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Vegetation mapping in an area of Ombrophilous Dense Forest at Parque Estadual da Serra do Mar, São Paulo State, Brazil, and floristic composition of the tree component of some physiognomies[1]

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ABSTRACT - (Vegetation mapping in an area of Ombrophilous Dense Forest at Parque Estadual da Serra do Mar, São Paulo State, Brazil, and floristic composition of the tree component of some physiognomies). This study aimed to map phytophysiognomies of an area of Ombrophilous Dense Forest at Parque Estadual da Serra do Mar and characterize their floristic composition. Photointerpretation of aerial photographs in scale of 1:35,000 was realized in association with field work. Thirteen physiognomies were mapped and they were classified as Montane Ombrophilous Dense Forest, Alluvial Ombrophilous Dense Forest or Secondary System. Three physiognomies identified at Casa de Pedra streamlet's basin were studied with more details. Riparian forest (RF), valley forest (VF), and hill forest (HF) presented some floristic distinction, as confirmed by Detrended Correspondence Analysis (DCA) and Indicator Species Analysis (ISA) conducted here. Anthropic or natural disturbances and heterogeneity of environmental conditions may be the causes of physiognomic variation in the vegetation of the region. The results presented here may be useful to decisions related to management and conservation of Núcleo Santa Virgínia forests, in general.
Key words: Atlantic Forest, floristic survey, photointerpretation, phytophysiognomies

RESUMO - (Mapeamento da vegetação em área de Floresta Ombrófila Densa no Parque Estadual da Serra do Mar, SP, Brasil, e composição florística do componente arbóreo de algumas fisionomias). Este trabalho teve como objetivos mapear fitofisionomias de uma área de Floresta Ombrófila Densa no Parque Estadual da Serra do Mar e caracterizar sua composição florística. Realizou-se interpretação de fotografias aéreas, em escala de 1:35.000, associada a estudos de campo. Foram mapeadas 13 fitofisionomias, classificadas como Floresta Ombrófila Densa Montana, Floresta Ombrófila Densa Aluvial ou Sistema Secundário. Três fisionomias identificadas na microbacia do Córrego Casa de Pedra foram estudadas com mais detalhes. Floresta ripária (RF), Floresta de fundo de vale (VF) e Floresta de encosta (HF) apresentaram distinções florísticas, como confirmado pela Análise de Correspondência Distendida (DCA) e pela Análise de Espécies Indicadoras (ISA), aqui realizadas. Distúrbios antrópicos ou naturais e heterogeneidade ambiental podem ser as causas das variações fisionômicas na vegetação da região. Os resultados apresentados, de modo geral, podem ser úteis na tomada de decisões relacionadas ao manejo e à conservação das florestas do Núcleo Santa Virgínia.
Palavras-chave: fitofisionomias, Floresta Atlântica, fotointerpretação, levantamento florístico

Introduction

The Atlantic Forest covered, originally, more than 1,300,000 km^2 of Brazilian territory, which represents about 15% of the total. Distributed along the coastal region, its boundaries covered areas of 17 States and portions of Argentina and Paraguay (Fundação S.O.S. Mata Atlântica & INPE 2008). This area has great biological diversity and high rates of endemism (Mori *et al.* 1981) and is reduced to about 7.5% of

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its original covering, which puts it among the most important global hotspots of biodiversity conservation (Myers *et al.* 2000).

The devastation of Atlantic Forest dates back to the history of colonization of Brazilian territory, and economic activities such as agriculture and industry and the urban expansion are among its main causes (Morellato & Haddad 2000). The largest remaining forests are located in areas where destructive economic activities were not developed due to the rugged topography, such as Serra do Mar (Câmara 1990, Leitão-Filho 1994), although these areas are still under constant threat because of the proximity to large urban centers or areas of economic interest (Dean 1996, Morellato & Haddad 2000).

The conservation of these remaining areas is also attributed to the presence of important conservation units (Franco *et al.* 2007). Among those located in São Paulo State it may be cited as examples the Parque Estadual da Ilha do Cardoso, Estação Ecológica Juréia-Itatins and Parque Estadual da Serra do Mar.

