



Article

Structure, composition and diversity of the urban forest of *Linares, Nuevo León*

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Abstract

The urban forests and green areas of the cities provide direct benefits to the population such as improving the temperature and air quality, protect the soil and allow the permeability of water to the subsoil. The aim of this study was to determine the structure, composition and diversity of the urban trees of *Linares, Nuevo León*. Dasometric information was collected from urban green areas and public parks, counting 6 ridges, 14 parks and 25 public spaces with a total area of 273 904 m². The variables of diameter ($d_{1.30}$), total height (h) and diameter of the crown (d_{crown}) were recorded. The density of plant species by urban green area and the total number of species was calculated. Diversity was assessed using the Shannon-Weiner and Margalef indices. The total number of trees registered was 2 066 belonging to 41 species, 34 genera and 25 families. The most representative was Fabaceae with six species; *Fraxinus americana* (ash) is outstanding from the ecological point of view, with 25.67 N ha⁻¹, which represents 34.03 % of total abundance and 1 225.38 m² ha⁻¹ which is equivalent to 46.93 % of dominance and 30.91 % of IVI, followed by *Quercus virginiana* with 22.46 % and *Washingtonia robusta* with 11.56 %. The Shannon-Weiner Index recorded $H' = 1.99$ and $H'_{max} = 3.17$, and the Margalef Index $D_{Mg} = 5.24$. It is concluded that the urban trees described here are mainly composed of introduced species, the most important of which is ash.

Key words: Abundance, green areas, urban forest, dominance, Margalef index, Shannon index.

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Introduction

Cities are home to a growing proportion of the world's population, and in the face of urban sprawl, green areas play a key role in maintaining social, economic and ecological well-being (McDonnell and Hahs, 2009; Acharya, 2011; Ramalho and Hobbs, 2012). Urban parks are green areas managed mainly for the purpose of coexistence and recreation, and unlike forests or protected parks, they are the most accessible green spaces for the population residing in urbanized areas (Oleyar *et al.*, 2008; Nagendra and Gopal, 2011; Niemelä *et al.*, 2011). Urban parks also provide multiple environmental services: mitigate air pollution, reduce noise, provide scenic beauty, recreation, opportunities for contact with nature (Dobbs *et al.*, 2011; Escobedo *et al.*, 2011; Zhang and Jim, 2014); and they favor the conservation of biological diversity by giving habitat and food to the local fauna (Chace and Walsh, 2006; Cabó-Ramírez and Zuria, 2011).

There is considerable information describing the composition and diversity of trees in urban parks in various parts of the world, and in the United States, Europe and Asia, where they have developed most (Lososová *et al.*, 2011; Nagendra and Gopal, 2011; Jim and Zhang, 2013; Pesola *et al.*, 2017; Riley *et al.*, 2017). In Mexico, there is not much information about the green areas within the urban areas of several cities. The best assessed areas are large metropolis such as Mexico City, where general studies have been conducted covering the entire urban area (Benavides, 1992; Checa-Artasu, 2016) or on a particular area such as *Chapultepec* Forest (Benavides and Young, 2012).

In the northeastern part of Mexico, there are few records on the subject of green areas and urban forests. Alanís (2005) and Jiménez *et al.* (2013) evaluated the green areas of the *Monterrey* municipality, *Nuevo León*, through geographic information systems and *in situ* forest inventories. In *Tamaulipas*, Mora and Martínez (2012) elaborated a

