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Structure of the woody component of an Atlantic forest Fragment, Moreno – PE

Estrutura do componente arbóreo em um fragmento de Floresta Atlântica, Moreno – PE

Lamartine Soares Bezerra de Oliveira[1*]; Luiz Carlos Marangon[2]; Ana Lícia Patriota Feliciano[2]; Mércia de Oliveira Cardoso[3]; Aldení Silva de Lima[4]; Wedson Batista dos Santos[5]; Valdemir Fernando da Silva[5]

Abstract

The aim of this study was to evaluate the phytosociological structure of an adult woody component in an Atlantic Forest fragment known as *Mata da Onça*, Municipality of Moreno – PE. Fifteen plots of 10 x 25 m were established, in three rows of five plots 25 m apart, while the rows were 50 m apart. The adult woody individuals with CBH (circumference at 1.30 m above ground level) ≥ 15 cm were identified to the species level, and the diameter and height were measured. 444 individuals belonging to 76 species were sampled, with an estimated density of 1,184 ind.ha^{-1} and estimated absolute dominance of 28 m^2.ha^{-1}. The most representative species were *Parkia pendula,Tapirira guianensis, Albizia saman, Schefflera morototoni, Miconia prasina, Inga thibaudiana, Eriotheca crenulaticalyx, Cupania racemosa* and *Cecropia pachystachya*. The diversity index was 3.61 nats.ind^{-1} with an evenness of 0.87. Therefore, the results observed are similar or high compared to others Atlantic Forest fragments within the region despite its anthropized situation, which emphasizes the importance of conserving this area.
Key words: Fragmentation, phytosociology, adult component

Resumo

O objetivo desse estudo foi avaliar a estrutura fitossociológica do componente arbóreo adulto em um fragmento de Floresta Atlântica denominada Mata da Onça, em Moreno – PE. Foram demarcadas 15 parcelas de 10 x 25 m, em três linhas de cinco parcelas distantes 25 m entre si e as linhas distantes 50 m uma das outras. Consideraram-se indivíduos arbóreos adultos aqueles com CAP (circunferência a 1,30 m do solo) ≥ 15 cm, os quais foram identificados em nível de espécie e mensurados o diâmetro e a altura. Foram amostrados 444 indivíduos, de 76 espécies, com uma densidade estimada de 1.184 ind.ha^{-1} e com uma dominância absoluta estimada de aproximadamente 28 m^2.ha^{-1}. As espécies mais representativas foram *Parkia pendula, Tapirira guianensis, Albizia saman, Schefflera morototoni, Miconia prasina, Inga thibaudiana, Eriotheca crenulaticalyx, Cupania racemosa* e *Cecropia pachystachya*. O índice de diversidade foi 3,61 nats.ind^{-1} e de equabilidade 0,87. Assim, os resultados observados são próximos ou elevados em relação a outros fragmentos de Floresta Atlântica na região, mesmo diante do seu estado de antropização, ressaltando assim, a importância da conservação desta área.
Palavras-chave: Fragmentação, fitossociologia, componente adulto

[1] Doutorando em Ciências Florestais, Faculdade de Tecnologia, Departamento de Engenharia Florestal, Universidade de Brasília, UnB. Brasília, DF. E-mail: soareslt@hotmail.com
[2] Prof. Dr. em Ecologia e Recursos Naturais, Deptº de Ciência Florestal, Universidade Federal Rural do Pernambuco, UFRPE, Recife, PE. E-mail: marangon@dcfl.ufrpe.br; licia@dcfl.ufrpe.br
[3] Doutoranda em Engenharia Agrícola, Deptº de Engenharia Agrícola, UFRPE, Recife, PE. E-mail: mercia.cardoso@yahoo.com.br
[4] Graduando em Engenharia Florestal, Deptº de Ciência Florestal, UFRPE, Recife, PE. E-mail: wedsonfl@hotmail.com; valdemir2100@hotmail.com
[*] Corresponding author

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Introduction

The inappropriate use of natural resources has caused deleterious effects to ecosystems worldwide (PEREIRA et al., 2010). The consequence of this fact is directly related to the process of habitat fragmentation, which is considered one of the most important and widespread consequences of the current dynamics of land use by human beings (TABARELLI; GASCON, 2005), as well as one of the main causes of biodiversity loss in tropical ecosystems (RAMBALDI; OLIVEIRA, 2005).