The Parque Estadual da Serra do Mar (PESM) was created in 1977 (Decreto N^o 10,251 of 30/08/1977) and covers an area of about 315,000 ha, located in the eastern portion of São Paulo State. Most of this area is on the escarpments of Serra do Mar, but some portions are located on Atlantic Plateau and Coastal Plain (Instituto Florestal 2006). Because it is a conservation unit with large covering area, PESM is managed through eight administrative units, three of them located at the Atlantic Plateau. Among them there is Núcleo Santa Virginia.

The vegetation of Núcleo Santa Virginia is predominantly comprised by Ombrophilous Dense Forest and, according to Tabarelli & Mantovani (1999), part of that forest suffered clear cut and burn in the 1960s, and it is currently in the form of a mosaic, formed by areas of mature forest, grassland, plantations of *Eucalyptus* spp. and secondary forests at different ages of regeneration.

A very useful tool in studies of characterization of areas with fragmented or heterogeneous vegetation is the vegetation mapping. Küchler (1988) stated that vegetation maps are an integrated expression of local ecological conditions, characterizing it as an accurate way to portray plant communities and their different stages in some area. Thus, techniques of remote sensing and geographical information systems (GIS) have been successfully implemented because of its repetitiveness and capacity of interaction and analysis of different levels of information (Defries & Townsend 1999).

The identification and mapping of spatial patterns of plant communities have received new boost in recent years, facing issues like global climate change and loss of biodiversity in various formations (Sánchez-Azofeifa *et al.* 1999, Foody 2002). However, studies involving mapping of vegetation in protected areas in larger scales are still necessary, especially those with complementary data about the floristic composition of the study area. They can be very useful in detailing the characterization of important remnants of highly endangered formations such as the Atlantic Forest. In São Paulo State, examples of studies involving mapping are those of Peccinini & Pivello (2002), in Parque Estadual das Fontes do Ipiranga and Cardoso-Leite *et al.* (2005), in Reserva Biológica da Serra do Japi. Other works involved mapping of Atlantic Forest in São Paulo in areas outside of conservation units, such as Fidalgo (1995), in Baixada Santista and, more recently, Franco *et al.* (2007) in Embu. The latter work presented also a floristic list that resulted from the field assessment conducted in some fragments mapped.

Thus, this study aimed to realize the mapping of vegetation covering in an area of Ombrophilous Dense Forest at Parque Estadual da Serra do Mar, São Paulo State, Brazil, and also to characterize the floristic composition of the tree component of some physiognomies identified, and thus answering the following question: Are physiognomies studied characterized by distinct floristic groups?

Material and methods

Study area - Núcleo Santa Virgínia (coordinates between 23°17'-23°24'S and 45°03'-45°11'W) at Parque Estadual da Serra do Mar has approximately 16,000 ha. It is inserted in a narrow strip of Atlantic Plateau between the coastal region and Paraíba Valley, covering the municipalities of São Luiz do Paraitinga and Natividade da Serra (Instituto Florestal 2006). The altitudes range from 860 to 1,500 m and the topography appears to be very steep, with straight slopes and valleys (Villani 1998). The predominant types of soil in the region are Red-Yellow Latosol, Cambisol and Litolic (Radambrasil 1983).

The regional climate can be classified as Cwa, according to Köeppen climatic classification (Setzer 1966), and the mean annual precipitation is 2,180 mm. December, January and February are the most humid months of the year while June, July and August present the lowest precipitation volume. The average precipitation for each month exceeds 60 mm (São Paulo 1972).

The vegetation of the area is predominantly characterized by Montane Ombrophilous Dense Forest (Veloso *et al.* 1991).

This study is a result of a partnership between two Brazilian research projects (see Acknowledgments for more information) and the necessity for its implementation arose due to the installation of a micrometeorological tower in Núcleo Santa Virgínia, in the basin of Casa de Pedra streamlet, as predicted in the projects mentioned above. The tower provides the structure for equipments that measure atmospheric flow of energy, H_2O and CO_2 in order to estimate balance of energy, water and carbon in the surrounding areas. Thus, it became necessary to characterize the vegetation in the area of influence of the micrometeorological tower.

