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# CASE STUDY: GREEN SITE IN MONTEIRO LOBATO PARK IN SOUTHERN BRAZIL

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## Resume

**Objective:** To identify tree species and the community's perception of afforestation in Monteiro Lobato Park (PML) in Ponta Grossa, Paraná state, Brazil.

**Methodology:** The methodology considered carrying out a census of all bushes and trees followed by an on-line questionnaire for PML users about the population's perceptions and use of space, as well as the possible effects of the presence of vegetation in this location.

**Relevance:** Urban afforestation has been increasingly studied to improve the choices of tree species in relation to the physical space available in central flower beds, green sites and on roads. The green sites have the highest concentration of trees and can be a space that offers beauty, leisure, rest and health to the population, such as the Monteiro Lobato.

**Results:** Monteiro Lobato Park performs its functions bringing economic, social and environmental benefits, presenting a considerable number of arboreal individuals, mostly exotic. The population that frequents the Park was accustomed to the vegetation and ends up propagating and naturalizing exotic species in their daily lives, without even realizing the risks that these species can often generate.

**Theoretical contributions:** It is important for decision making regarding the enrichment of Monteiro Lobato Park, in addition to improving the environmental quality that is sought by visitors.

**Contributions to management:** To directing the management actions of trees present in the Monteiro Lobato Park, while encouraging the expansion of urban green sites, once the population demonstrates the use of these spaces.

**Keywords:** Urban afforestation. Native plants. Exotic plants.

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***Special Edition*** *- Urban treescape as essential equipment of the sustainable cities*

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## ESTUDO DE CASO: ÁREA VERDE NO PARQUE MONTEIRO LOBATO NO SUL DO BRASIL

### Resumo

**Objetivo:** Identificar as espécies arbóreas e a percepção da comunidade em relação à arborização do Parque Monteiro Lobato (PML) no município de Ponta Grossa, Paraná, Brasil.
**Metodologia:** Foi realizado o censo das árvores presente no PML e foi direcionado a população um questionário on-line coletando perfil dos participantes da pesquisa e para entender a percepção da população em relação a vegetação do Parque Monteiro Lobato.
**Relevância:** Melhoria nas escolhas de espécies arbóreas em relação ao espaço físico disponível em canteiros centrais, áreas verdes e nas vias. As áreas verdes possuem maior concentração de indivíduos de porte arbóreo, podendo ser um espaço que oferece beleza, lazer, descanso e saúde para a população, a exemplo do Parque Monteiro Lobato.
**Resultados:** O Parque Monteiro Lobato oferece benefícios econômicos, sociais e ao meio ambiente, apresentando considerável número de indivíduos arbóreos, no entanto em sua maioria exóticos, ao mesmo tempo em que a população já está acostumada com a vegetação acaba propagando e naturalizando em seu cotidiano as espécies exóticas, sem mesmo perceber os riscos que muitas vezes podem ser gerados por essas espécies.
**Contribuições teóricas:** A identificação das espécies arbóreas é importante para a tomada de decisão referente ao enriquecimento para o Parque Monteiro Lobato e a melhoria da qualidade ambiental que é buscada pelos frequentadores.
**Contribuições para a gestão:** Direcionamento do manejo dos indivíduos arbóreos presentes no Parque Monteiro Lobato ao mesmo tempo em que incentiva a ampliação de áreas verdes urbana no município, ao passo que a população demonstra o uso destes espaços.

**Palavras-chave:** Arborização urbana. Plantas nativas. Plantas exóticas.

## ESTUDIO DE CASO: ÁREA VERDE EN EL PARQUE MONTEIRO LOBATO EN EL SUR DE BRASIL

### Resumen

**Objetivo:** Identificar las especies arbóreas y la percepción de la comunidad sobre la forestación en el Parque Monteiro Lobato (PML) en Ponta Grossa, Paraná, Brasil.
Metodología: Realizar un censo de forestación seguido de un cuestionario en línea dirigido a visitantes locales sobre la percepción y uso del espacio por parte de la población.
**Relevancia: Mejora en la elección de especies arbóreas en relación al espacio físico** disponible en parterres centrales, áreas verdes y carreteras. Las áreas verdes tienen la mayor concentración de árboles y pueden ser un espacio que ofrezca belleza, ocio, descanso y salud a la población, como el Parque Monteiro Lobato.
**Resultados:** El Parque Monteiro Lobato realiza sus funciones aportando beneficios económicos, sociales y ambientales, presentando un número considerable de individuos arbóreos, por exóticos que sean, mientras la población ya está acostumbrada a la vegetación, termina propagándola y naturalizándola en sus especies exóticas cotidianas. sin siquiera darse cuenta de los riesgos que muchas veces pueden generar estas especies.
**Aportes teóricos:** La identificación de especies arbóreas es importante para la toma de decisiones sobre el enriquecimiento del Parque Monteiro Lobato y la mejora de la calidad ambiental que buscan los visitantes.
**Contribuciones al manejo:** Dirigir el manejo de los árboles individuales presentes en el Parque Monteiro Lobato mientras se incentiva la expansión de áreas verdes urbanas en la ciudad, mientras la población demuestra el uso de estos espacios.