According to Primack and Rodrigues (2001), fragmentation is the process through which continuous areas are reduced or subdivided into smaller areas, forming small remnants which are suppressed and completely immersed in non-forest matrices. This occurrence is directly related to different negative changes in the ecological processes that occur on a spatial scale on the biodiversity (EWERS; DIDHAM, 2006; FISCHER; LINDENMAYER, 2007).

Such action may be noticed and observed in Atlantic Forest areas, where the fragmentation process is one of the main factors responsible for the dramatic reduction in area, with only 11.73% of this formation left in Brazil and 12.1% in the State of Pernambuco (RIBEIRO et al., 2009). This fact corroborates the statement that this formation should be considered one of the most threatened by anthropic action in the world (DAN; BRAGA; NASCIMENTO 2010).

Therefore, studies with a theoretical character are necessary, mainly aimed at the advance of knowledge, whose conclusions or forecasts may support practical decisions or actions (DURIGAN, 2009). That is, for example, a phytosociological study of the few still existent remnants, which supports the elaboration of measures that aim towards biodiversity conservation (FAHRIG, 2003; OLIVEIRA FILHO et al., 2004; PEREIRA; OLIVEIRA FILHA; LEMOS FILHO, 2006).

According to Kunz, Ivanauskas and Martins (2009), phytosociology is considered one of the tools used in the characterization of the biological diversity and structure of a species in a determined ecosystem. It is considered a method of recognition and definition of plant communities, regarding its origin, structure, classification and the relation of the community with the environment into which it is inserted (FELFILI; REZENDE, 2003).

Thus, the objective of this work was to evaluate the phytosociological structure of the adult woody component in an Atlantic Forest fragment in the Municipality of Moreno – Pernambuco, aimed at contributing to future actions of recovery and conservation of fragments in this region.

Material and Methods

Description and selection of the area

The work was carried out in the Municipality of Moreno, located in the Metropolitan Mesoregion and in the Recife Microregion of the State of Pernambuco. An area with a demographic density of approximately 260 inhabitants/km², where the main source of labor and income depend on agrofarming, plant extractivism, hunting and fishing sectors (CPRM, 2005).

The study in this region was carried out in a forest remnant of the *Dourado* Refinery and Distillery, the *Mata da Onça*, with an approximate area of 130 ha, and located around 3 km from the Municipality of Moreno between the coordinates 35º07'461'' longitude West and 8º06'560'' latitude South. This area is considered an Atlantic Forest remnant, and is placed in the Ombrofila Dense Forest category (IBGE, 1992).

Data survey and collection

The survey of the adult woody component structure was carried out on February 2010. 15 plots of 10 x 25 m were established, in three rows of five

plots 25 m from each other, and all the rows were 50 m apart from each other. Adult woody individuals were considered as all trees with a circumference of 15 cm of more at 1.30 m above the soil (CBH).

The individuals sampled were numbered with PVC tags, had their circumference measured with a tape measure and their height estimated. Fertile branches were collected from each species for their identification through comparison with exsiccates from the Herbarium Professor Vasconcelos Sobrinho of the Department of Biology of URFPE, as well as by consulting specialists and the related bibliography. The classification of the species was performed according to the Cronquist (1988) system.

Data analysis

The parameters usually applied in surveys of the phytosociological structure and that proposed by Mueller-Dumbois and Ellenberg (1974) were used: absolute and relative density, absolute and relative frequency, absolute dominance and importance value. The diversity estimations were calculated through the Shannon-Wiener Index, and evenness by the Pielou Index, as proposed by Magurran (1988). The software used in these analyses was *Mata Nativa* 2© (CIENTEC, 2006).

