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Floristic composition and structure of an urban forest remnant of Fortaleza, Ceará

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Abstract

The northeastern Brazil coastal region has some vegetation fragments in the pre-litoranean plains, locally called Tabuleiro forests. Our knowledge of the vascular plant flora of these forests is poor. This study describes the structure and floristic composition of a remnant forest into the city and its main aim is determinate the floristic composition and indicate the preservation condition of the forest. To carry out the inventory, two areas of 0.25ha were chosen (wet and dry) and we marked 25 points quadrats for each. Al trees > 150 cm height and ≥ 5 cm DBH were sampled, numbered and identificated. We found 200 trees and shrubs belonging to 27 species, 26 genera and 18 families; the total number of species recorded rose to 116 species, representing 100 genera and 49 families when we joined this result to different studies in the same area. The families with higher number of species were Fabaceae (18), Rubiaceae (13), Asteraceae (8) and Malvaceae (8). The wet and dry areas were very similar floristically (0.43 and 0.58, Jaccard and Sorensen respectively), having 12 species in common. The average distance and the total density of the study area (0.5ha) was 3.27m ± 0.23 and 980 ind./ha respectively. For the diameter, we found an average value of 14.53cm ± 5.6 and, for the height, we observed a midsize of 6.13m ± 2.4. The *Tabuleiro* forest of Campus do Pici presented a high Shannon diversity index for a degraded remnant (H' = 3.11 nats/ind) and low dominance (J' = 0.8). This area plays a critical role in the preservation of Brazil's natural heritage.
Key-words: conservation, floristic, pre-litorenean plains, density.

Resumo

Composição florística e estrutura de um remanescente florestal urbano de Fortaleza, Ceará. A região costeira do Nordeste do Brasil apresenta alguns fragmentos de vegetação na planície pré-litorânea, chamados de florestas de Tabuleiro. O nosso conhecimento da flora de plantas vasculares dessas florestas é escasso. Este estudo descreve a estrutura e composição florística de uma floresta remanescente na cidade e o seu principal objetivo é determinar a composição florística e indicar a condição de preservação da floresta. Para realizar o inventário, duas áreas de 0.25ha foram escolhidas (úmida e seca) e 25 pontos quadrantes foram amostrados para cada uma. Árvores com altura > 150 cm e DAP ≥ 5 cm foram amostradas, numeradas e identificadas. Foram amostradas 200 árvores e arbustos pertencentes a 27 espécies, 26 gêneros e 18 famílias, o número total de espécies registradas aumentou para 116 espécies, representando 100 gêneros e 49 famílias, quando esse resultado foi unido a diferentes estudos na mesma área. As famílias com maior número de espécies foram Fabaceae (18), Rubiaceae (14), Asteraceae (9) e Malvaceae (8). As áreas úmida e seca foram muito semelhantes floristicamente (0,43 e 0,58, Jaccard e Sorensen, respectivamente), com 12 espécies em comum. A distância média e a densidade total da área de estudo foram de 3.27m ± 0,23 e 980 ind./ha, respectivamente. Para o diâmetro, encontramos um valor médio de 14,53 cm ± 5,6 e, para altura, observou-se um tamanho médio de 6.13m ± 2.4. A floresta de Tabuleiro do Campus do Pici apresentou um alto índice de diversidade de Shannon para um remanescente degradado (H '= 3,11 nats/ind) e baixa dominância (J' = 0,8). Esta área tem um papel fundamental na preservação das florestas de Tabuleiro, patrimônio natural do Brasil.
Palavras-chave: conservação, florística, tabuleiros pré-litorâneos, densidade.

Introduction

Agriculture and urban growth are the main causes of destruction and fragmentation of ecosystems. Urbanization is the process of converting forest lands into developed areas of multiple uses (Chant et al. 2010). Urban areas occupy around 4% of the Earth's land surface, totaling 471 million of hectares (McKinney 2002,2006). Large and developed cities maintain few areas of the original vegetation cover and the remaining fragments present some kind of anthropogenic effect (McKinney 2002). These data demonstrate how is necessary to think in biological conservation areas within cities nowadays.