**Palabras clave:** Forestación urbana. Plantas autóctonas. Plantas exóticas.

## Introduction

Trees present in urban areas, usually located on flowerbeds, roads, or in parks that make up the greenery of cities, are resilient to get their space as well as the society that is concentrated in these areas. At present, the arborization of cities is being pursued in order to improve planning and in selecting species that fit in such a perimeter (Bargos & Matias, 2019).

Vegetation performs beneficial functions to the population present in the urban area, as it can contribute to climate stability, improvement in air quality, reduction of noise pollution in addition to health improvement. However, each urban area can be defined according to the physical space and environmental interactions, those considered parks can have a large extension and shelter a large number of arboreal individuals, because they can offer to their visitors an environment with a different microclimate in relation to the climate of the streets, the arrangement of well-architected individuals providing beauty, intertwining social relationships, and may contain sports courts, walking trails, which results in leisure and health for the population.

Yet, in most examples related to the arborization of public streets, there is the un-organized growth of cities, which highlights the issue of poor planning, especially in relation to the distances between buildings, setback on sidewalks, problems with wiring that, instead of generating benefits, generates damage to the area (Abreu et al., 2017).

In a city's management process, urban arborization should be thought of and directed as a public health resource, therefore, engaging regulatory bodies to support the growth and insertion of urban greenery and reducing the lack of information among communities that depend on these spaces (Bucci et al., 2021).

The arborization, when present, is often problematic due to the large use of exotic species planted in these areas. As shown by Miranda and Carvalho (2009) in a neighborhood of Ponta Grossa, Paraná, that even with data of high diversity and abundance, there is a predominance of exotic species, with 25% conflict degree of all individuals measured by the lack of planning.

Most problems are regarding alien invasive species, which are able to thrive extraordinarily even outside their native environment, competing for nutrients, space and sunlight with local species such as the *Pinus* sp. (pinus), *Hovenia dulcis* Thunb. (Japanese grape) and *Eriobotrya japonica* (Thunb.) Lindl (yellow plum) among other species. Another point, related to the use of native species that benefit the urban environment, and are attractive to ecological relationships, especially birds, and that may also contribute to their conservation due to their visibility, are *Ocotea puberula* (Rich) Nees (canela-guaicá), *Syagrus romanzoffiana* (Cham. ) Glassman (jerivá), *Cassia leptopylla* Vogel (cassia-fastuosa), since they are first thought of according to their characteristics with their size and have due care that is intended

for all arborization present in the urban framework (Dias & Costa, 2008).

In urban areas, parks can be classified as spaces of informal environmental education, since they are places that can be frequented on weekends with the family that can help the subject to build some knowledge outside their formal education, as occurs in schools, which work in the construction of knowledge methodically planned, which in turn adds conceptual values. In these, the socio-environmental relationships that can happen in these spaces provide an approach, even unintentionally, with nature, where the objects of greater values are in one place, the vegetation / environment and the human that refers approximation and possible environmental reconnection, firming again the link between these, which has been lost as people run out of time to enjoy the landscape and the beauties of nature (Louv, 2014).

Part of the population has the habit of visiting these environments, so the use of parks for education can occur through scientific dissemination, having as object of study the arborization, and can increasingly emphasize the importance of greenery for cities. Scientific information must reach the community, because this knowledge is worthless without adding value to the society that lives in these environments.

In this context, knowing the species of vegetation in a certain place is extremely important for decision making regarding the use of urban areas, as well as the conservation of nature in these places and the search for the population's environmental reconnection. This study aims to identify the perception of the community in relation to the afforestation of Monteiro Lobato Park in the city of Ponta Grossa, Paraná, through a memory game with information about species in the park and suggestions for urban afforestation. Thus, the question of this work is: Which species are there and what is the perception of the community regarding the arborization of Monteiro Lobato Park in the city of Ponta Grossa, Paraná?