Phytophysiognomic mapping - Vegetation mapping was carried out to an area of about 1,950 ha which covers the Casa de Pedra streamlet's basin (115 ha, approximately) and surroundings, at Núcleo Santa Virgínia. The identification of different physiognomies in the study area was performed using bibliographic and cartographic materials (digital and printed), photointerpretation of vertical aerial photographs in natural color, obtained by BASE - Aerofotogrametria e Projetos S/A to SMA - Secretaria do Meio Ambiente do Estado de São Paulo, in 2001, on the scale of 1:35,000, and field verification.

Procedures used were based on the method employed by Lueder (1959) and Spurr (1960), which uses photographic image elements such as color, tone, texture, shape, size and combination of evidences to classify the vegetation, by photointerpretation of aerial photographs, establishing a correlation of photographic and structural elements of vegetation which are observed in the field, such as size of individuals, density, canopy features and other ecological conditions.

After the development of preliminary map, visits to Casa de Pedra streamlet's basin were made in order to check it at the field. Adjacent areas have not been visited and their physiognomies were identified only by aerial photographs analysis. During the field verification, features such as individuals' size, tree density, occurrence of gaps and presence of bamboo in different physiognomies were observed. After the field studies, there were made small corrections in preliminary map and then concluded the preparation of final map. Its digitization was made by scanning in georeferenced base to launch the polygons obtained by photointerpretation and than it was transferred to ArcView 3.2 (ESRI 1999) software to perform the final art.

Estimates of the area occupied by each physiognomy mapped in total area and in Casa de Pedra's basin were calculated in order to complement the characterization of this region. The estimates were also obtained using the program ArcView 3.2 (ESRI 1999).

Floristic composition - From the physiognomies mapped in Casa de Pedra's basin, three (physiognomies 01, 02 and 08, presented in the next section) were selected for implementation of detailed floristic survey, based on phytosociological sampling of the tree component conducted in those areas (Medeiros & Aidar 2011). There were used contiguous plots of 10 × 10 m aggregated in 20 × 50 m (1,000 m^2) blocks. Two blocks (0.2 ha) were installed in each physiognomy, totaling 0.6 ha of sample area. All trees with stem perimeter at 1.30 m above the ground (or perimeter at breast height, PBH) $\geq$ 15 cm were sampled. The physiognomies 01, 02 and 08 are named throughout this work as hill forest (HF), valley forest (VF) and riparian forest (RF), respectively. Sampling areas were selected due to their representativity and accessibility.

Botanical material was collected at vegetative and/or reproductive stage. In the latter case, it was incorporated to Herbarium SP (Instituto de Botânica). Identifications were made by consulting appropriate literature, comparisons with specimens deposited in SP and UEC (Unicamp) and by sending material to specialists. The floristic list was drawn up in accordance with the classification proposed in APG III (2009). Confirmation and update of species names and authors were made by consulting the Lista de Espécies da Flora do Brasil 2012 database at http://floradobrasil.jbrj.gov.br/2012 (access in .10.05.2012).

In order to detect floristic patterns for the physiognomies, two techniques were applied to a matrix of species abundance data. Detrended Correspondence Analysis (DCA) (Hill & Gauch 1980) was performed using the software PAST 2.12 (Hammer *et al.* 2001) and Indicator Species Analysis (ISA) (Dufrêne & Legendre 1997) was carried out using the software PCORD 4.0 (McCune & Mefford 1999). The statistical significance of species' indicator value was assessed via Monte Carlo randomizations.

Results and Discussion

Phytophysiognomic mapping - Thirteen physiognomies were identified by photointerpretation (figure 1). From these, eight were grouped in the class Montane Ombrophilous Dense Forest, three in the class Alluvial Ombrophilous Dense Forest, which are characterized as formations associated with watercourses or located on flooded areas (Veloso *et al.* 1991), and two were grouped in the class Secondary System. The areas occupied by each class and their physiognomies are in table 1, where the predominance of the area covered by Montane Ombrophilous Dense Forest can be seen, in comparison with the other classes.