The northeastern Brazil coastal region has some vegetation fragments in the pre-litoranean plains, locally called *Tabuleiro* forests, which is very important for the maintenance of the biodiversity and is the most critically endangered, especially in areas of seasonal forest (Saatchi et al. 2001, Tabarelli et al. 2003). The name is given because of the flat topography, not reaching altitudes higher than 200m. The Cenozoic sediments (tertiary and quaternary) are abundant along the seafront and have undergone an intense fragmentation by agriculture, industrialization and deforestation for illegal removal of timber until nowadays (Rizzini 1979).

The current critical state of conservation of the *Tabuleiro* forests in Northeastern Brazil calls for the collection of basic information about the composition, structure, richness, as well as the expansion of knowledge regarding the floristic and structural variations. Our knowledge of the vascular plant flora of these forests is poor, there are regional and national checklists (Barbosa et al. 2006, Forzza et al. 2010), but there are few checklists for specific sites (Alves-raújo et al. 2008, Amorim et al. 2008, Barbosa et al. 2011). These data indicate the need to expand the scientific exploration in order to inform decision-making regarding the conservation and restoration of these ecosystems, thus increasing the chances of success in the long term.

The present study aims firstly to determinate the floristic composition of an urban fragment of *Tabuleiro* forest. Secondly, we assess if the vegetation structure indicates how the level of the forest preservation is. We hypothesized that there is changes in the current floristic composition, revealed by the species present in the wet area. We believe that knowing the remaining biodiversity in vegetation fragments of a city and the understanding its structure and potential, we can contribute to conservation politics and to justify the creation of new protected areas.

Material and methods

Location and environmental characterization of the area

The study was conducted in 2010, in a fragment of semi-deciduous forest located in Campus do Pici (Universidade Federal do Ceará), Fortaleza, Northeastern Brazil, between the geographical coordinates of 3º 34' 16.79" and 3º 34' 43.49" South, 38º 34' 03.81" and 38º 34' 42.71" West. The annual temperature varies between 24° and 28°C, with the average about 26.7ºC. The annual maximum is about 31.6°C and the minimum about 21.9°C. The elevation ranges from 20m to 25m. Based on 30 years of records, the average rainfall is 1642.4mm/year and the relative humidity is around 79%. The rainy season usually starts in February and lasts through July, with the wettest months being April, May, and June. Following the classification system of Köppen, the climate is Aw, characterized by being tropical and sub-humid.

The site occupies an area of approximately 4 ha and the soil is classified into argisols and alisols, predominantly, deep and loamy texture. It is relatively flat and characterized by alluvial sands and clays dissected by steep-sided streams. The predominant vegetation ranges from lowland semi-deciduous forest to savanna (also known as *tabuleiro*), depending on the sandiness of the soil and how well it holds moisture. Along streams where there is year-round access to water and higher humidity, the forest is lowland tropical moist forest (Thomas & Barbosa 2008).

This patch was chosen for its position and easy access by the urban population, being inside the biggest University of the city. Moreover, it is one of the few remnants of semi-deciduous seasonal forest in the city, which reinforces the importance of its characterization regarding environmental pressures caused by human activities.

Floristic composition

We carry out the delimitation of the area to apply the method of point quadrats (Cottam & Curtis, 1956), selecting 0.25ha next to a reservoir and 0.25ha in an area 10km far from the same reservoir. The distance between the sampling points was 10m, based on recent studies with this method (Ferreira et al. 2012; Ricotta & Feoli 2013). We marked a total of 25 points quadrats for each area. We sampled all tree or shrub individuals that were > 150 cm in height and DBH ≥ 5 cm and expressed the result with standard deviation.

We measured the height with dockable rods fixed size (2m) and we did the average distance from the individuals to the central point (AD) and the total area of the point (TA). We calculated the density (D) of the arboreous stratum by $D = TA/AD^2$. We made histograms to analyze the height and diameter structures of the vegetation.

To determine the total flora of the *Tabuleiro* forest of the remnant, we enrich this floristic list with other studies in the same area (Mata et al. 1985, Oliveira et al. 1988, Souza 1997, Oliveira-Filho et al. 1998a, Oliveira-Filho et al. 1998b) by collecting trips made at different years in all ecologically distinct parts of the forest. Most of the individuals sampled in the areas were identified in the field. When that was not possible, we collected botanical material and recorded morphological characteristics for later identification.