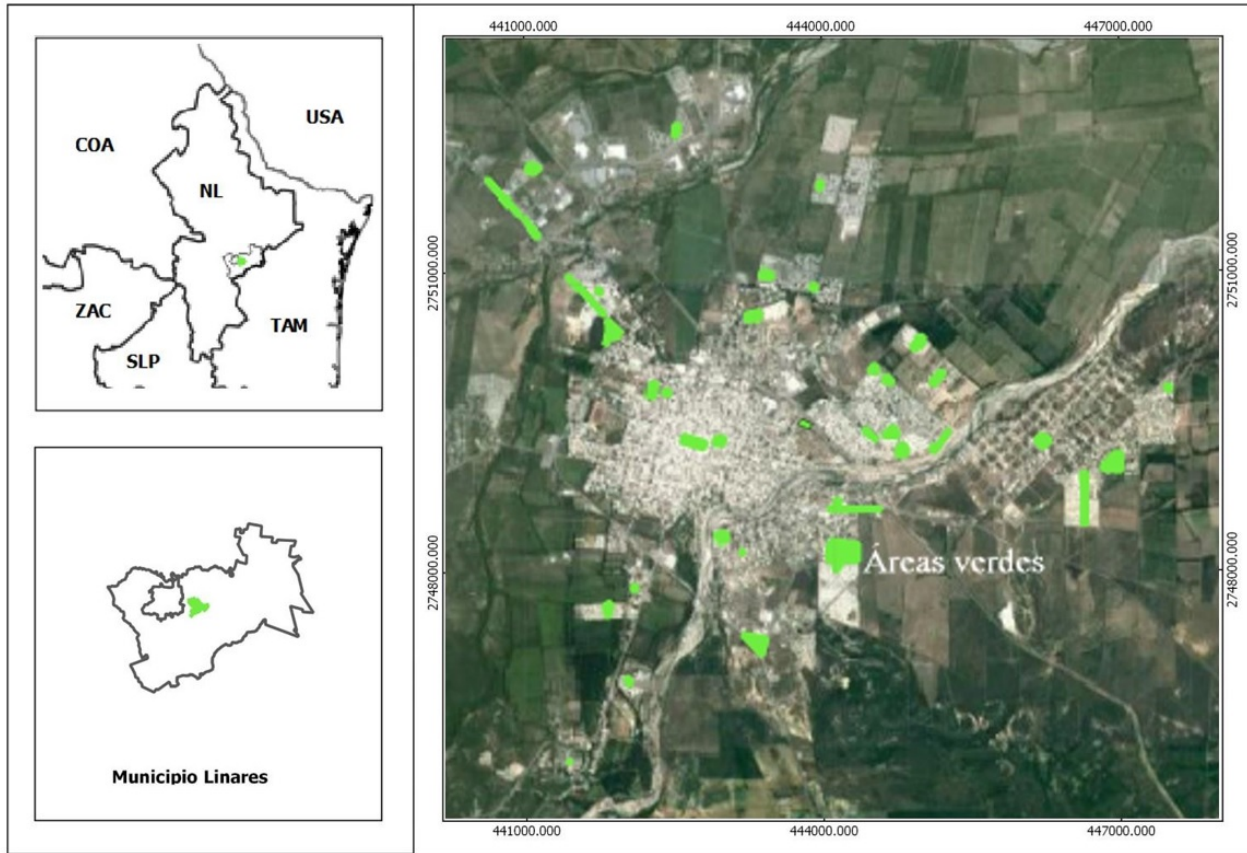
work on the wild plants of an urban forest located in *Ciudad Victoria*. In the case of the municipality of *Linares, Nuevo León*, information is scarce and limited to studies carried out on the main square of the city on the trees on the sidewalks (Zamudio, 2001) and on a student campus (Alanís *et al.*, 2014). Based on the above, the objective of this study was to determine the structure, composition and diversity of urban trees in the different squares, parks and ridges of the urban area of *Linares, Nuevo León*.

Materials and Methods

Study area

The *Linares* municipality (Figure 1) is located southeast of the state of *Nuevo León*. Geographically it limits towards the north with the *Hualahuises* and *Montemorelos* municipalities; both to the south and to the east with the state of *Tamaulipas* and to the west with *Galeana* and *Iturbide* municipalities. Its geographic coordinates correspond to 24°51' N and 99°24' W (Municipios Mx, 2018).





Upper left image = NE of Mexico and SE United States of America; Lower left image = *Linares* municipality, *Nuevo León*; Right image = *Linares* urban area with its green areas; COA = *Coahuila*; NL = *Nuevo León*; ZAC = *Zacatecas*; SLP = *San Luis Potosí*; TAM = *Tamaulipas*.

Figure 1. Location of the study area.

Floristic inventory

A census was made of all the plant species present in public areas such as plazas, parks and ridges of the city of *Linares*. Thus, it was considered that the squares and parks are clearly delimited public spaces, dominated by vegetation and intended as public green areas for the realization of recreational or outdoor sports activities. This information was collected during the months of March and April 2016.

The dendrometric variables of normal diameter ($d_{1.30\ m}$) were measured with a Hagl f Mantax Blue 1270 mm caliper; total height (h), with a Suunto PM-5 hypsometer; and the diameter of the crown (d_{crown}), with a 100 m metric cross fiber glass TruperTM, tape according to the four cardinal points north-south and east-west. The coordinates of each square, park and ridge were recorded with an eTrex 20x Garmin[®] mountain crossing GPS.