Alluvial areas showed variable tree size, since large (physiognomy 08), characterizing the riparian forests, going through medium (physiognomy 09), on restricted plains, up to small (physiognomy 10), on plains periodically flooded. In areas occupied by Montane Ombrophilous Dense Forest, similar situation was found, the size of trees varied from large (physiognomies 01, 01A and 02), medium (03, 04 and 07) to small (05 and 06). In Secondary System areas, both physiognomies (11 and 12) showed herbaceous size and were included.

For physiognomies with medium or large tree size from classes Montane Ombrophilous Dense Forest and Alluvial Ombrophilous Dense Forest, analysis of the characteristics of canopy uniformity led to comments related to the state of conservation of some of these physiognomies. For example, in physiognomies 02, 04 and 07, the occurrence of heterogeneous canopy or of canopy heights and spacing with high variation leaded to the observation that these areas have some degree of disturbance in its structure. This can be natural, as trees falls, for example, or anthropogenic, as wood removal. In physiognomy 07, it was possible to identify by aerial photographs and also in subsequent field work, the presence of bamboos causing changes in the canopy of these areas. On the other hand, physiognomy 03 showed very uniform and homogeneous canopy, which led to the observation that it presents a good state of conservation.

In Casa de Pedra streamlet's basin, five physiognomies characterize the vegetation (figure 2): four from Montane Ombrophilous Dense Forest class and one from Alluvial Ombrophilous Dense Forest class. Within the former class of physiognomies, there were drawn some polygons that received the designation 01A in the key. This is because these areas, when analyzed in aerial photos, showed similar features to physiognomy 01, such as size and density of individuals, but it differs by the marked presence of *Vochysia magnifica* Warm. individuals, which was verified during the field work. Table 2 presents the estimated values of area occupied by each of them.

Structural differences in the vegetation of a given area can result from different causes, like disturbance regimes (cutting, burning and selective wood extraction, for example) and environmental heterogeneity (Alves & Metzger 2006). The area of Núcleo Santa Virgínia presents effective human occupation for more than one hundred years since the establishment of a private property there (Tabarelli 1997). According to this author, some forest areas were replaced by small plantations, and as mentioned in the introduction, approximately 40% of original covering suffered burn and cut, about 50 years ago. In addition to this disturbance, different environmental characteristics at the local scale can determine the physiognomic and structural differences identified in the area mapped in this study.

According to Oliveira-Filho *et al.* (2001), on local scale, topographic variables, such as elevation and degree of land slope, for example, have been considered important causes of structural variation in tropical forests. This is directly related to changes in soil properties, that can lead to intricate patterns of resources availability such as water and nutrients, which influence the structure and composition of vegetation (Resende *et al.* 2002). Thus, the irregular topography that characterizes Núcleo Santa Virgínia region can determine differences in plant covering, because of the intrinsic relationship between topography and soil characteristics.

Besides the soil properties, topography determines the patterns of occurrence of watercourses in an area and the exposure sides of vegetation. Consequently, some microclimatic characteristics such as temperature and humidity can vary considerably in some regions, causing differences in structure and physiognomy of the vegetation, as observed by Cardoso-Leite (2000), in Reserva Biológica Municipal da Serra do Japi, São Paulo State.

Regarding structural changes in the canopy of some physiognomies, it was remarkable the presence of bamboos causing internal differences in the vegetation of Núcleo Santa Virgínia region. Physiognomy 07, visibly occupied by bamboos communities, was represented by a large number of polygons, which were responsible for 9.2% of the