All botanical material was duly numbered, arranged in presses, dehydrated and delivered to the Prisco Bezerra Herbarium (EAC) at Universidade Federal do Ceará, where it was identified through comparisons with materials, as well as by consulting experts of recognized competence and the specialized literature. The fertile specimens were incorporated into the collection of the same herbarium. We adopted the classification system proposed by the Angiosperm Phylogeny Group (APG III, 2009).

Statistical analysis

For both area and the soil seed bank, we estimated the Shannon diversity index (H', using a neperian logarithm and 95% jackknife confidence intervals) and the Pielou's evenness index (J'; Pielou, 1966). For this analysis, we used the Mata Nativa software (CIENTEC, 2004). We analyzed the floristic similarity between the areas by the Sorensen and Jaccard indices.

Results

The total number of species recorded at the *Tabuleiro* forest of Campus do Pici in Fortaleza rose to 116 species, representing 100 genera and 49 families. In this study, we sampled 200 trees and shrubs belonging to 27 species (23.3%), 26 genera (26%) and 18 families (36.7%), four individuals being identified only down to the genus level. In the wet area, we sampled 19 species, 19 genera and 14 families. In the dry area, we sampled, respectively, 20 species, 19 genera and 15 families (Table 1). The species that were exclusive to our floristic survey accounted for 12.1% of the species observed, which demonstrates its additional contribution to the knowledge of the local flora. We found four dead individuals (3.45%), three still standing and one broken.

Table 1. Species list of *Tabuleiro* forest in Fortalez, Ceará. D – dry area, W – wet area. *MATA et al. (1985), OLIVEIRA et al. (1988), SOUZA (1997), OLIVEIRA- FILHO et al. (1998a,b).

Family/Specie	This study	Others*	Voucher
Amaranthaceae			
Alternanthera brasiliana (L.) Kuntze		X	EAC11544

Anacardiaceae			
Anacardium occidentale L.	X, W		EAC34870
Tapirira guianensis Aubl.		X	EAC579
Annonaceae			
Annona squamosa L.		X	EAC31710
Arecaceae			
Acrocomia intumescens Drude		X	EAC43948
Cocos nucifera L.		X	EAC39439
Apocynaceae			
Asclepias curassavica L.		X	EAC13605
Tabernaemontana catharinensis A. DC.		X	EAC33339
Asteraceae			
Bidens sp.		X	EAC16105
Blainvillea acmella (L.) Philipson		X	EAC50475
Centratherum punctatum Cass.		X	EAC35977
Elephantopus hirtiflorus DC.		X	EAC13543
Elephantopus mollis Kunth.		X	EAC13533
Eleutheranthera ruderalis (Sw.) Sch. Bip.		X	EAC3208
Praxelis clematidea (Griseb.) R.M.King & H.Rob.		X	EAC31711
Weledia calcyna Rich.		X	EAC47117
Bignoniaceae			
Tabebuia avellanedae Lorentz ex Griseb.	X, W		EAC16707
Bixaceae			
Bixa orellana L.	X, D	X	EAC21288
Boraginaceae			
Cordia oncocalyx Allemão		X	EAC38498
Bromeliaceae			
Ananas nanus (L.B. Sm.) L.B. Sm.		X	EAC20362
Burseraceae			
Protium heptaphyllum (Aubl.) Marchand		X	EAC47116
Cannabaceae			
Trema micrantha (L.) Blume		X	EAC13493

Cappareaceae			
Cynophalla hastata (Jacq.) J.Presl.	X, DW	X	EAC24759
Celastraceae			
Maytenus sp.	X, DW	X	EAC13523
Chrysobalanaceae			
Hirtella racemosa Lam.		X	EAC15641
Combretaceae			
Combretum glaucocarpum Mart.		X	EAC3121
Terminalia catappa L.	X, DW	X	EAC34869
Commelinaceae			
Commelina agraria Kunth		X	EAC13498
Commelina benghalensis L.		X	EAC50508
Convolvulaceae			
Aniseia martinicensis (Jacq.) Choisy.		X	EAC15096
Operculina alata (Ham.) Urb.		X	EAC27656
Cucurbitaceae			
Momordica charantia L.		X	EAC13507
Cyperaceae			
Cyperus cayennensis Willd. Ex Link		X	EAC29369
Cyperus laxus Lam.		X	EAC29368
Dilleniaceae			
Davilla cearensis Huber		X	EAC29035
Tetracera breyniana Schltdl.	X, W		EAC15636
Tetracera willdenowiana Steud.		X	EAC47119
Euphorbiaceae			
Croton barbatus Kunth.		X	EAC39434
Croton blanchetianus Baill.	X, D		EAC42802
Dalechampia pernambucensis Baill.		X	EAC51660
Euphorbia hyssopifolia L.		X	EAC51621
Fabaceae			
Caesalpinioideae			
Bauhinia ungulata L.	X, D	X	EAC13502
Chamaecrista calycioides (DC. Ex Collad.) Greene		X	EAC12657
Chamaecrista hispidula (Vahl) H. S. Irwin & Barneby.		X	EAC15305
Hymenaea courbaril L.	X, DW	X	EAC32277