Data analysis

For each species, their abundance was determined, according to the number of trees, their coverage, depending on the crown area, and their frequency based on their presence in the sampling sites. The relativized variables were used to obtain a weighted value at the taxon level called the Importance Value Index (IVI), which acquires percentage values on a scale of 0 to 100 (Mostacedo and Fredericksen, 2000).

For the estimation of relative abundance the following equation was used:

$$A_{i=N_i/S} \quad AR_{i=\left(\frac{A_i}{\sum_{i=1...n} A_i}\right)*100} \quad (1)$$

Where:

AR_i = Relative abundance of the i species in regard to total abundance

A_i = Absolute abundance of the i species ($N\ ha^{-1}$)

Dominance was calculated through the equation:

$$D_{i=Ab_i/S(ha)} \quad DR_{i=\left(\frac{D_i}{\sum_{i=1...n} D_i}\right)*100} \quad (2)$$

Where:

DR_i = Relative dominance of the i species in regard to total dominance

D = Absolute dominance of the i species ($m^2 \text{ ha}^{-1}$)

The absolute and relative frequencies were obtained with the equations:

$$F_i = P_i / N_S \quad FR_i = \left(\frac{F_i}{\sum_{i=1 \dots n} F_i} \right) * 100 \quad (3)$$

Where:

F_i = Absolute frequency (percentage of presence in the sampling sites)

f_i = Number of sites in which the i species is present

N = Number of sampling sites

FR_i = Relative frequency of the i species in regard to total frequency

The Importance Value Index (IVI) is defined through the equation:

$$IVI = \frac{AR_i + DR_i + FR_i}{3}$$

To estimate the alpha diversity, we used the Margalef index (D_{Mg}) and the Shannon-Weiner index (H') [18], using the following equations:

$$D_{Mg} = \frac{(S-1)}{\ln(N)} \quad (5)$$

$$H' = - \sum_{i=1}^S p_i * \ln(p_i) \quad p_i = n_i / N \quad (6)$$

Where:

S = Number of present species

N = Total number of individuals

n_i = Number of individuals of the i species

By means of a correlation analysis, the relationship between the parameters of wealth and diversity and the distance of ages from urban parks was explored.

Results

There were 41 species belonging to 34 genera and 25 families of vascular plants (Table 1). The most representative family was Fabaceae with six species, Fagaceae with four species, later Moraceae and Arecaceae with three each, and finally, Bignoniaceae, Oleaceae, Pinaceae and Rutaceae with two. Of the 41 species recorded in the study, 14 were native and 27 exotic (Table 2).

Table 1. Distribution of species and number of individuals per assessed area.

	Areas	Species	Individuals
Squares	21	37	1 071
Parks	14	21	835
Ridges	6	9	160
Total	41	41	2 066

Table 2. Scientific and common name, family and origin of the tree species recorded in the study area.