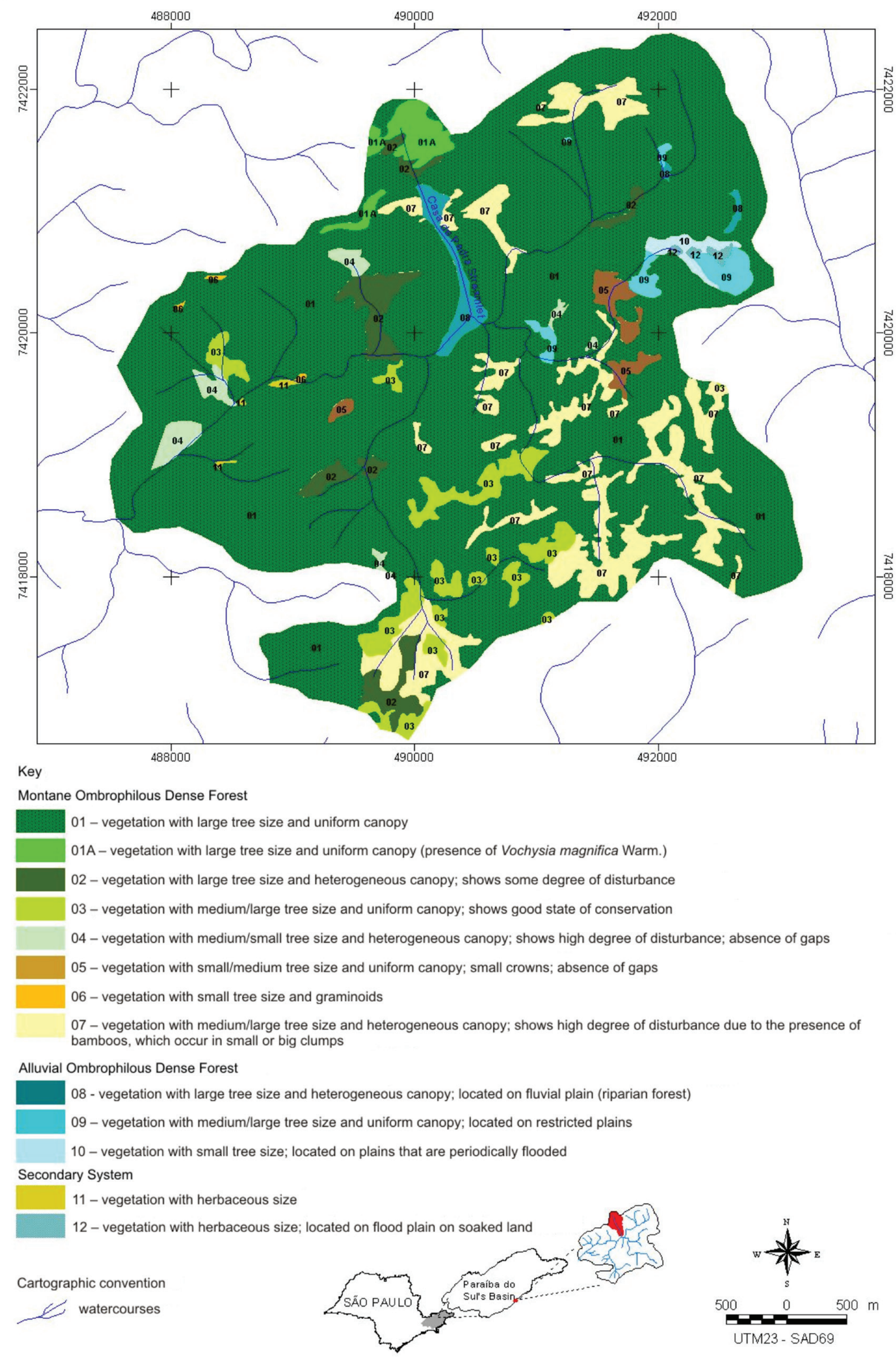

Figure 1. Phytophysiognomic map of an Ombrophilous Dense Forest area at Núcleo Santa Virgínia, Parque Estadual da Serra do Mar, São Paulo State, Brazil.