The individuals sampled were also analyzed by diametric and hipsometric classes, as used in studies of phytosociological structure, and were then distributed in histograms by center of class. The first center of diameter class was 7.27 cm, determined by the minimum diameter observed, and the amplitude was 5 cm. In the hipsometric class the first center of class was 2.5 m, with a 5 m amplitude, as similarly used by Alves Júnior et al. (2007) and Costa Júnior et al. (2008).

Results and Discussion

444 individuals were sampled distributed across 76 botanic species, with an estimated density of 1,184 ind.ha^{-1} and an estimated absolute dominance of around 28 m².ha^{-1} (Table 1). The density value observed in this work is among the values encountered in Atlantic Forest remnants in Pernambuco: 1,309 (LOPES; FERRAZ; ARAÚJO, 2007), 1,049 (COSTA JÚNIOR et al., 2008), 970 (ESPIG et al., 2008), 1,049 (ALVES JÚNIOR et al., 2009), 1,251 (GUIMARÃES et al., 2009), 1,068 (OLIVEIRA et al., 2009) and 1,235 ind.ha^{-1} (SILVA et al., 2010). However, it is lower than those found in Atlantic Forest remnants in other states, which ranged from 1,400 to 2,842 live woody individuals per hectare, with an average of 2,057 ind.ha^{-1} (FARIAS; CASTRO, 2004; GOMES; FISCH; MANTOVANI, 2005; PEIXOTO et al., 2005; ANDRADE et al., 2006; CARVALHO; NASCIMENTO; BRAGA, 2007; MEIRELES; SHEPHERD; KINOSHITA, 2008; SOARES; FERRER, 2009; THOMAS et al., 2009).

Due to its vulnerability, the necessity of the conservation of the Atlantic Forest remnants in Pernambuco must be emphasized, which, besides presenting low density values, are mostly under an intense and uncontrolled process of anthropization. This was observed in *Mata da Onça*, which is located next to a sugar cane plantation without a protected fire line, which is completely in contact with the fragment.

The species that presented the highest density estimations were *Albizia saman*, *Miconia prasina*, *Tapirira guianensis, Schefflera morototoni* and *Inga thibaudiana*, representing around 40% of the community studied (Table 1). With respect to the species distribution in the sample area, it is observed that the species of *Schefflera morototoni, Tapirira guianensis, Parkia pendula, Miconia prasina* and *Inga thibaudiana* were the most frequent in the unity samples.

Table 1. Structure parameters of the adult woody component, ordered by importance value, sampled at *Mata da Onça*, Moreno – PE. Where: AD = absolute density (ind.ha^{-1}); RD = relative density (%); AF = absolute frequency (%); RF = relative frequency (%); ADo = absolute dominance (m^2.ha^{-1}); RDo = relative dominance (%) e IV = importance value (%).