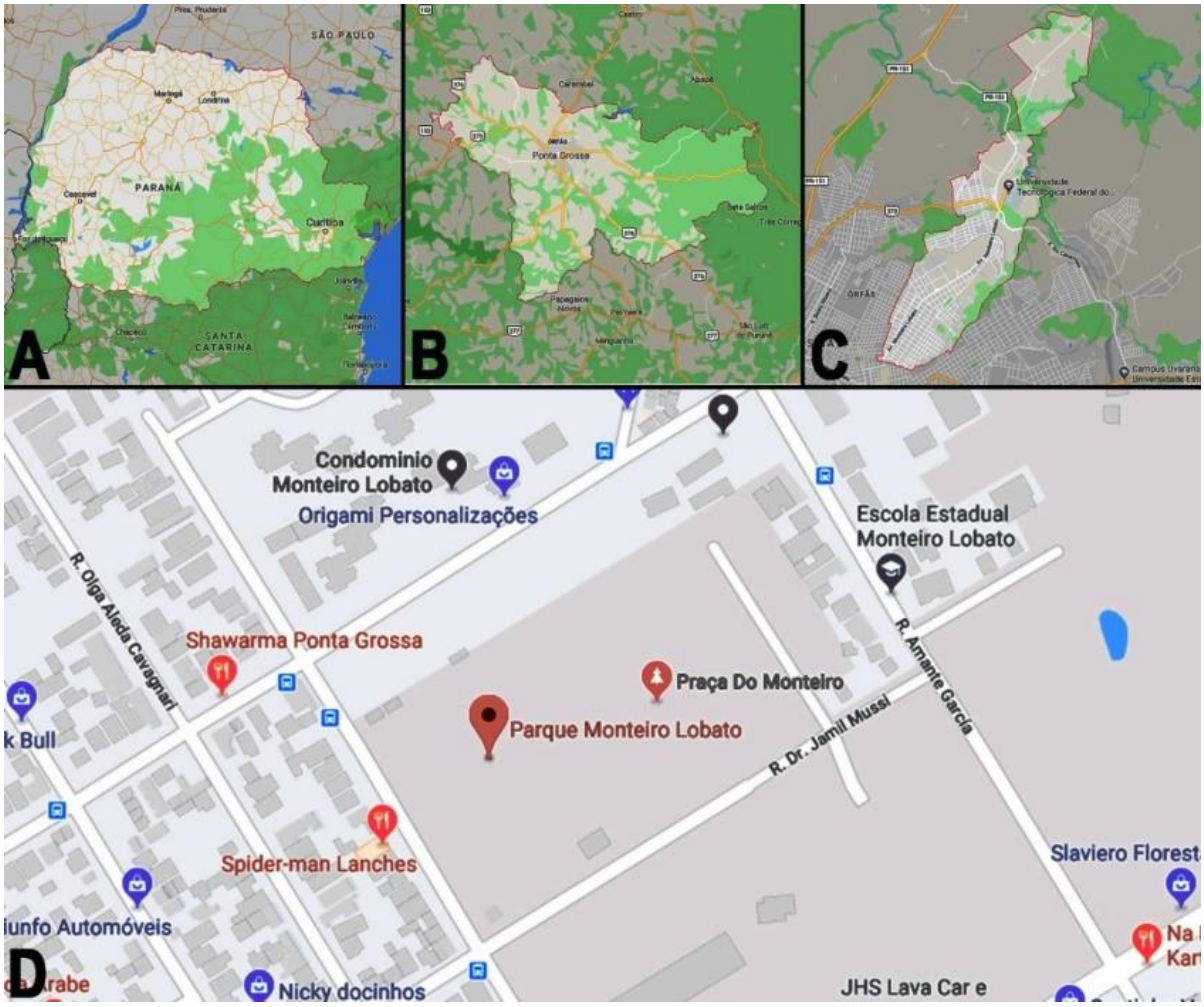
## Methodology

The present study has an applied research approach, which seeks to understand social relationships. It is of a qualitative and quantitative nature for complementing the data, and is also exploratory (Lakatos & Marconi, 2003). The study area is located in the municipality of Ponta Grossa, Paraná, which has a territorial area of 2,025.697 Km², at an altitude of 969 m, latitude 25º05'42''S and longitude 50º09'43''W, with an estimated population of 351,736 inhabitants (IBGE, 2018). The climatic predominance is Humid Subtropical Mesothermal - Cfb, inserted in the second plateau with temperatures below 18ºC and 22ºC on winter and summer days respectively. Ponta Grossa is also known as Campos Gerais and is characterized by shallow and sandy soils that favor the predominance of clean fields, gallery forests or isolated clumps of mixed ombrophilous forest (FOM), known as Araucaria Forest (IPLAN, 2001). In the urban area there are some green areas, among them is the Monteiro Lobato Park (MLP,

25°04'03 "S 50°08'58 "W), which has an area of approximately 55,917.96 m², located in the neighborhood of Jardim Carvalho (Figure 1).

**Figure 1**

*Study area, where: A) Map of Paraná; B) Map of Ponta Grossa; C) Jardim Carvalho neighborhood and; D) Monteiro Lobato Park*




**Source:** Adapted from Google Maps 2020.

The Monteiro Lobato Park was the place where the research was carried out, being much visited on weekends. It has attractive sports courts, sand courts, and a beautiful environment with green areas for the population's leisure. It also has a playground, tables and barbecue grills, which further increases the rate of visitation to the park. On weekdays it is very frequented by the local population that seeks a better quality of life through walking, jogging and outdoor activities in the open-air gym that is available in this environment. Besides this, due to the good lighting, the park enables night activities (Figure 2).