Libidibia ferrea (Mart. ex Tul.) L.P.Queiroz	X, D	X	EAC16708
Senna obtusifolia (L.) H.S.Irwin & Barneby		X	EAC50452
Mimosoideae			
Chloroleucon acacioides (Ducke) Barneby & J.W.Grimes.	X, W		EAC16694
Enterolobium contortisiliquum (Vell.) Morong	X, D	X	EAC31695
Mimosa hirsutissima Mart.		X	EAC13495
Mimosa somnians Humb. & Bonpl. Ex Willd.		X	EAC23351
Piptadenia stipulacea (Benth.) Ducke	X, W	X	EAC15099
Papilonioideae			
Abrus precatorius L.		X	EAC14229
Aeschynomene evenia C. Wright ex Sauvalle		X	EAC13500
Calopogonium muconoides Desv.		X	EAC31697
Crotalaria pallida Aiton.		X	EAC35574
Dioclea grandiflora Mart. ex Benth.		X	EAC34893
Dioclea violacea Mart. ex Benth.		X	EAC26213
Vatairea macrocarpa (Benth.) Ducke	X, DW	X	EAC12184
Heliconiaceae			
Heliconia psittacorum L. f.		X	EAC13494
Hypericaceae			
Marsypianthes chamaedrys (Vahl) Kuntze		X	EAC51605
Vismia guianensis (Aubl.) Pers. Lamiaceae		X	EAC13538
Vitex flavens Kunth		X	EAC28784
Loganiaceae			
Spigelia anthelmia L.		X	EAC51615
Strychnos parvifolia A.DC.		X	EAC13521
Malvaceae			
Guazuma ulmifolia Lam.		X	EAC34854
Helicteres sp.		X	EAC13508
Melochia pyramidata L.	X, DW	X	EAC50647

Pavonia cancellata (L.) Cav.		X	EAC16654
Sida acuta Burm f.		X	EAC15577
Sida tuberculata R. E. Fr.		X	EAC15610
Thespesia populnea (L.) Sol. ex Corrêa	X, W	X	EAC20350
Waltheria americana L.		X	EAC15432
Melastomataceae			
Mouriri cearensis Huber		X	EAC13527
Pterolepis polygonoides (DC.) Triana.		X	EAC13516
Moraceae			
Ficus benjamina L.	X, DW		EAC34834
Myrtaceae			
Campomanesia sp.		X	EAC28783
Psidium guajava L.	X, D		EAC30387
Psidium sp.	X, DW		EAC47125
Nyctaginaceae			
Pisonia sp.	X, D		EAC3068
Ochnaceae			
Ouratea fieldingiana (Gardner) Engl.	X, D		EAC29036
Opiliaceae			
Agonandra brasiliensis Miers ex Benth. & Hook.f.		X	EAC13529
Orchidaceae			
Oeceoclades maculata (Lindl.) Lindl.	X, DW	X	EAC15743
Passifloraceae			
Passiflora kermesina Li nk & Otto		X	EAC13529
Polygonaceae			
Polygonum ferrugineum Wedd.	X, DW	X	EAC10664
Poaceae			
Dactyloctenium aegyptium (L.) Willd.		X	EAC50418
Panicum trichoides Sw.		X	EAC52567
Setaria geniculata P. Beauv.		X	EAC50390
Sporobolus tenuissimus (Schrank) Kuntze		X	EAC29694
Rubiaceae			
Borreria sp.		X	EAC47120
Borreria verticillata (L.) G.Mey.		X	EAC52572
Chiococca nitida Benth.		X	EAC3070