Species	AD	RD	AF	RF	ADo	RDo	IV
Parkia pendula (Willd.) Benth. ex Walp.	45.33	3.83	66.67	4.95	6.27	22.44	31.22
Tapirira guianensis Aubl.	85.33	7.21	73.33	5.45	3.93	14.07	26.72
Albizia saman (Jacq.) F. Muell.	106.67	9.01	26.67	1.98	2.87	10.26	21.25
Schefflera morototoni (Aubl.) Maguire, Steyerm. & Frodin	85.33	7.21	80.00	5.94	1.58	5.67	18.82
Miconia prasina (Sw.) DC.	106.67	9.01	66.67	4.95	0.60	2.16	16.12
Inga thibaudiana DC.	82.67	6.98	66.67	4.95	0.86	3.09	15.03
Eriotheca crenulaticalyx A. Robyns	10.67	0.90	6.67	0.50	2.77	9.90	11.30
Cupania racemosa (Vell.) Radlk.	64.00	5.41	53.33	3.96	0.42	1.50	10.87
Cecropia pachystachya Trécul.	58.67	4.95	26.67	1.98	0.71	2.55	9.48
Protium heptaphyllum (Aubl.) Marchand	26.67	2.25	40.00	2.97	1.05	3.77	8.99
Apeiba tibourbou Aubl.	24.00	2.03	40.00	2.97	0.89	3.17	8.17
Eugenia multiflora Lam.	32.00	2.70	46.67	3.47	0.42	1.51	7.67
Byrsonima sericea DC.	24.00	2.03	33.33	2.48	0.88	3.14	7.64
Brosinum discolor Schott	29.33	2.48	40.00	2.97	0.35	1.26	6.71
Thyrsodium spruceanum Benth.	26.67	2.25	33.33	2.48	0.32	1.13	5.86
Eschweilera ovata (Cambess.) Miers	18.67	1.58	40.00	2.97	0.31	1.12	5.67
Himatanthus phagedaenicus (Mart.) Woodson	21.33	1.80	40.00	2.97	0.15	0.54	5.32
Ocotea longifolia Kunth.	24.00	2.03	26.67	1.98	0.10	0.35	4.36
Albizia pedicellares (DC.) L. Rico	18.67	1.58	26.67	1.98	0.22	0.80	4.36
Erythroxylum citrifolium A. St.-Hil.	18.67	1.58	33.33	2.48	0.06	0.20	4.25
Pourouma acutiflora Trécul	16.00	1.35	20.00	1.49	0.39	1.39	4.22
Plathymenia foliolosa Benth	13.33	1.13	20.00	1.49	0.44	1.58	4.19
Siparuna guianensis Aubl.	18.67	1.58	26.67	1.98	0.13	0.46	4.01
Virola gardneri (A. Dc.) Warb.	16.00	1.35	13.33	0.99	0.32	1.14	3.48
Swartzia sp.	16.00	1.35	20.00	1.49	0.05	0.19	3.03
Myrsine guianensis (Aubl.) Kuntze	10.67	0.90	20.00	1.49	0.11	0.39	2.78
Guapira opposita (Vell.) Reitz	8.00	0.68	13.33	0.99	0.29	1.05	2.71
Ocotea glomerata (Nees) Mez	10.67	0.90	20.00	1.49	0.07	0.23	2.62
Casearia cf. *sylvestris* Sw	8.00	0.68	20.00	1.49	0.06	0.22	2.38
Myrtaceae 1	8.00	0.68	20.00	1.49	0.03	0.09	2.26
Inga capitata Desv.	10.67	0.90	13.33	0.99	0.07	0.26	2.15
Miconia hypoleuca (Bonpl.) Triana	8.00	0.68	13.33	0.99	0.11	0.38	2.04
Cupania cf. *oblongifolia* Mart.	8.00	0.68	13.33	0.99	0.03	0.12	1.79
Miconia minultiflora (Bonpl.) DC.	8.00	0.68	13.33	0.99	0.03	0.10	1.76
Anaxagorea cf. *dolichocarpa* Sprague & Sandwith	8.00	0.68	13.33	0.99	0.03	0.09	1.76
Dialium guianense (Aubl.) Sandwith	5.33	0.45	6.67	0.50	0.21	0.73	1.68
Melastomataceae 1	5.33	0.45	13.33	0.99	0.05	0.17	1.61
Simarouba amara Aubl.	5.33	0.45	13.33	0.99	0.03	0.12	1.56
Xylopia frutescens Aubl.	5.33	0.45	13.33	0.99	0.04	0.12	1.56
Andira cf. *nitida* Mart. Ex Benth	5.33	0.45	13.33	0.99	0.03	0.09	1.53
Myrcia fallax (Rich.) DC.	5.33	0.45	13.33	0.99	0.02	0.08	1.52
Guarea guidonia (L.) Sleume	5.33	0.45	13.33	0.99	0.02	0.05	1.49
Ocotea sp.	5.33	0.45	13.33	0.99	0.02	0.05	1.49
Eugenia sp.	8.00	0.68	6.67	0.50	0.08	0.29	1.46