Scientific name	Common name	Family	Origin
<i>Azadirachta indica</i> A.Juss.	<i>Neem</i>	Meliaceae	Exotic
<i>Bauhinia variegata</i> L.	<i>Pata de vaca</i>	Fabaceae	Exotic
<i>Caesalpinia mexicana</i> A.Gray	<i>Árbol del potro</i>	Caesalpinaceae	Native
<i>Carya illinoensis</i> (Wangenh.) K.Koch	<i>Nogal</i>	Yuglandaceae	Native
<i>Celtis laevigata</i> Willd.	<i>Palo blanco</i>	Fabaceae	Native
<i>Citrus sinensis</i> (L.) Osbeck	<i>Naranja</i>	Rutaceae	Exotic
<i>Cordia boissieri</i> A.DC.	<i>Anacahuita</i>	Boraginaceae	Native
<i>Delonix regia</i> (Bojer) Raf.	<i>Flamboyán</i>	Fabaceae	Exotic
<i>Diospyros texana</i> Scheele	<i>Chapote prieto</i>	Ebenaceae	Native
<i>Ebenopsis ebano</i> (Berland.) Barneby & J.W.Grimes.	<i>Ébano</i>	Fabaceae	Native
<i>Eucalyptus globulus</i> Labill.	<i>Eucalipto</i>	Myrtaceae	Exotic
<i>Ficus benjamina</i> L.	<i>Ficus</i>	Moraceae	Exotic
<i>Ficus microcarpa</i> L.f.	<i>Laurel de la India</i>	Moraceae	Exotic
<i>Fraxinus americana</i> L.	<i>Fresno</i>	Oleaceae	Exotic
<i>Helietta parvifolia</i> (A. Gray ex Hemsl.) Benth.	<i>Barreta</i>	Rutaceae	Native
<i>Jacaranda mimosifolia</i> D.Don	<i>Jacaranda</i>	Bignoniaceae	Exotic
<i>Leucaena leucocephala</i> (Lam.) de Wit	<i>Leucaena</i>	Fabaceae	Exotic
<i>Ligustrum japonicum</i> Thunb.	<i>Trueno</i>	Oleaceae	Exotic
<i>Melia azedarach</i> L.	<i>Canelón</i>	Meliaceae	Exotic
<i>Phoenix dactylifera</i> L.	<i>Palma datilera</i>	Arecaceae	Exotic
<i>Pinus halepensis</i> Mill.	<i>Pino halapensis</i>	Pinaceae	Exotic
<i>Pinus pseudostrobus</i> Lindl.	<i>Pino real</i>	Pinaceae	Native
<i>Platanus rzedowskii</i> Nixon & J.M.Poole	<i>Sicomoro</i>	Moraceae	Native
<i>Prosopis laevigata</i> (Humb. & Bonpl. ex Willd.) M.C. Johnst.	<i>Mezquite</i>	Fabaceae	Native
<i>Prunus persica</i> (L.) Batsch	<i>Durazno</i>	Rosaceae	Exotic
<i>Punica granatum</i> L.	<i>Granado</i>	Lythraceae	Exotic
<i>Quercus macrocarpa</i> Michx.	<i>Encino macrocarpa</i>	Fagaceae	Exotic
<i>Quercus rubra</i> L.	<i>Encino Rojo</i>	Fagaceae	Exotic
<i>Quercus texana</i> Buckley	<i>Encino Cartamus</i>	Fagaceae	Exotic

<i>Quercus virginiana</i> Mill.	<i>Encino siempre verde</i>	Fagaceae	Native
<i>Salix humboldtiana</i> Willd.	<i>Sauce</i>	Salicaceae	Exotic
<i>Sapindus saponaria</i> L.	<i>Jaboncillo</i>	Sapindaceae	Native
<i>Sapium sebiferum</i> (L.) Roxb.	<i>Chainis</i>	Euphorbiaceae	Exotic
<i>Schinus molle</i> L.	<i>Pirul</i>	Anacardiaceae	Exotic
<i>Syagrus romanzoffiana</i> (Cham.) Glassman	<i>Palma coco plumoso</i>	Arecaceae	Exotic
<i>Tabebuia rosea</i> (Bertol.) DC.	<i>Palo de rosa</i>	Bignoniaceae	Exotic
<i>Taxodium mucronatum</i> Ten.	<i>Sabino</i>	Taxodiaceae	Native
<i>Thuja occidentalis</i> L.	<i>Tuya</i>	Cupressaceae	Exotic
<i>Vitex agnus-castus</i> L.	<i>Árbol casto</i>	Lamiaceae	Exotic
<i>Washingtonia robusta</i> var. <i>gracilis</i> (Parish) Parish ex Becc.	<i>Palma Washingtonia</i>	Arecaceae	Exotic
<i>Yucca filifera</i> Chabaud	<i>Palma pita</i>	Asparagaceae	Native

A total abundance of 75.43 N ha⁻¹ was recorded. The most outstanding species was *Fraxinus americana* L. with 25.67 N ha⁻¹, which represents 34.03 % of the total. *Quercus virginiana* Mill. with 28.61 % and *Washingtonia robusta* var. *gracilis* (Parish) Parish ex Becc. with 15.15 % follow; the remaining species together sum 22.21 %.

The crown coverage of the urban green areas (parks, squares and ridges) was 2 611.31 m² ha⁻¹. *Fraxinus americana* registered greater dominance with 1 225.38 m² ha⁻¹, followed by *Quercus virginiana* with 552.04 m² ha⁻¹ and *Carya illinoensis* (Wangenh.) K.Koch with 255.63 m² ha⁻¹; the remaining species represented 22.14 %.

Quercus virginiana stands out as the main species in urban green areas in *Linares*, as it was recognized 33 of the 41 green areas analyzed (17.65 %). *Washingtonia robusta* var. *gracilis* was in 25 of them, which is equivalent to 13.37 %, followed by *Fraxinus americana* in 22 (11.76 %).

The highest calculated value for the Importance Value Index was for *Fraxinus americana* with 30.91 %, followed by *Quercus virginiana* with 22.46 % and for *Washingtonia robusta* with 11.56 %, which together add up to 64.93 % (Table 3).