Chomelia sp.		X	EAC27131
Cordiera sessilis (Vell.) Kuntze.		X	EAC27127
Diodella gardneri (K. Schum.) Bacigalupo & E.L. Cabral.		X	EAC13542
Diodella teres (Walter) Small		X	EAC50383
Genipa americana L.		X	EAC20211
Guettarda angelica Mart. ex Müll.Arg.	X, W	X	EAC13535
Oldenlandia corymbosa L.		X	EAC52569
Randia armata (Sw.) DC.		X	EAC20228
Richardia grandiflora (Cham. & Schltdl.) Steud.		X	EAC38480
Richardia scabra L.	X, DW		EAC14972
Rutaceae			
Zanthoxylum syncarpum Tul.		X	EAC3781
Sapindaceae			
Talisia esculenta (A. St.-Hil.) Radlk.		X	EAC34894
Sapotaceae			
Manilkara triflora (Allemão) Monach.	X, DW	X	EAC13510
Pouteria ramiflora (Mart.) Radlk.		X	EAC26048
Simaroubaceae			
Simarouba versicolor A.St.-Hil.		X	EAC32636
Solanaceae			
Solanum agrarium Sendtn.		X	EAC3109
Solanum paludosum Moric.		X	EAC23403
Turneraceae			
Turnera melochioides A. St.-Hil. & Cambess.		X	EAC13511
Turnera subulata Sm.		X	EAC47124
Verbenaceae			
Lantana sp.		X	EAC47123
Stachytarpheta angustifolia (Mill.)		X	EAC13513
Urticaceae			
Cecropia palmata Willd.		X	EAC25757
Vitaceae			
Cissus verticillata (L.) Nicolson & C.E. Jarvis	X, DW	X	EAC49900

Xyridaceae		
Xyris sp.	X	EAC13512

The most species-rich families in the total floristic survey were Fabaceae (18 species); Rubiaceae (13 species); Asteraceae (8 species) and Malvaceae (8 species). In this study, we found Fabaceae (7 species) and Malvaceae, Myrtaceae and Rubiaceae (2 species each). It is of note that there was an abundance of families represented by a single species – 26 (53%) of those in total and 15 (83.3%) of those in this survey. Therefore, the fragment had a large number of rare species, ie, species with a density less than two individuals per hectare.

The most species-rich genera in the total floristic were *Borreria*, *Chamaecrista*, *Commelina*, *Cyperus*, *Croton*, *Dioclea*, *Diodella*, *Elephantopus*, *Mimosa*, *Psidium*, *Richardia*, *Sida*, *Solanum*, *Tetracera and Turnera* (2 species each). In this study, was *Psidium* (2 species). This number represents a great quantity of monospecifics genera.

The wet and dry areas were very similar floristically (with Jaccard and Sorensen indices of 0.43 and 0.58, respectively), having 12 species in common (44.44%). More than two thirds of the wet species also occurred in the dry area. We found a similar number of species that occurred only in each area: *Anacardium occidentale*, *Tabebuia avellanedae*, *Tetracera breyniana*, *Chloroleucon acacioides*, *Piptadenia stipulacea*, *Thespesia populnea* and *Guettarda angelica* – 7 species occurred only at wet area. While, *Bixa orellana*, *Ouratea fieldingiana*, *Pisonia sp.*, *Psidium guajava*, *Enterolobium contortisiliquum*, *Libidibia ferrea*, *Bauhinia ungulate and Croton blanchetianus* – 8 species occurred only at dry area.

The average distance and the total density of the study area (0.5ha) was 3.27m ± 0.23 and 980 ind./ha respectively. When we divided the sampling into wet and dry areas, we observed 2.98m ± 0.34 and 1111ind./ha for the wet, and 3.38m ± 0.47 and 872 ind./ha for the dry. For the diameter structure of the vegetation, we found an average value of 14.53cm ± 5.6, with 66.88cm at maximum and 4.78cm at minimum. For the wet area, we found 14.53cm, 49.04cm and 4.78cm respectively and, for the dry area, 14.94cm ± 6.7, 66.88cm and 4.78cm respectively. The highest density of plants occurred in class 5-10 cm of DBH, with few trees reaching over 35-40cm (Figure 1).

