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Population Structure of the Palm *Euterpe edulis* in an Urban Atlantic Forest Reserve¹

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Abstract

The palm *Euterpe edulis* is one of the most exploited species of the Atlantic Forest, suffering population declines in several localities due to adult mortality following palm-heart removal. The knowledge of the demographic structure of a population provides current information on the state of conservation of a population, allowing inferences about previous impacts and future management strategies. This study aimed to characterize the population structure of *E. edulis* in a protected urban forest - the Tijuca National Park (RJ), that was intensively explored in the past. Individuals were sampled in 20 plots of 20x20m (0.8 ha), and classified as seedlings, infants, juveniles, immatures and reproductives. A total of 2482 individuals was counted, corresponding to a density of 3103 individuals/ha, with seedlings and infants corresponding to 79% of the total. This structure resembles that described in other preserved areas of the Atlantic Forest and is commonly found in natural plant populations not subject to impacts. The results found indicates that due to its intense fruit production and interaction with the dispersing fauna, the species could recovery from previous impacts, reaching a high population density, even in an urban forest. This scenario, that reflects the actual conservation status of the Tijuca National Park is interesting, both for the conservation of the species and benefits for the area, since it is a species that attracts and helps to maintain the dispersing fauna, promoting biodiversity.

Key-words

Areaceae; demography; density; life stages; recruitment.

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Introduction

Several biomes have been degraded as result of human exploitation as well as urban sprawl. The Atlantic Forest is one such example, especially due to its location in areas with high human population density (RIBEIRO *et al.*, 2009; TABARELLI *et al.*, 2010). In this Biome, the palm *Euterpe edulis* has been historically exploited to obtain its palm heart, one of the most harvested non-timber products in the Atlantic Forest (GALETTI; FERNANDEZ, 1998). Intense exploitation began in the early 20th century, culminating in drastic population reductions of the species in some localities (SILVA MATOS; BOVI, 2002). Nowadays, the exploitation diminished due to the reduction of natural populations, intensification of the inspection and the crescent use of palm-heart from other palm species (BOVI, 1997). Fruit exploitation, however, is expanding to the acquisition of pulp, a product previously obtained predominantly from its congeneric Amazonian species, *E. oleifera* (PEREIRA *et al.*, 2018).

The intense exploitation of non-timber products can produce drastic alterations in plant population structures, compromising species regeneration. A limited number of individuals in the initial stages, for example, has been found in overexploited populations, indicating recruitment bottlenecks resulting from long-term harvest (PERES *et al.*, 2003). The knowledge of the demographic structure of a population, therefore, can provide an actual picture of their conservation status, providing some insights about previous impacts and future management strategies (BRUNA; KRESS, 2002; VIRILLO *et al.*, 2011; MELITO *et al.*, 2014). Additionally, it can also be used to evaluate the recovery of previously exploited populations through comparisons among populations of the same species in more preserved areas.

Although the population structure of *E. edulis* has been described in several studies (for a review see Silva Matos e Bovi, 2002 and Melito *et al.*, 2014), most of them were carried out more than 10 years ago, with a few exceptions (e.g. MELITO *et al.*, 2014; NASCIMENTO *et al.*, 2016). Besides that, the areas sampled in such studies were predominantly non-protected small fragments (<1000ha). Although plant populations are expected to thrive well in large protected areas, Portela *et al.* (2010) found that an *E.*



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edulis population was declining in a large Atlantic Forest Reserve as a consequence of the herbivory by capuchin monkeys. Therefore, the knowledge of *E. edulis* populations living actually in other protected remnants or even forest fragments can be useful to help in understanding the conservation status of the species. Considering this, the objective of this study was to characterize the population structure of *Euterpe edulis* in an urban forest currently protected, but historically exploited in the Atlantic Forest, The Tijuca National Park, Rio de Janeiro, Brazil.

Material and Methods

Studied species

Euterpe edulis Mart. is a species belonging to the family Arecaceae, which presents a solitary stem that can reach 15 cm in diameter and 12 m in height, composing the forest canopy (LORENZI *et al.*, 2010). Its occurrence is mainly the Atlantic Coastal Forest, but it is also found in the interior of Brazil, reaching as far as Argentina and Paraguay (LORENZI *et al.*, 2010; HENDERSON *et al.*, 1995).

The species is an important food resource to the fauna, especially mammals, many of them seed predators, and diverse frugivorous birds, which act primarily as dispersal agents (GALETTI; ALEIXO, 1998; GALETTI *et al.*, 1999).

In addition to overexploitation, the species is also threatened by the loss and fragmentation of its habitat, being classified as vulnerable in the red list of the Brazilian flora (CNCFlora, 2019). Decreases in *E. edulis* populations, by its turn, can result in changes in the regeneration dynamics of the whole plant community, due to the effects in the activity of seed dispersers (MULER *et al.*, 2014).

