global urbanization and the separation of humans from nature. Bioscience 54:585–590
United Nations (2005) World urbanization prospects: the 2003 revision. United Nations, New York
Vargas Uribe G (2006) Cambios del entorno ecológico de Valladolid-Morelia, una perspectiva desde la historia ambiental (Changes in the ecological surounding of Valladolid-Morelia, a perspective from its environmental history). In: Tapia CE, Vargas Uribe G (eds) El impacto del desarollo urbano en los recursos naturales (The impact of the urban development in natural resources). CIDEM-UMSNH, Morelia
Vargas Uribe G (2008) Urbanización y configuración territorial en la región Valladolid-Morelia 1541–1991 (Urbanization and teritorial configuration of the Valladolid-Morelia region 1541–1991). Morevallado Editores, Morelia
Whyte A (1985) Guidelines for field studies in environmental perception. MAB Technical Notes 5. UNESCO, Paris
Zheng B, Zhang YQ, Chen JQ (2011) Preference to home landscape: wildness or neatness? Landsc Urban Plan 99:1–8