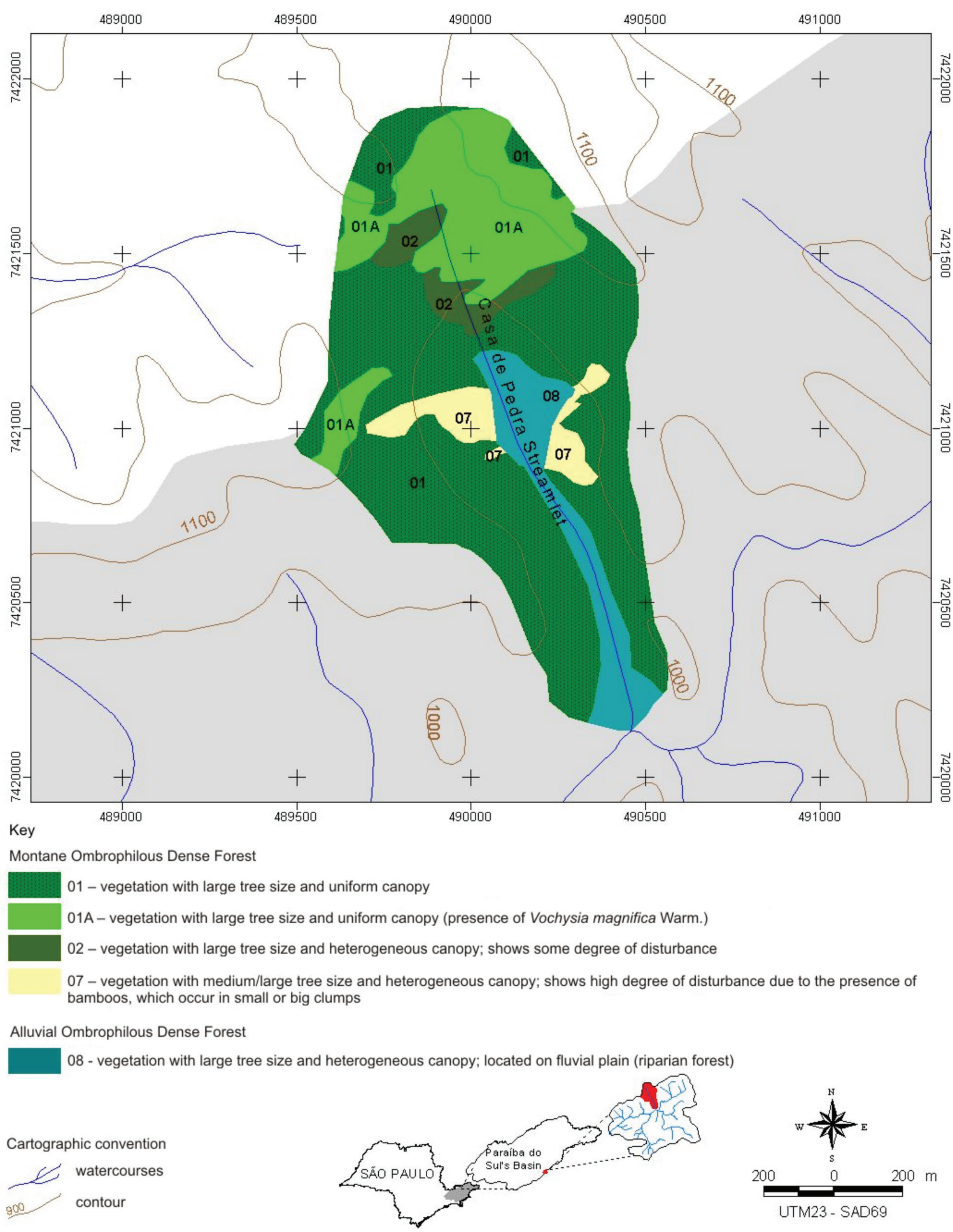

Figure 2. Ampliation of physiognomic map at Casa de Pedra streamlet's basin area, Núcleo Santa Virgínia, Parque Estadual da Serra do Mar, São Paulo State, Brazil.

Table 1. Area occupied by physiognomies in total area mapped at Núcleo Santa Virgínia, Parque Estadual da Serra do Mar, São Paulo State, Brazil.