For the height structure, the classes were defined at regular intervals of 0.5m to improve the comparison between areas. We observed a midsize of 6.13m ± 2.4, with 16m at maximum and 1.5m at minimum. The dry area presented *Enterolobium contortisiliquum* (Vell.) Morong as the highest individual (14m) and *Bauhinia ungulata* L. as the smallest (2m). While the wet area presented *Cecropia palmata* Willd. as the highest (16m), although this specie showed high values of height throughout the remaining forest, and *Psidium* sp. as the smallest (2m). The highest density of plants occurred in class 5.5-6 m of height, with few trees reaching over than 12m (Figure 2).

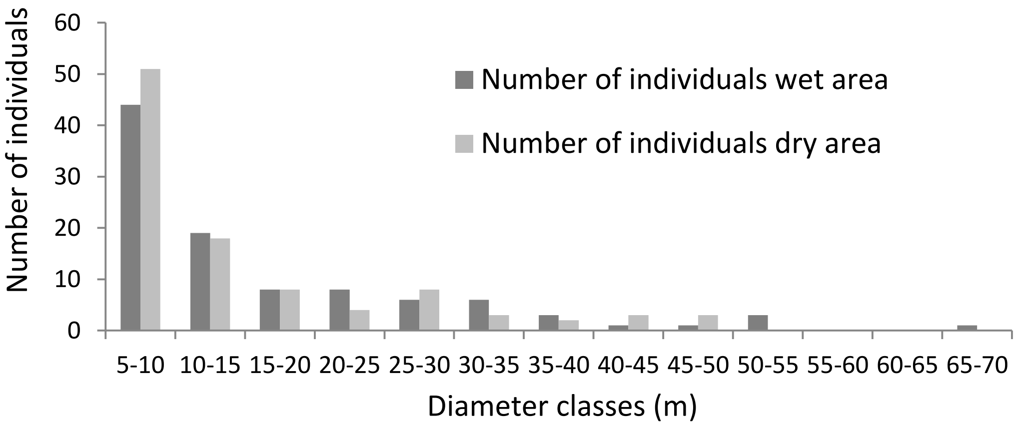

Figure 1. Number of individual per diameter classes in the Tabuleiro forest of Campus do Pici.

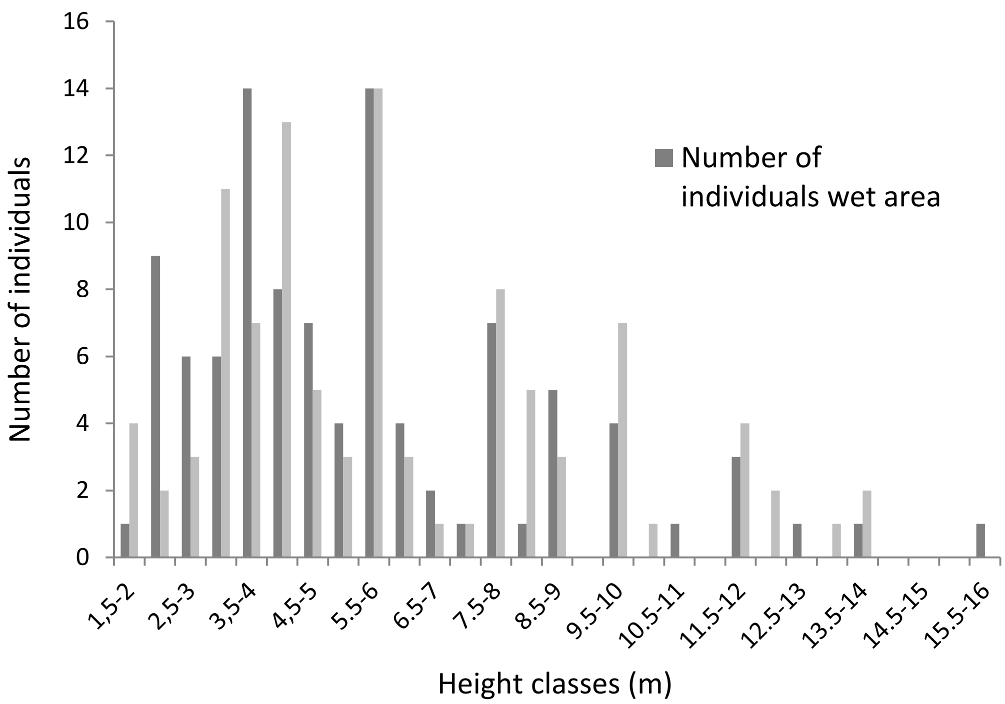

Figure 2. Number of individual per height classes in the Tabuleiro forest of Campus do Pici.