Study area

The study was carried out in the Tijuca National Park, located in the municipality of Rio de Janeiro (RJ, Brazil, 22° 55'- 23° 00' S and 43° 11'- 43° 19' W), with a total area of 3.953 ha. The altitude ranges from 80 to 1021 m, and average monthly temperatures



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varying between 18° C and 26° C. Annual rainfall exceeds 1.200 mm, without marked seasons as rains occurs throughout the year (ICMBio, 2008).

The original vegetation, which is characteristic of the Dense Ombrophylous Forest, suffered several disturbances during the development of the Rio de Janeiro city (ABREU, 1992), resulting in scarcity of water to the city. This propels restoration initiatives, including reforestation and faunal enrichment (FREITAS *et al.*, 2006). In 1961, the area became an Integral Protection Conservation Unit (ICMBio, 2008), being protected from intense human impacts since then.

Data collect

Sampling was carried out in one of the four forest blocks that constitutes the Park, the Floresta da Tijuca sector, which encompass 1900ha. Twenty 20x20m plots, totaling 0.8ha, were demarcated in the area with a minimum distance of 150m between plots. In each plot, all individuals of the species were marked with numbered tags and classified as seedlings, infants, juveniles, immatures or reproductives according to Portela e Santos (2011).

Results and Discussion

A total of 2482 *E. edulis* individuals were sampled. The seedling/reproductive ratio was 17.05 and the demographic structure followed the inverted J model, with the first two stages summing 79% (Figure 1A). This pattern has been attributed to the inhibition of seedling growth resulting from the great coespecific competition at this stage (SILVA MATOS *et al.*, 1999). Besides that, the high mortality in these early stages, leads to a decline in the proportion of individuals in intermediate and final classes (SILVA MATOS *et al.*, 1999). Such pattern indicates a potential for the regeneration and maintenance of the demographic structure, provided there are enough adults to maintain seed replenishment (CAPPELATTI; SCHMITT, 2015; SILVA *et al.*, 2009).

The number of individuals per plot was highly variable, ranging from five to 541 (Figure 1B), reflecting the patch distribution generally found for palm species. Infants



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were the only stage observed in all plots (mean $\pm$ sd = 45.5 ± 64.9), followed by seedlings (52 ± 69.6), that were absent at only two plots and concentrated mainly in three of them. As expected, plots with the higher seedling abundance were those with the higher number of reproductive adults. However, seedlings were also found in plots without adults, evidencing the action of seed dispersers.

Considering all plots, the density found was 3102.5 individuals/ha (Table 1). The structure and density found resemble that described in other preserved areas of the Atlantic Forest (Table 1). The demographic structure found is commonly found in natural plant populations not subject to impacts (REIS *et al.*, 2000). Marcos e Silva Matos (2003), studying the species in the same locality but 15 years before, also found a high number of seedlings, but the other stages were underrepresented and have similar numbers among stages (Table 1). This, together with the actual density that was more than twice higher than those found by the authors, suggests an improvement of the conditions for the survival and growth of earlier stages.

When comparing the densities described for *E. edulis* in other protected areas the value found in this study is the third higher (Table 1). Variation in physical and climatic attributes, as well as conservation history of each area, can explain such differences. The creation of the União Biological Reserve, for example, occurred only 20 years ago and before the area was used to produce eucalypt logs for the railway line, which can explain the low *E. edulis* densities found there. Another interesting result was found by Fadini *et al.* (2009), which attributed the low density of *E. edulis* at Anchieta Island to the high seed predation by agoutis. As the red-rumped agouti *Dasyprocta leporina* has been reintroduced recently in the Tijuca National Park (CID *et al.*, 2014), it would be helpful to compare *E. edulis* seedling recruitment in areas with and without these rodents, that are considered important seed predators of this palm (FADINI, 2009; GALETTI *et al.*, 2010).