Class / Physiognomies	Area (ha)
Montane Ombrophilous Dense Forest	-
Physiognomy 01	1,515.46
Physiognomy 01A	24.60
Physiognomy 02	56.00
Physiognomy 03	72.25
Physiognomy 04	22.49
Physiognomy 05	19.75
Physiognomy 06	1.21
Physiognomy 07	180.87
Total	1,892.63
Alluvial Ombrophilous Dense Forest	-
Physiognomy 08	22.59
Physiognomy 09	21.33
Physiognomy 10	9.41
Total	53.33
Secondary System	-
Physiognomy 11	2.01
Physiognomy 12	3.37
Total	5.38

total mapped area. Tabarelli & Mantovani (1999) have noted the frequent presence of bamboo in illuminated habitats of the forests in the region, such as the tops of hills and the rivers edge. The same authors in subsequent work (Tabarelli & Mantovani 2000) discussed the presence of bamboo colonizing gaps in those forests, and being part of the succession process there.

Floristic data – For the total of 1,046 individuals sampled in Casa de Pedra streamlet's basin, there were listed 119 species belonging to 65 genera and 35 families. Twelve species had their identification at the level of genus and three at families (table 3).

Regarding species richness, Myrtaceae (31 species), Lauraceae (10), Rubiaceae (nine), Fabaceae (six), Sapindaceae and Asteraceae (five each) highlighted in the total sampling. They accounted together for 55% of total recorded species. Fifteen families (44%) presented only one species. Among the genera, there were remarkable for their richness *Myrcia* (eight species), *Eugenia* (seven), *Marlierea* (six), *Inga* (five), *Mollinedia* and *Ocotea* (four each), totaling 28% of the total sampled.

Analyzing separately the floristic composition of the physiognomies studied, we observed that the richest families in each of them are cited among that with high species richness in the total sampling. Myrtaceae is the family with greatest number of species in all study area, with 12 species in RF, 16 in VF and 21 in HF. Lauraceae contributed mainly to the richness of RF (four species) and HF (seven species) and Rubiaceae to VF (five species) and HF (six species), mainly. The other families contributed distinctly to the floristic composition of the areas, and some were exclusive to one of the three physiognomies studied: Phyllanthaceae is present only in RF, Aquifoliaceae, Malpighiaceae, Olacaceae, Schoepfiaceae, Siparunaceae and Solanaceae only in VF and Araliaceae, Clusiaceae, Magnoliaceae and Moraceae only in HF. Except for Araliaceae and Solanaceae, with two species, such families are each represented by only one species.

It is noteworthy that the richest families listed in this study, particularly Myrtaceae, Lauraceae, Rubiaceae and Fabaceae were also cited in other studies realized in areas of Atlantic Forest, for example, Silva & Leitão-Filho (1982) and Sanchez *et al.* (1999), in Serra do Mar, Guilherme *et al.* (2004), in Serra de Paranapiacaba and Gomes *et al.* (2005), Catharino *et al.* (2006) and Ogata & Gomes (2006) in Atlantic Plateau, confirming its importance in the general characterization of this domain in southeastern Brazil. Euphorbiaceae and Melastomataceae are also cited as important in this characterization (Ivanauskas *et al.* 2001, Zipparo *et al.* 2005) and although they are not among the families of greatest richness in this study, they were represented by two and four species, respectively. Mantovani (1993) noted also that Myrtaceae, Lauraceae and Fabaceae are families usually well represented in montane formations near the coast of São Paulo, like others sampled in this study, although with smaller species number, such as Cyatheaceae, Sapotaceae and Aquifoliaceae.

Similarly, the genera that presented high species richness in this study are among those with greatest number of tree species in the 102 areas of Atlantic Forest examined by Oliveira-Filho & Fontes (2000). *Eugenia* must be emphasized, because it presented high species richness in studies conducted in other Ombrophilous Dense Forest areas located in São Paulo (Melo & Mantovani 1994, Sanchez *et al.*

Table 2. Area occupied by physiognomies in Casa de Pedra streamlet's basin area, Núcleo Santa Virgínia, Parque Estadual da Serra do Mar, São Paulo State, Brazil.