continua

continuação

Species	AD	RD	AF	RF	ADo	RDo	IV
Flacourtiaceae 1	5.33	0.45	6.67	0.50	0.06	0.22	1.17
Miconia sp.	5.33	0.45	6.67	0.50	0.04	0.14	1.08
Sorocea hilarii Gaudich.	5.33	0.45	6.67	0.50	0.03	0.12	1.07
Helicostylis tomentosa (Poepp. & Endl.) Rusby	5.33	0.45	6.67	0.50	0.02	0.07	1.02
Indeterminate 1	2.67	0.23	6.67	0.50	0.09	0.31	1.03
Euphorbiaceae 1	2.67	0.23	6.67	0.50	0.06	0.21	0.93
Symphonia globulifera L. f.	2.67	0.23	6.67	0.50	0.06	0.20	0.92
Indeterminate 2	2.67	0.23	6.67	0.50	0.06	0.22	0.94
Indeterminate 3	2.67	0.23	6.67	0.50	0.03	0.12	0.84
Albizia polycephala (Benth.) Killip	2.67	0.23	6.67	0.50	0.03	0.10	0.82
Bowdichia virgilioides Kunth	2.67	0.23	6.67	0.50	0.03	0.10	0.82
Casearia javitensis Kunth	2.67	0.23	6.67	0.50	0.02	0.06	0.78
Pera ferruginea (Schott) Mülle. Arg.	2.67	0.23	6.67	0.50	0.01	0.02	0.75
Guatteria pogonopus Mart.	2.67	0.23	6.67	0.50	0.01	0.02	0.74
Inga cayennensis Sagot ex Benth.	2.67	0.23	6.67	0.50	0.01	0.02	0.74
Myrtaceae 2	2.67	0.23	6.67	0.50	0.01	0.04	0.76
Pogonophora schomburgkiana Mieres ex Benth	2.67	0.23	6.67	0.50	0.01	0.02	0.74
Total	**1184**	**100**	**1354**	**100**	**27.9**	**100**	**300**

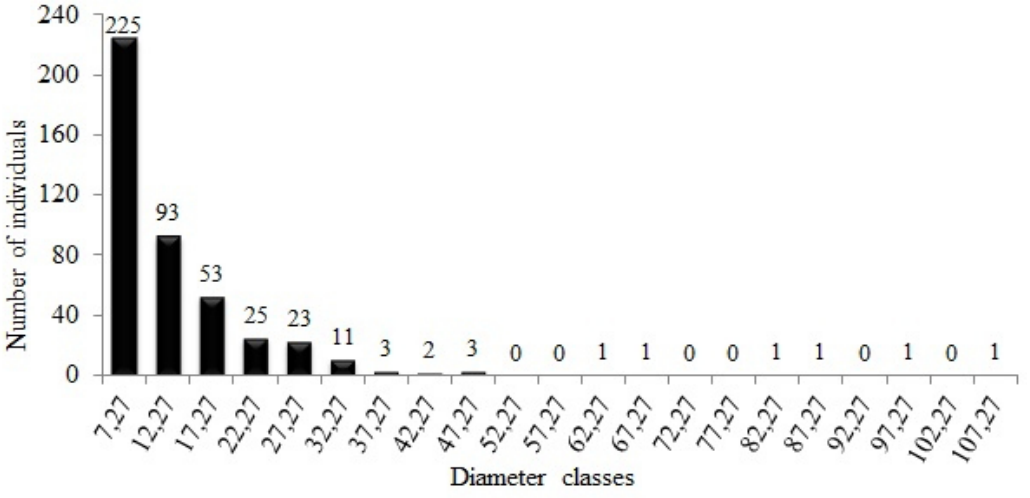
Source: Elaboration of the authors.