The target group of the research were regular visitors of the Monteiro Lobato Park, and

because it was carried out during a pandemic moment, the questionnaires were online. The questionnaire was prepared through *Google Forms* and disseminated through social networks (*Facebook and Whatsapp*), for a period of 7 days in April 2020; the form was open to be answered from April 22 to April 28, 2020. The answers were grouped through different sections, related to the functions of the green areas and the purpose of the research was to understand the perception of the population towards the MLP, the importance of the place for the environment and quality of life of the research participants. We obtained 104 answers, four of which stated that they did not know the MLP, and these were removed from the sample.

In the census, the following parameters adapted from Silva Filho (2002) were used to measure tree and shrub individuals. I - Location and species identification; II - Dimensions, individual height and PAP (perimeter at breast height above 10 cm); III- Injuries; IV - Ecology, highlighting the presence of nests in the trees.

After the identification of the arborization and shrubs present in the park, the species were classified into exotic species (E) and native species (N), the exotic plants were classified according to the official list of invasive exotic plants of Paraná (ordinance IAP 59/2015) and the native plants according to specific literature.

**Figure 2**
*Images of Monteiro Lobato Park, green area in the municipality of Ponta Grossa, Paraná*

**Source:** The author.

## Results and Discussion

### *Urban Arborization of Monteiro Lobato Park*

When the census of trees in Monteiro Lobato Park was carried out, 487 tree and shrub individuals were measured, representing 26 species and 19 botanical families (Table 1). In this population 362 individuals are exotic (74%) and 125 are native (26%), especially the exotic *Eucalyptus globulus* Labil (eucalyptus), with 321 individuals (66%).

The abundance of eucalyptus in the area is possibly a result of the planting of individuals at the time of installation of the Park, and due to rapid growth and easy adaptation to the environment. Even though there are important native species of local flora such as *Araucaria angustifolia* (Bert) O. Kuntze, it is necessary to raise awareness about the value of local flora and its preservation in the urban environment (Fernandes, 2015), encouraging the insertion of more native species in these locations.

The second most abundant species was *Eugenia uniflora* L. (pitangueira), which represented 40% of the native species present in the park, but most of these individuals were planted recently, by a local church project. Of the total number of pitangueira trees, 82% measured between 0.1 and 1 m, 16% from 1 to 2 m, and 2% up to 3 m, but most are still establishing themselves and continue without monitoring or tutors, which is compromising the development of these individuals, because at the end of this sampling, some have already failed due to lack of care.

**Table 1**

*List of tree species of Monteiro Lobato Park in Ponta Grossa, Paraná*

| Family | Scientific Name | Common Name | C. | F% |
|---|---|---|---|---|
| Anacardiaceae | *Schinus molle* L. | mastic-parsley | N | 1,4 |
| Araucariaceae | *Araucaria angustifolia* (Bert) O. Kutze | paraná pine | N | 2,8 |
| Bignoniaceae | *Handroanthus albus* (Cham.) Mattos | yellow ipe | N | 0,8 |
| | *Caesalpinia peltophoroides* (Mart. ex DC.) Mattos | purple IPE | N | 0,2 |
| Cupressaceae | *Cupressus lusitani* Mill. | cedar | E | 1,4 |
| Euphorbiaceae | *Euphorbia pulcherrima* Willd. ex Klotzsch | parrot's beak | E | 0,4 |
| Fabaceae | *Caesalpinia peltophoroides* Benth. | Sibipiruna | N | 2,6 |
| | *Jacaranda puberula* Cham. | Carobinha | N | 0,2 |
| | *Senna multijuga* (Rich.) H. S. Irwin & Barneby | yellow hallelujah | N | 0,8 |
| Fagaceae | *Castanea sativa* Mill | Brunette | E | 0,8 |
| Flacourtiaceae | *Casearia sylvestris* Sw. | Guaçatonga | N | 0,4 |
| Lauraceae | *Nectandra grandiflora* Nees & Mart. ex Ness | yellow cinnamon | N | 0,2 |
| | *Persea Americana* Mill. | Avocado | E | 0,2 |
| Lythraceae | *Lafoensia* pacari A ST | Foxglove | N | 2 |
| Malvaceae | *Hibiscus rosa-sinensis* L. | Hibiscus | E | 1,2 |
| Melastomataceae | *Tibouchina granulosa* (Desr.) Cogn. | Lent | N | 2,6 |
| Meliaceae | *Cedrela fissilis* Vell. | rose cedar | N | 0,2 |
| Moraceae | *Morus nigra* L. | blackberry | E | 1,4 |
| | *Ficus auriculata* Lour. | Ficus | E | 0,2 |
| Myrtaceae | *Eucalyptus globulus* Labil | Eucalyptus | E | 66 |
| | *Eugenia uniflora* L. | Surinam cherry | N | 10,2 |
| | *Psidium cattleianum* Sabine | Arrack | N | 0,4 |
| | *Campomanesia xanthocarpa* O. Berg. | Guabiroba | N | 0,2 |
| Oleaceae | *Lingustrum lucidum* W. T.Aiton | Privet | E | 0,2 |
| Pinaceae | *Pinus taeda* L. | pine | E | 2,2 |
| Rosaceae | *Eriobotrya japonica* Lindl. | loquat | E | 0,2 |