In contrast, *Citrus sinensis* (L.) Osbeck, *Punica granatum* L., *Prunus persica* (L.) Batsch and *Tabebuia rosea* (Bertol.) DC. recorded 0.20 % each, which is the lowest value.

Table 3. Abundance (N ha⁻¹), dominance (m² ha⁻¹), frequency, Importance value Index of the species registered in urban green areas in *Linares*, N L.

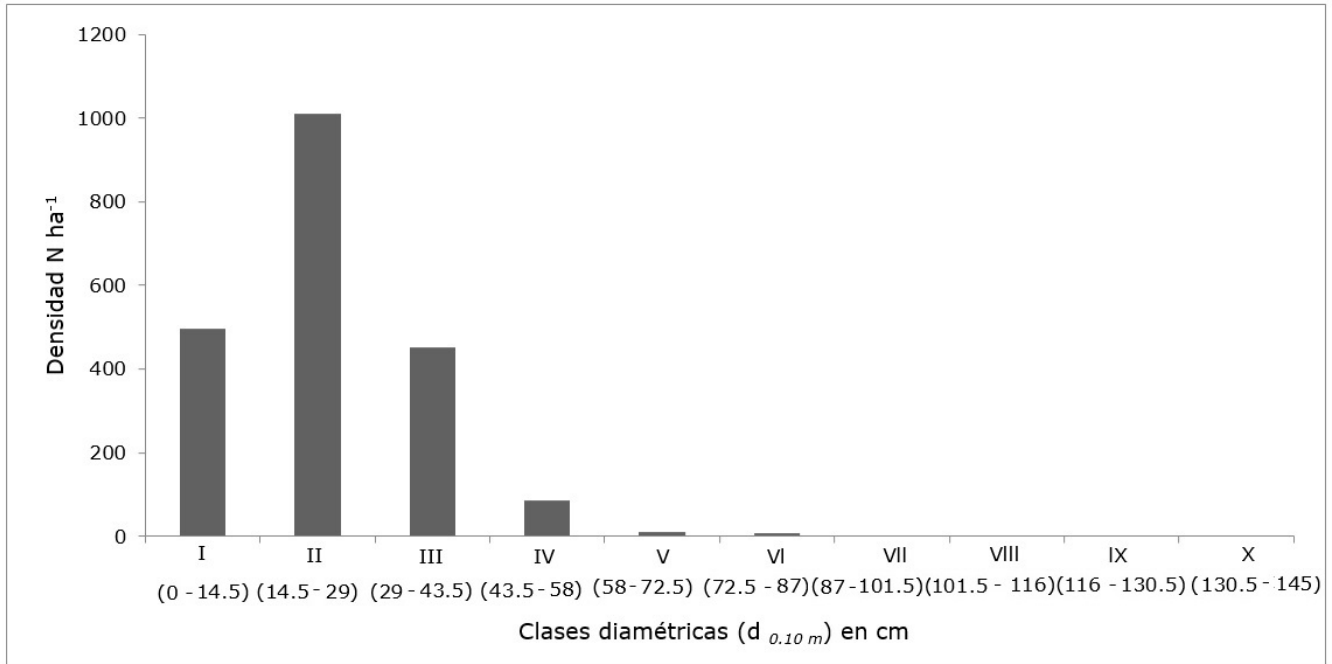
Scientific name*	Abundance		Dominance		Frequency		Importance values	
	N ha ⁻¹	%	m ² ha ⁻¹	%	N/Site	%	IVI	IVI rel
<i>Fraxinus americana</i> L.	25.67	34.03	1 225.38	46.93	22.00	11.76	92.72	30.91
<i>Quercus virginiana</i> Mill.	21.58	28.61	552.04	21.14	33.00	17.65	67.39	22.46
<i>Washingtonia robusta</i> var. <i>gracilis</i> (Parish) Parish ex Becc.	11.43	15.15	161.23	6.17	25.00	13.37	34.69	11.56
<i>Carya illionensis</i> (Wangenh.) K.Koch	2.15	2.86	255.63	9.79	10.00	5.35	17.99	6.00
<i>Ligustrum japonicum</i> Thunb.	3.50	4.65	75.96	2.91	5.00	2.67	10.23	3.41
<i>Quercus rubra</i> L.	1.50	1.98	32.97	1.26	8.00	4.28	7.53	2.51
<i>Cordia boissieri</i> A.DC.	0.51	0.68	12.64	0.48	8.00	4.28	5.44	1.81
<i>Syagrus romanzoffiana</i> (Cham.) Glassman	0.69	0.92	10.41	0.40	6.00	3.21	4.53	1.51
<i>Quercus macrocarpa</i> Michx.	0.47	0.63	11.32	0.43	6.00	3.21	4.27	1.42
<i>Thuja occidentalis</i> L.	1.02	1.36	21.77	0.83	3.00	1.60	3.79	1.26
<i>Ebenopsis ebano</i> (Berland.) Barneby & J.W.Grimes.	0.22	0.29	13.98	0.54	5.00	2.67	3.50	1.17
<i>Azadirachta indica</i> A.Juss.	0.47	0.63	13.11	0.50	4.00	2.14	3.27	1.09
<i>Phoenix dactylifera</i> L.	0.91	1.21	38.38	1.47	1.00	0.53	3.21	1.07
<i>Pinus pseudostrobus</i> Lindl.	0.80	1.06	23.45	0.90	2.00	1.07	3.03	1.01
<i>Jacaranda mimosifolia</i> D.Don.	0.44	0.58	21.13	0.81	3.00	1.60	2.99	1.00
<i>Melia azedarach</i> L.	0.26	0.34	10.99	0.42	4.00	2.14	2.90	0.97
<i>Taxodium mucronatum</i> Ten.	0.18	0.24	13.44	0.51	4.00	2.14	2.90	0.97
<i>Leucaena leucocephala</i> (Lam.) de Wit	0.18	0.24	9.53	0.36	4.00	2.14	2.75	0.92
<i>Sapium sebiferum</i> (L.) Roxb.	0.69	0.92	18.11	0.69	2.00	1.07	2.68	0.89
<i>Bauhinia variegata</i> L.	0.40	0.53	13.60	0.52	3.00	1.60	2.66	0.89
<i>Ficus benjamina</i> L.	0.29	0.39	12.64	0.48	3.00	1.60	2.48	0.83
<i>Salix humboldtiana</i> Willd.	0.15	0.19	2.15	0.08	3.00	1.60	1.88	0.63
<i>Prosopis laevigata</i> (Humb. & Bonpl. ex Willd.) M.C. Johnst.	0.11	0.15	9.84	0.38	2.00	1.07	1.59	0.53
<i>Quercus texana</i> Buckley	0.33	0.44	13.19	0.51	1.00	0.53	1.48	0.49
<i>Yucca filifera</i> Chabaud	0.15	0.19	4.41	0.17	2.00	1.07	1.43	0.48