Among the species with the highest distribution it should be pointed out that the species of *Schefflera morototoni* was registered with 80% relative frequency. A similar result was obtained by Brandão et al. (2009), who registered a high frequency (92.5%) of this species in an Atlantic Forest fragment. This percentage is related to the efficiency in the dispersion of this species' diaspore (STEFANELLO et al., 2010), and to the abundant amount of fruits and seeds produced annually (FRANCO; FERREIRA, 2002), as well as the growth capacity of seedlings under different levels of shade (MAZZEI et al., 1998).

In Table 1 *Parkia pendula, Tapirira guianensis, Albizia saman, Schefflera morototoni, Miconia prasina, Inga thibaudiana, Eriotheca crenulaticalyx, Cupania racemosa* and *Cecropia pachystachya* can be observed as the ten species of highest importance value in the survey carried out, which correspond to 56.54% of the importance value of all the species sampled (Figure 1). Among these, it may be emphasized that *Parkia pendula,* which despite not presenting a high density and frequency, was the species with the highest importance value, which is directly related to its dominance since the highest circumference and height values registered in the area were from this species.

The Shannon-Wiener's diversity index and Pielou's evenness index in the adult woody component were 6.61 nat.ind^{-1} and 0.87, respectively (Table 2). According to Silva Júnior et al. (2008), there is little information with respect to the diversity index in secondary forests for it to be possible to categorically affirm that the value obtained is considered high, which makes its interpretation and comparison difficult. However, when comparing the *Mata da Onça* fragment to other fragments (Table 2), it is observed that the diversity and evenness indices are higher than most of the works carried out in Atlantic Forest in Pernambuco, emphasizing the importance and necessity to preserve this fragment, so that the anthropic actions to which it is submitted do not compromise its diversity.

Figure 1. Diameter distribution, by center of class at 5 cm fixed intervals, of the individuals sampled at *Mata da Onça*, Moreno – PE.



Source: Elaboration of the authors.

Table 2. Shannon-Wiener's diversity index and Pielou's evenness index encountered at Mata da Onça, Moreno – PE and of other surveys carried out in Atlantic Forest fragments in Pernambuco. Where: CI = inclusion criterion of the individuals sampled (cm); H' = Shannon-Wiener's Index; J' = Pielou's evenness Index, DBH = diameter at breast height; CBH = circumference at breast height and PBH = perimeter at breast height.

Fragments	Authors	CI	*H'*	*J'*
Mata da Onça, Moreno	Este Trabalho	CBH≥15	3.61	0.87
Mata da Alcaparra, Recife	Holanda et al. (2010)	CBH≥15	3.29	0.77
Mata das Galinhas, Catende	Guimarães et al. (2009)	CBH≥10	3.43	0.83
Mata da Guararema, Aliança	Oliveira et al. (2009)	CBH≥10	3.08	0.89
Mata da Usina São José, Igarassu	Brandão et al. (2009)	CBH≥10	3.68	0.80
Mata das Caldeiras, Catende	Costa Júnior et al. (2008)	DBH≥4,77	3.83	0.85
Reserva do Gurjaú, Cabo de Santo Agostinho	Silva Júnior et al. (2008)	CBH≥15	3.91	0.83
Mata Campo do Avião, Igarassu	Rocha et al. (2008a)	CBH≥15	3.6	0.76
Matas do Curado, Recife	Rocha et al. (2008b)	DBH≥4,77	3.12	0.78
Mata do Triunfo, São Vicente Férrer	Lopes, Ferraz and Araújo (2007)	PBH≥15	3.99	0.83
Matas do Curado, Recife	Alves Júnior et al. (2006)	CBH≥15	3.2	0.81

Source: Elaboration of the authors.

A considerable variation in the diversity index can be observed, from 2.69 to 3.99 nats.ind^{-1} (Table 2). According to Marangon, Soares and Feliciano (2003), this variation is due to the successional differences, different sampling methodologies, inclusion levels used, taxonomic identification efforts and the dissimilarity existent between the different communities.