**Source:** Data extracted from literature and adapted by the authors. Where: C. Classification; N: Native Species; E: Exotic Species. F%: Frequency (%).

Another fruit species is *Morus nigra* L. (blackberry) with a frequency of 1.2%, from 0.15 cm to 1 m in height, this is considered a potentially attractive species for birds because of its infructescences, a tree that fruits abundantly without much care (Góes-Silva; Moreira; Moura, 2012). It is not recommended for planting on flowerbeds or sidewalks, although in parks it is very important to increase the diversity of species in the area.

A *Caesalpinia peltophoroides* Benth. (sibipiruna) drew attention by the lack of care, because in the park the individuals reached heights of up to one meter, but had a PAC of less than 30 cm, and with the action of wind and rain due to the absence of adequate support they broke, which compromised their development.

In this case, when considering the planting of new trees in the urban environment there are still many failures, since the choice of tree species has much to be considered, issues of

crown, fruits, roots (Chaves; Dos Santos Silva; Amador, 2013), but despite knowing the species, it is necessary to know the location in order to avoid conflicts with wiring or sidewalks. In addition, after planting, it is essential to follow up with proper management and tutoring, since the individuals were inserted in environments that are not conducive to their development.

Among the species measured is Hibiscus rosa-sinesis L. (hibiscus), an ornamental species, representing 1.2% of the total, most are distributed in only one place in the park, ranging from 1.57 m to 1.98 m in height. It is a species pollinated by insects of the order Hymenoptera, Diptera and Lepidoptera (Silva & Figueiredo, 2010), despite being an exotic species, it plays an important role as an attraction, its continuous flowering offers food all year round for these visitors.

As an emblematic species and symbol of the state of Paraná, *Araucaria angustifolia* (Bert) O. Kuntze has a 2.8% representativity in the park, totaling 14 individuals, being a species so important to the regionality of the state, there are few individuals, because from this total approximately 43% has between 0.70 and 0.80 m, indicating that they have been recently planted in the site although apparently establishing themselves well, however, by their slow development rate it will take decades to reach their adult size. Others of these (21.4%) when measured were only 0.15 m tall, and may still be at risk of death during their first months of adaptation and survival. The remaining trees (35.7%) are more than 16 meters tall, and therefore are remnants of the site, prior to the installation of the Park The largest tree among these individuals is about 25 m tall. These mature trees add great value to the park, for their characteristic beauty in the landscape.

Considering the species with ecological importance in attracting wildlife and birds, in another environment of the park as a square, there is the presence of the species Lafoensia pacari, whose flowers are visited by bats of the Phyllostomidae family, moths of the Sphingidae family and bees *Trigona spines* (Sazima & Sazima,1975), reinforcing the importance of regional species for the biodiversity of species of native flora and fauna.

The record of *Furnarius rufus* (joão-de-barro) nests in native species was recorded only in a 16m araucaria, but an important record was the presence of native bees, with the observation of a jataí bee nest in one of the oldest araucaria trees in the site, which is 16m long. The tree species present offer food resources, nesting sites, and resting places to the animals present or passing through Monteiro Lobato Park. The native species favor the relationship with regional species, but exotic species at this point also offer a place to live in their trunks and branches.

The exotic species also have the potential to attract avifauna, because considering the ecological relationships, the vegetation cover they present in the park offer shelter for some species, which were recorded during data collection, five of the *Furnarius rufus* (joão-de-barro)

nests were observed in eucalyptus trees from 17 m to 19 m, and also in *Castanea sativa* Mill (castanha-portuguesa), in one of *Cupressus lusitani* Mill. (cedrinho) there was a record of a bumble bee, another native bee species, and also a wasp nest in a 16 m eucalyptus tree.

The record of native bees in this site is an indication that these species have more generalist habits and are becoming increasingly present in anthropized areas, and the arborization was crucial for these species to find a place to nest and resources for their survival (Brun, Link & Brun, 2007).

Among the exotic species with great potential for invasion is *Pinus taeda* L. (Pinus) having 2.2% of the total trees, the smallest is 6 m and the largest is 18 m, there are 11 individuals that are well established on the site, is a tree with great economic potential, but by its high reproductive potential and distribution of seed by wind action, can generate difficulties in maintaining biodiversity and tend to a homogenization of the site, because it hinders the growth of native trees (Zanchetta & Diniz, 2006), is an indication of attention to the growth or not of numbers of pine trees on site, for a control.