<i>Celtis laevigata</i> Willd.	0.11	0.15	3.09	0.12	2.00	1.07	1.33	0.44
<i>Delonix regia</i> (Bojer) Raf.	0.11	0.15	2.13	0.08	2.00	1.07	1.30	0.43
<i>Schinus molle</i> L.	0.29	0.39	8.92	0.34	1.00	0.53	1.26	0.42
<i>Diospyros texana</i> Scheele	0.22	0.29	2.62	0.10	1.00	0.53	0.93	0.31
<i>Platanus rzedowskii</i> Nixon & J.M.Poole	0.11	0.15	3.06	0.12	1.00	0.53	0.80	0.27
<i>Eucalyptus globulus</i> Labill.	0.04	0.05	5.00	0.19	1.00	0.53	0.77	0.26
<i>Helietta parvifolia</i> (A. Gray ex Hemsl.) Benth.	0.11	0.15	0.58	0.02	1.00	0.53	0.70	0.23
<i>Pinus halepensis</i> Mill.	0.04	0.05	2.35	0.09	1.00	0.53	0.67	0.22
<i>Vitex agnus-castus</i> L.	0.04	0.05	1.40	0.05	1.00	0.53	0.64	0.21
<i>Sapindus saponaria</i> L.	0.04	0.05	1.27	0.05	1.00	0.53	0.63	0.21
<i>Ficus microcarpa</i> L.f.	0.04	0.05	0.93	0.04	1.00	0.53	0.62	0.21
<i>Caesalpinia mexicana</i> A.Gray	0.04	0.05	0.86	0.03	1.00	0.53	0.62	0.21
<i>Tabebuia rosea</i> (Bertol.) DC.	0.04	0.05	0.66	0.03	1.00	0.53	0.61	0.20
<i>Prunus persica</i> (L.) Batsch	0.04	0.05	0.59	0.02	1.00	0.53	0.61	0.20
<i>Punica granatum</i> L.	0.04	0.05	0.29	0.01	1.00	0.53	0.59	0.20
<i>Citrus sinensis</i> (L.) Osbeck	0.04	0.05	0.26	0.01	1.00	0.53	0.59	0.20
	75.43	100.00	2 611.31	100.00	187.00	100.0	300.0	100.00

*The species follow a decreasing order according to their importance value.