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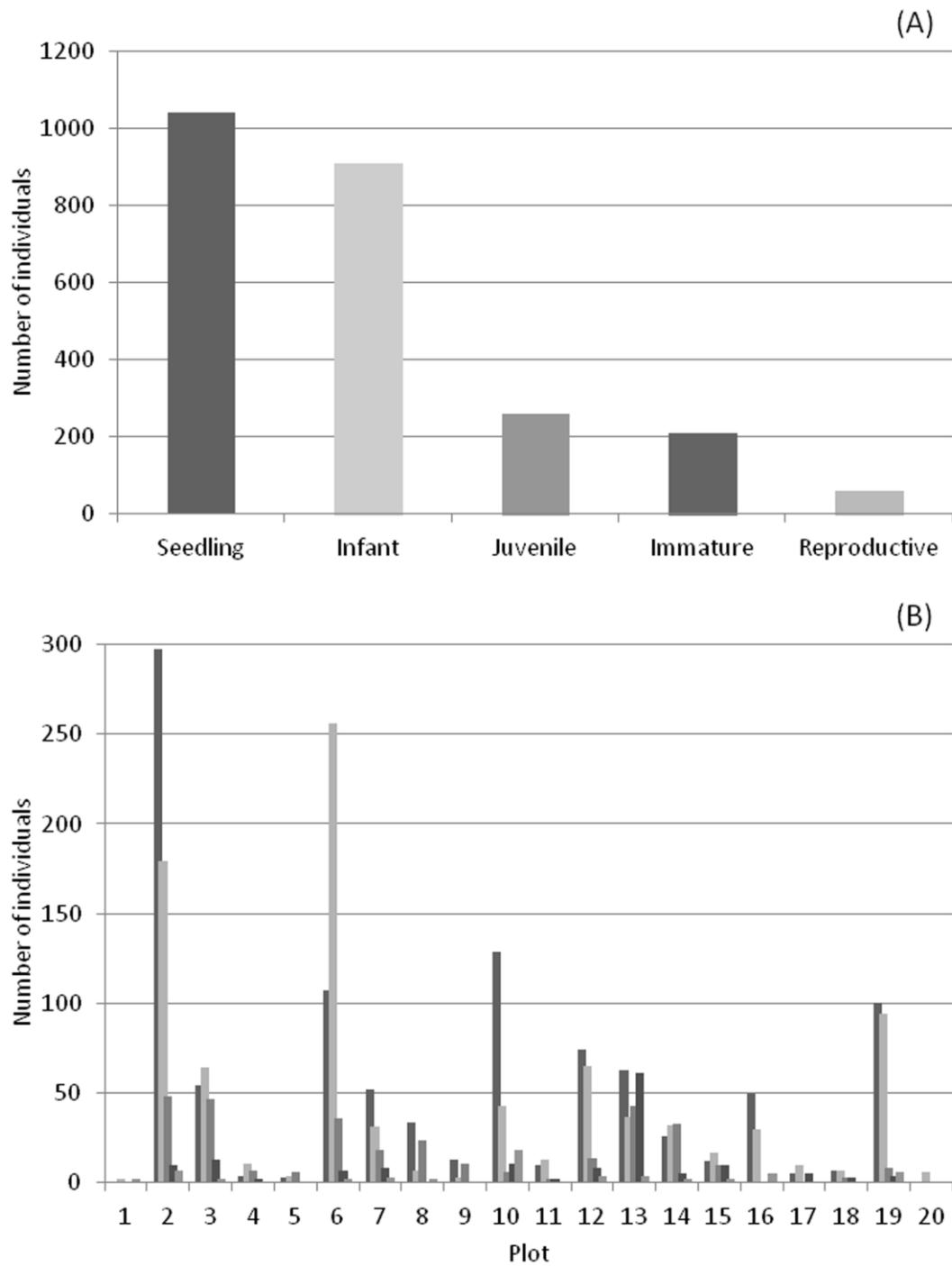


Figure 1: Number of *Euterpe edulis* individuals found per ontogenetic stage in all plots sampled (A) and in each one of the 20 sampled plots (B), Tijuca National Park - RJ, Brazil.



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Protected area (state)	Area total / sampled (ha)	Density (individuals/ha)						Reference
		Seedling	Infant	Juvenile	Immature	Reproductive	Total	
Tijuca Nacional Park (RJ) (Floresta da Tijuca sector)	1900 / 0.4	1732	1500	362	277	90	3962	Present study
Tijuca Nacional Park (RJ)	1900 / 0.25	1500	24	24	24	32	1604	Marcos & Silva Matos, 2003
Poço das Antas Biological Reserve (RJ)	3500 / 0.81	179	321	185	267	84	1060	Portela, 2008
União Biological Reserve (RJ)	2400 / 0.81	6	5	5	1	0	17	Portela, 2008
Santa Genebra Reserve (SP)	252 / 0.25	836	1980	540	164	260	3780	Silva Matos, 2000
Serra do Mar State Park – Caraguatatuba (SP)	39800 / 0.8	1056	-	754	-	50	1860	Fadini et al., 2009
Ilha Anchieta State Park (SP)	806 / 0.8	83	-	50	-	21	154	Fadini et al., 2009
Una Biological Reserve (BA)	12334 / 0.19	103	2490	1578	389	117	4677	Melito et al., 2014
Una EcoPark - Private Natural Heritage Reserve (BA)	383 / 0.61	454	3466	139	129	74	4262	Silva et al., 2009

Table 1: Densities of *Euterpe edulis* in studies carried out in Conservation Units of the Atlantic Forest.



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Conclusion

Euterpe edulis, even in an urban forest that suffered drastic human impacts in the past, presented a natural population with a large numbers of individuals, and a demographic structure similar to the found in other preserved localities. This scenario, that reflects the actual conservation status of the Tijuca National Park is interesting, both for the conservation of the species and benefits for the area, since it is a species that attracts and helps to maintain the dispersing fauna, promoting biodiversity.

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