However, the fact that most of these species are exotic did not prevent them from attracting avifauna by providing resources and a place for nesting. Often eucalypt species can serve as shelter for migratory birds during their trajectory, given that in the campos gerais alone 17 species from the southern and northern hemisphere have been recorded which have this habit (Uejima & Bornschein, 2007).

## The community and the arborization of Monteiro Lobato Park

Green areas have earned their place because they contribute with their most diverse functions to the solution of current problems, and to mitigate environmental degradation. Understanding then what the regular visitors seek in a green area or how they understand it, is a way to seek improvements in the planning of these areas to achieve more motivation and awareness of this public (Costa & Colesanti, 2011), acquiring a multifunctional role in urban environments (Queiroz, 2018). Thus, we sought to address questions to try to understand how the frequenters of Monteiro Lobato Park (MLP) perceive the vegetation present at the site. Following the form, the interviewees were asked if they knew or frequented other green areas in the city of Ponta Grossa, with balanced answers, 50% knew or frequented and 50% did not (Table 2). Of the 50% who answered yes to this question, they were asked to name these other areas, which revealed other places mentioned, which were the Parque Ambiental; Buraco do Padre, Lago de Olarias and Parque Linear; Vila Velha Park; Praça do Por do Sol; Cachoeira da Mariquinha; Cachoeira do São Jorge, Parque Marguerita Masini; Represa dos Alagados; Capão da Onça; Furnas Gemeas; Chácara Maria Emilia; Clube da Lagoa; Espaço Tavarana; Horto Municipal; Lagoa Dourada; Parque de Oficinas; Parque Santo Antonio; Rio

Verde; Rivers, Squares and Other Parks.

**Table 2**
*Questions and answers from regular visitors to Monteiro Lobato Park in Ponta Grossa, Paraná*

| Questions | Yes | No |
|---|---|---|
| Do you know or frequent other green areas in the municipality of Ponta Grossa? | 50% | 50% |
| Do you know native species within the Park? | 25% | 75% |
| Do you know exotic species inside the Park? | 39% | 61% |
| Do you believe that this area contributes to the urban environmental quality of Ponta Grossa? | 96% | 4% |
| Do you consider that the temperature inside the park is milder than your neighborhood? | 96% | 4% |
| Does the tree vegetation inside the park contribute to this difference? | 98% | 2% |
| Is there less noise inside the park than in other parts of the city? | 85% | 15% |
| Do you consider that the air inside the park is less polluted than in other parts of the city? | 91% | 9% |
| Do you consider that afforestation is important for the survival of the local animals? | 97% | 3% |
| Can the arboreal vegetation inside the park serve as a shelter for migratory animals/birds? | 94% | 6% |
| Is the park landscape pleasant? | 96% | 4% |
| Does tree vegetation help to make the landscape more pleasant? | 99% | 1% |
| Is Monteiro Lobato Park important for raising awareness of urban green areas? | 97% | 3% |
| Is the park an appropriate place for environmental education campaigns/practices? | 97% | 3% |
| Would Monteiro Lobato Park be a place with potential for scientific dissemination? | 92% | 8% |

**Source:** The Authors.

Initially, we sought to register information about the profile of the participants, through questions about income, education, profession/occupation, and their neighborhood. As a result, 51% of the participants have incomplete college education, 21% have or are attending post-graduate courses, while 19% have incomplete high school education, and 9% complete high school education. Regarding the monthly income of the participants, 20% receive more than 5 minimum wages, 18% receive between 1-2 minimum wages, 12% between 3-4 minimum wages, 11% between 2-3 minimum wages, 10% between 4-5 minimum wages, 9% with one minimum wage, and 4% of the participants have no income, while 16% did not declare it. As for their place of residence, 38% of the people who attend MLP live in Jardim Carvalho neighborhood, but there are also people from more distant neighborhoods, including Jardim Eldorado, located in Carambeí-PR, which is 25 km away from the study site, which shows how attractive MLP can be in Ponta Grossa.

There were 26 occupations mentioned, the most expressive one among the people who frequent MLP is that of student (47%), the most practiced profession by the participants is that of teacher (12%), 7% said they have no profession, and 5% are self-employed. Among other professions mentioned are: agronomist, administrative assistant, biologist, civil engineer, driver, public servant (2% each) and manager, lawyer, systems analyst, artist, merchant, accountant, seamstress, entrepreneur, nurse, intern, pharmacist, military, military police officer, laboratory technician, occupational safety technician, process technician, and exchanger (1% each). Therefore, the participants and frequenters of MLP showed themselves to be a very heterogeneous group, with a very diverse set of professions.