The density of individuals per hectare according to the diameter classes registered in the study showed that most of the individuals evaluated are concentrated in category II (14.5 - 29 cm) with a total of 1 011 N ha⁻¹ (Figure 2).



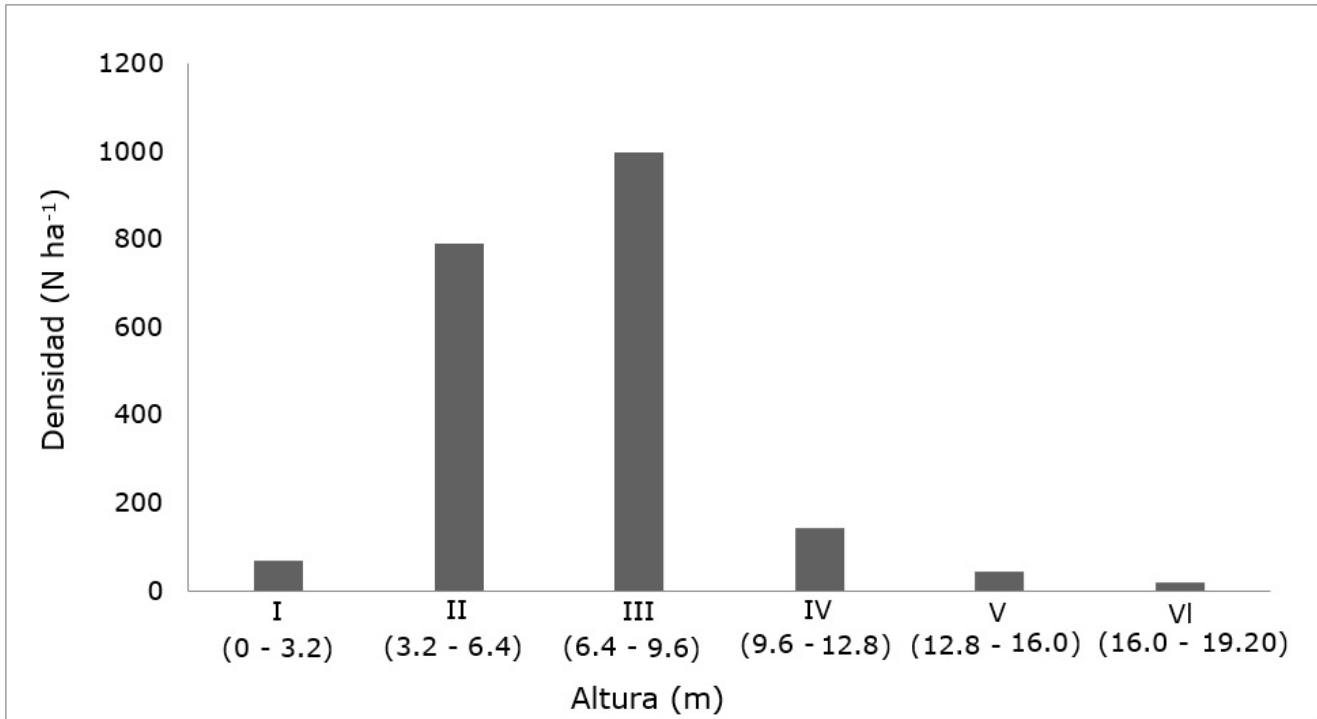


Densidad = Density; *Clases diamétricas* = Diametric classes.

Figure 2. Density of individuals according to diametric classes in the study areas.

The mensuration variable of total height was calculated based on the density of individuals by height category. Category III (6.4 - 9.6 m) was the one that predominated with a total of 998 individuals per hectare, which corresponds to 48.3 % of all registered individuals, while category VI (16 - 19.2 m) was the lowest number of individuals with only 19 (0.91 %) (Figure 3).





Densidad = Density; *Altura* = Height

Figure 3. Density of individuals by height in the study area.

The evaluated area showed values of Margalef's Index of $D_{Mg} = 5.24$ and of Shannon-Wiener of $H' = 1.99$, and the val $H'_{max} = 3.17$.