In the diametric distribution of *Mata da Onça* (Figure 1) a predominance of individuals in the first class and a decrease in individuals with an increase in the class size was verified. Such decrease in the number of individuals, from the smallest to the highest classes, enables the formation of a negative exponential, known as the inverted "J". This result, according to Machado et al. (2004), is

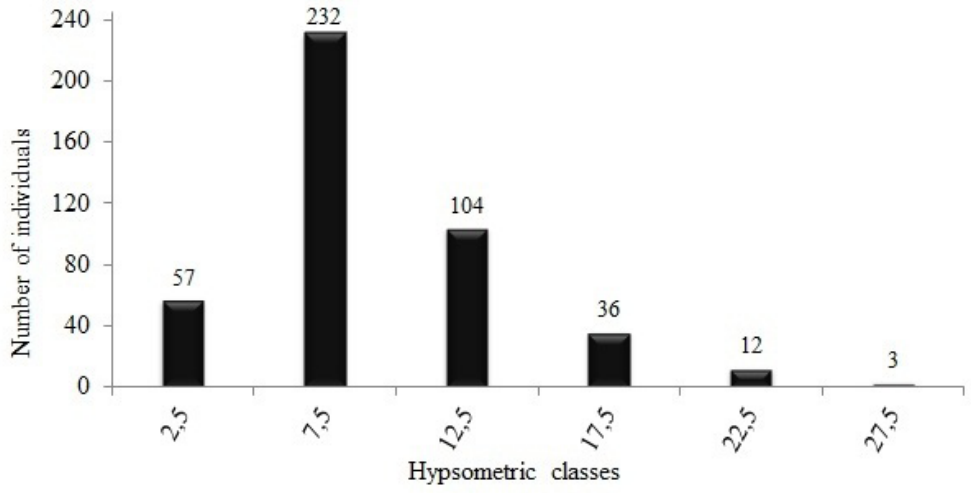
typical and commonly verified in studies of tree-shrub community, characterizing secondary forest formations. With regards to Atlantic Forest areas, such a fact may be related to the historical process of disturbance and of the degradation of these areas, whereas currently only the existence of forest formations in the secondary succession stage is considered.

In Figure 1 it can be observed that around 51% of the individuals are distributed in the first class. Such a percentage is higher than most of the Atlantic Forest fragments studied by Alves Júnior et al. (2007), Costa Júnior et al. (2008), Silva Júnior et al. (2008), Alves Júnior et al. (2009), Oliveira et al. (2009), Alves Júnior et al. (2010) and Holanda et al. (2010), who observed a predominance ranging from 35 to 50.61% of individuals in the first diameter class. This fact is probably related to the strong evidence of anthropic disturbance still existing in the area, as well as the illegal harvesting of individuals with higher wood volume, decreasing the percentage of individuals in the highest diameter classes, and favoring the establishment and development of young individuals.

With respect to the vertical structure of the adult component, the hipsometric distribution, it was established as being in the second and third center of classes with the highest number of individuals, 126 and 191, respectively (Figure 2). Alves Junior et al. (2007) observed a higher distribution from the second to the fourth class. While Rocha et al. (2008a) verified the same distribution, a higher number of individuals present in the second and third hipsometric classes. Adding these results to those observed in the diameter distribution, it may be affirmed, according to Nunes et al. (2003), that communities mainly comprised of individuals with diameters and heights in the first classes are in areas that have suffered more severe disturbance in the past, being encountered in initial stage of succession.

Although the *Mata da Onça* fragment is under process of anthropization and located around a sugar cane plantation, it presents density values similar to those observed in other Atlantic Forest fragments in the region, besides having diversity and evenness values that are considered high. Thus, the necessity for preservation and conservation practices in this area must be emphasized.

Figure 2. Hipsometric distribution, by center of class at 5 m fixed intervals, of the individuals sampled at *Mata da Onça*, Moreno – PE.



Source: Elaboration of the authors.

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