Regarding the park's structure, we tried to find out how the participants of this research considered the safety, cleanliness and infrastructure aspects of the park. The cleanliness of the place stood out in this part of the questionnaire, considered good by 71% of the interviewees, and none of the participants considered it bad (Table 3).

**Table 3**

*Table of questions about the facilities of Monteiro Lobato Park*

| Questions | Good | Regular | Bad |
|---|---|---|---|
| Park Security | 31% | 57% | 12% |
| Monteiro Park cleaning | 71% | 29% | - |
| Infrastructure (benches, drinking fountains, restrooms, etc.) | 36% | 52% | 12% |

**Source:** The Authors.

When considering the study by Queiroz (2018) that evaluates the aesthetic function of MLP according to its real estate composition, in relation to the other parks in Ponta Grossa, this was one of the most outstanding, for containing 6 concrete benches, 52 security posts, 12 trash cans, 7 concrete dining tables, 7 gymnastic apparatuses, and 6 sports fields, obtaining good indexes among the public green areas in the municipality.

When asked about the knowledge of park users about native species in MLP, 73% answered that they did not know any native species in the park and 27% answered that they did. For those who answered yes, they were asked to mention which ones they knew, and as expected, the most mentioned was pinheiro-do-Paraná, with 73% of the answers, another native species mentioned was the ipê, with 3%. However, what drew attention was the fact that both pine and eucalyptus, both with 11.5%, were mentioned in the answers. Despite being very common in the landscape, they are exotic species. The *Eucalyptus globulus*, for example, is native to Australia, and since the twentieth century there has been a lot of investment to plant them on a large scale, due to their good development for the use of their wood as boards and cellulose production. And during the implementation of this new species, many situations favored the invasion that we have today, from the lack of scientific studies to failures in

legislation regarding the exchange of native forest for a planted one (Bertola, 2013), so it is common to have them taking over the landscape of several areas as well as in the park where the study was carried out.

Then we analyzed the knowledge of respondents regarding exotic species present in the MLP, 61% answered no and 39% yes, figuring as known species, eucalyptus (60.5%), pine (36.9%) and pitanga (2.6%). When native species are mentioned among exotic species or vice versa, it is clear the need for the dissemination of scientific content and academic work to build knowledge about the urban green and tree species, to advance the popularization of science among the general public seeking new ways to reach everyone beyond the scientific community (Valério & Pinheiro, 2008).

When considering that the Monteiro Lobato Park contributes to the urban environmental quality of Ponta Grossa, the answers were divided, where 50% said yes and 50% said no. However, it was expected that all had answered yes, since a green area can be beneficial in several ways to the city, such as reducing pollution, noise, radiation absorption, air quality, and carbon capture, which are all harm caused by large cities, even if in this case it is mostly composed of exotic species. So much so, that green areas can be used as criteria for urban quality, because the absence of green areas highlights a city that is not properly ready to manage the needs of a population (Londe & Mendes, 2014).

In a contradictory way to the previous statement, when answering about the functions of urban green, with the creation of a differentiated microclimate in its interior, it was asked if they consider the temperature inside the park to be milder than in the neighborhood where the participant lives, 96% responded that it is more pleasant and 4% responded that they do not consider a change in temperature. To understand what change they perceived, 2% noticed an increase in temperature and 98% noticed a decrease in temperature. When asked if they related the vegetation to these changes, there was a repetition of the pattern of the previous answers, where 98% responded positively, while 2% said that the vegetation does not contribute to the changes in temperature in the area.

In this context, it should be noted that temperature changes, or thermal comfort, produces a feeling of well-being to humans that is achieved by attenuating the incidence of solar radiation. In studies by Bartholomei (2003), with some tree species, it was obtained how much each tree can attenuate the incidence of radiation, noting that trees of different species, even some deciduous, can attenuate the radiation by about 30%.

Next, it was asked what motivates the participant to go to the MLP, the answers were: for relaxation, distraction and leisure (56%), to practice physical activities (22%), because it is a pleasant place (15%), to walk with your pet (2%), for physical activities and leisure (2%), and 4% of the interviewees marked all the alternatives. All these reasons are relevant to the physical and mental health of the green areas regular visitors,

where they can be in contact with a more natural scenario, with the possibility of observing the seasons changes, contemplation of biodiversity (Carvalho, 2009), besides their other functions that are made possible by the leisure and physical activities structure. However, social and economic disparities can generate difficulties in valuing the urban green as an integral part of the improvement and quality of the population.