The *Tabuleiro* forest of Campus do Pici presented a high Shannon diversity index when compared with others degraded remnants (H' = 3.11 nats/ind). For the wet area, we estimated the H' at 2.89 nats/ind (2.75 < H' < 3.16, using 95% jackknife confidence intervals). The community showed low dominance, as evidenced by the estimated J' values (0.8). In the dry, these values were similar, H' = 2.82 nats/ind (2.73 <H' <3.12, using 95% jackknife confidence intervals); J' = 0.77.

Discussion

The Fabaceae family, that had the highest tree species richness in the *Tabuleiro* forest of Campus do Pici, occurs, generally, with the largest number of species along the Brazilian Atlantic coast (Peixoto et al. 2005, Guedes-Bruni et al. 2006) and has the same behavior in other studies with *Tabuleiro* forests (Silva & Nascimento 2001, Peixoto et al. 2008, Barbosa et al. 2011). This family is among the richest in species in neotropical lowland forests (Gentry 1982, Peixoto & Gentry 1990). A large proportion of species with low density is a common feature in tropical forests in general (Whitmore 1990) and is considered an aspect of the distribution of relative abundance.

The species that were exclusive to our floristic study demonstrates its additional contribution to the knowledge of the local flora. The low annual rainfall coupled with strong seasonality can be considered responsible for the high occurrence of deciduous species such *Piptadenia stipulacea*, *Croton blanchetianus*, *Tabebuia avellanedae* among others.

The density of individual per classes of DBH was similar to different studies (Oliveira-Filho & Carvalho 1993, Silva & Nascimento 2001, Giaretta et al. 2013), however was low when compared to other forets in Southeastern Brazil (Moreno et al. 2003, Rochelle et al. 2011). This seems to be related not only to the type of forest, but most likely to the degree of human disturbance in the area. A recent study highlighted the influence of the edge effect on diameter and number of trees in this same area (Diogo et al. 2012). The individual distribution in diameter classes, including all sampled trees, showed a pattern of distribution J-shaped inverted, suggesting that is a remnant of primary forest in regeneration. However, there is need more analysis at the specie level (Santos et al. 1998).

The wet area had a greater density of individuals due to the proximity to the reservoir, which provides better drainage, higher humidity and, consequently, better establishment and development of species. So, this area showed continuous growth, with individuals in all diameter classes in opposite to the dry area, which presented a discontinuity in the higher diameter classes. Based on height classes, we were able to identify three clear strata: emergent (highest), canopy and understory. The plant stratification in the dry area as in the wet presented uniformly, with no significant differences, demonstrating a good structure for development and growth of vegetation.

The Shannon index was low when compared to that obtained by other studies in *Tabuleiro* and semideciduous forests (Silva & Nascimento 2001,Rochelle et al. 2011, Giaretta et al. 2013). On the contrary, the evenness index was very similar to the other studies above mentioned. Comparing the two areas (wet and dry), it was noted that they were quite similar, since they are nearby areas and are part of the same vegetation complex. Although these indexes are influenced by the number of individuals sampled (Durigan 2009).

Unfortunately, due to the variety of methods used and the size of the areas and the scarce surveys at northeastern Brazil, it is difficult to adequately compare the studies. Nevertheless, the fact that the diversity was quite similar to some preserved forests in an area of 0.25ha underscores the importance of this area for conservation and hence the need of proper management of this regeneration, so that the values identified are maintained or increased.

These forests had greatly reduced their area in the past and the forest is now in regeneration, although there is anthropic actions and edge effect (Giulietti & Forero 1990; Diogo et al. 2012). Because of the composition and diversity of the vegetation, the *Tabuleiro* forest of Campus do Pici harbors a rich assemblage of species, many of which have limited distributions and are at the northern end of their range and plays a critical role in the preservation of Brazil's natural heritage. This study could contribute to decisions regarding future management plans, forest restoration projects in surrounding areas and environmental education initiatives aimed at raising awareness among the population about the need to and importance of preserving these last living witnesses to the original landscape.

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