Discussion

In the inventory of urban trees 2 066 specimens were registered, belonging to 24 families and 41 species. This number of species is close to the data of Zamudio (2001) in the center of *Linares*, who identified the existence of 39 species, with 19 families in 1995 and 49 species with 27 families in 1999. It is low compared to the study conducted by Alanís (2005), who in an investigation in the metropolitan area of Monterrey, detected 115 species, grouped in 37 families, which surely responds to the difference in the sampled surface.

On the other hand, Alanís et al. (2014) observed a similar number of species (39) to the one registered in this study, by restricting the area to the university campus of the Faculty of Forestry Sciences of the UANL.

The Fabaceae family was the best represented with six species (three native and three exotic), followed by Fagaceae with four species (three exotic), Moraceae with three species (two exotic), and Arecaceae with three species (all exotic). These data coincide with those of Alanís et al. (2014), who highlighted Fabaceae with 10 species (nine native). It also coincides with the information of Alanís (2005), in which Fagaceae and Moraceae are the most important in the Metropolitan Area of Monterrey.

The species with the greatest ecological weight for this study was *Fraxinus americana*, which concentrates 30.91 % of the Importance Value Index, followed by *Quercus virginiana*, *Carya illinoensis*, *Washingtonia robusta* and *Ligustrum japonicum* Thunb. This percentage is higher than that calculated by Alanís et al. (2014) who granted *Fraxinus americana* 18.21 % of IVI. Zamudio (2001) defined the latter within the four species with the greatest ecological weight (13.40 % of IVI).

In the study described here, dominant were *Fraxinus americana* (46.93 %), *Quercus virginiana* (21.14 %), *Carya illinoensis* (9.79 %) and *Washingtonia robusta* (6.17 %). For Carabias and Herrera (1986), these percentages are not satisfactory, since they establish that no species should exceed 5 % of the total population in the public trees of a city.

Only 13 species are native (36.6 %) and 27 are exotic (63.4 %) (Table 2). The opposite is revealed by Alanís et al. (2014), since of its total number (39), 12 are exotic and 27 are native; this corresponds to a higher percentage of species of the second origin in the urban trees of the campus of the forest school. For the Metropolitan Area of Monterrey, Alanís (2005) accounted for 61 introduced species (53 %) and 54 native species (47 %).

The evaluated plant community has a species richness of $D_{Mg} = 5.24$ and a diversity of $H' = 1.99$. These values are lower than those of Alanís et al. (2014), $D_{Mg} = 7.62$ and $H' = 3.05$. When comparing the results observed in this research with those of

Zamudio (2001) for diversity, for the year 1995 the value obtained was $H' = 2.54$ and for the year 1999 it was $H' = 2.27$.

If the results of diversity and richness determined in the present investigation are contrasted only with the native species consigned by Alanís *et al.* (2014), it can be observed that these authors estimated high values of $D_{Mg} = 5.80$ and $H' = 2.82$, with respect to those here calculated of $D_{Mg} = 2.12$ and $H' = 0.8127$, which are lower.

Conclusions

The urban trees of the of Linares include a high number of exotic species; *Fraxinus americana*, *Quercus virginiana*, *Carya illinoensis* and *Washingtonia robusta* var. *Gracilis* are dominant, the first one of which is the most representative with a total of 703 individuals, which are equivalent to more than 45 % of its green areas.

The actual research study revealed data about the number and surface areas of the squares, ridges and parks in the city of interest, as well as of the species and families of all the trees of the urban forest. This information is useful in the detection of priority areas for reforestation, as this is a reliable inventory that contributes to the management of public trees.

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Conflict of interests

The authors declare no conflict of interests.

Contribution by author

Carlos Eduardo Leal Elizondo: fieldwork, preparation of the manuscript regarding the summary, results and conclusions; Nelly Leal Elizondo: field work, elaboration of the manuscript regarding the summary, discussion and conclusions, design of figures and maps; Eduardo Alanís Rodríguez: preparation of the manuscript regarding the summary, introduction, results, discussion, conclusions and general review; Miguel Ángel Pequeño Ledezma: elaboration of the manuscript regarding the summary, abstract, introduction, discussion, conclusions, general review and application of corrections; Arturo Mora-Olivo: elaboration of the manuscript regarding the summary, introduction, discussion, conclusions, general review, application of corrections and identification of species; Enrique Buendía Rodríguez: preparation of the manuscript regarding the introduction, discussion and general review.

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