In the next session the agenda was about noise and air pollution and whether the interviewees relate the vegetation to the changes perceived, about the noises 85% consider hearing less noise and 15% consider not noticing any difference than in other places in Ponta Grossa. Among the interviewees, 64% agree that the arboreal vegetation contributes to the lower amount of noise perceived inside the park, 8% does not consider the interference of vegetation to reduce noise and 28% that maybe it is because of the vegetation. In this case, vegetation acts as an acoustic barrier, reducing the propagation of sound, reducing noise that may bother (Costa & Colesanti, 2011). When it comes to air pollution, 91% consider that the air present at the site is less polluted than in other parts of the city and 9% do not believe that the air is less polluted than other parts of the city, if the vegetation contributes to this reduction or not 93% agree and 7% disagree that the arborization contributes to this.

Air quality is a very worrying issue for human health, in large cities there are always many expenses for the reduction of pollution and the urban forest can be used as a tool for decontamination, because they can perform the filtration of these atmospheric particles accumulating and absorbing pollutants, can also be bioindicators of areas with high levels of pollution (Moreira, 2010).

Given that vegetation contributes to air quality, the MLP with its extent and number of trees, has its function along with other parks, squares and other wooded places to mitigate the amount of pollutants and particles present in the air of the city of Ponta Grossa, the perception of park attendants regarding the reduction of air pollution in the city 96% yes, 4% disagree that the park contributes to the reduction of pollution in the city.

When considering whether the vegetation is important for the animals in this place, the majority answered yes, adding up to 97%, and when asked if it serves as shelter for birds, 94% answered affirmatively. In addition to its many benefits, the tree can serve as shelter for animals to nest and get resources to survive, but with the urbanization process the reduction of habitat has changed the lives of these animals, leaving small areas for them to get their resources, such as parks and squares, and the record of these animals is important for describing the situation of an environment (Carmo et al., 2015).

When questioning whether landscape of the MLP is pleasant, 96% agreed and 99% answered that it is the trees that make the landscape a more pleasant place, agreeing that these are a component of aesthetics and beauty, as it is one of their most noticeable functions in this environment. Finally, three issues were questioned for the valuation of urban greenery,

where the place can be considered for green area awareness and if it is a suitable place for Environmental Education practices and for both, there was 97% agreement, but when considering if this is a place for a scientific dissemination point, this percentage dropped to 92%. The potential for environmental education is a new way to awaken new ideals for public awareness towards the environmental resources (Melazo, 2005) of urban green areas. In the MLP, for example, it would be important to approach aspects about the species present there, and with emphasis on the species that can be used in the urban environment, because many errors are found even today, in the ecological characteristics of these and the relation of the lack of care after planting.

In the face of what was exposed through this questionnaire, it is important to seek the understanding of the perception of the population regarding the green areas to the MLP itself, each answer is seen through the ideals and values of each individual, in the search for the improvement of the place presented. Seeking a way to change the vision of the city of stone to include the urban green, reducing the predation on the environment is through sustainable development, to change this vision the environmental perception and environmental education are as interdisciplinary resources to sensibilize the population in order to create engagement, since they are places frequented by the population and these same individuals may have initiatives for care and preservation of the site (Melazo, 2005).

One of the research participants ended up describing his relationship with the space before, when it did not yet have this infrastructure, and one of his statements highlights some species that are not currently found there: (...) *there were large Brazil nut trees too, I used to carry bags of nuts on a single tree, there were many pear trees, I didn't go hungry (...) I used to get wood to eat and play on vines as thick as my arm.* He also revealed that most of the trees in the place were eucalyptus, which in the current scenario of the park continues to be one of the most abundant species, of the chestnut trees there are still four individuals, however the pear trees are not found on site. The landscape in this context changes as the man-nature relationship changes, which ends up recreating a new version, hence the importance of studies on environmental perception to understand the change of values, cultures and reality in this interrelationship (Melazo, 2005).

As for vegetation, there are many benefits provided to the population and the environment. Wooded areas in the urban environment, even if not extensive, offer resources and are attractive to synanthropic species, becoming a place of survival for fauna. The presence of some species in these places can be interpreted as indicative of the quality of the environment, the urban environment may be inhospitable, but in places like squares and parks that can offer a source of food throughout the year and a place for nesting they attract birds during flight in winter, helping to maintain biodiversity (Brun et al., 2007). And due to this reality and the loss of species caused by habitat fragmentation, there is much to be considered about

the importance of the ecological functions performed by these species in urban arborization.

## Final considerations

Monteiro Lobato Park is a place that performs its functions bringing economic, social and environmental benefits. As this is a place with a considerable number of arboreal individuals, and consequently there is a great reduction in noise and air pollution, offering leisure and health conditions to the surrounding population and even to those more distant from the neighborhood, it is a place of great value to the city of Ponta Grossa-PR. Nevertheless, there is a lack of dissemination of information about native and exotic species and the functions of urban green areas, requiring more information and encouragement of the cultivation of native species. For, the trees in the park are mostly exotic, present in the area before the creation of the park, so the population already familiar with the existing trees, end up naturalizing the exotic species, without even realizing the risks that can often be caused by these species.

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