Class / Physiognomies	Area (ha)
Montane Ombrophilous Dense Forest	-
Physiognomy 01	68.19
Physiognomy 01A	22.95
Physiognomy 02	5.32
Physiognomy 07	6.00
Total	102.46
Alluvial Ombrophilous Dense Forest	-
Physiognomy 08	12.53
Total	12.53

1999, Ivanauskas *et al.* 2001). *Ocotea* and *Myrcia* also should receive emphasis because they presented high species number in another area of Montane Ombrophilous Dense Forest in Reserva Florestal do Morro Grande (Cotia, SP), studied by Catharino *et al.* (2006).

Regarding the occurrence of species in physiognomies, it was observed that the greatest number was found in HF, 76 species, and the fewest in RF, 54. VF, in turn, presented 64 species. HF also presented the highest number of exclusive species (29, corresponding to 24% of total) when compared with RF and VF with, respectively, 14 (12%) and 20 (17%) exclusive species. Of the 56 remaining species, 37 (31% of total) are present in two of the three physiognomies and 19 (16%) have representatives in the three areas of study.

Among the species that occurred in the three sampled areas, *Alchornea triplinervia*, *Cabralea canjerana*, *Matayba guianensis* and *Myrciaria floribunda* are considered widely distributed within the Atlantic domain. *Campomanesia guaviroba*, *Alseis floribunda*, *Euterpe edulis*, *Myrcia pubipetala* and *Ocotea dispersa* are considered typical of lowland Atlantic forests and *Psychotria suterella* of higher altitudes (Oliveira-Filho & Fontes 2000). In the latter category there are also other species that occurred in one or two physiognomies in this study and, according to the same authors, are typical of montane formations: *Casearia obliqua* (occurred just in VF), *Cryptocarya saligna* (HF), *Heisteria silvianii* (VF), *Mollinedia argyrogyna* (VF and HF), *Nectandra puberula* (RF), *Schefflera angustissima* and *S. calva* (HF).

RF is the riparian forest that borders Casa de Pedra streamlet. Some exclusive species of this physiognomy seem being typical of environments of moist soil, such as *Blepharocalyx salicifolius* and *Allophylus edulis* (Lorenzi 2002a, b). *Guarea macrophylla* and *Inga marginata* are also species that characterize riparian forests (Sanchez *et al.* 1999) and occurred in this area, although they are not exclusive of it. VF presents, among its exclusive species, *Casearia decandra*, which is common in open areas that have suffered some disturbance (Lorenzi 2002b). In fact, this physiognomy is characterized by the presence of large gaps and of bamboos' clumps in some portions, what suggests that this area may have suffered some natural or anthropogenic disturbance. HF, in turn, presented among its exclusive species *Nectandra membranacea*, *Inga sessilis*, *Talauma ovata*, *Guapira opposita* and *Syagrus romanzoffiana*, which occur preferably in moist soil areas (Lorenzi 2002a, b). This is due, possibly, to the fact that some of the plots were located near the fluvial plain, where the soil must be moister.

Quantitative analyses – Quantitative analyses confirm that there is some floristic differentiation among the physiognomies. Analyzing the DCA diagram it is possible to detect some groups of plots for each physiognomy, especially for RF and VF (figure 3). Eigenvalues for axis 1 and 2 were 0.5671 and 0.3678, respectively. Distribution of plots in the diagram shows that RF plots are located mostly in the left and lower sides of the diagram and VF plots in the lower and right sides. HF plots, in turn, are more scattered throughout the diagram, especially in its central portion.

ISA results presented as significantly ($p < 0.05$) indicative species of RF (in descending order of indicator value): *Alsophila sternbergii*, *Vernonanthura puberula*, *Myrcia pubipetala*, *Eugenia* sp.1, *Cabralea canjerana*, *Inga marginata* and *Allophylus edulis*. For VF, the species with significant indicator values were *Psychotria suterella*, *Marlierea obscura*, *Psychotria nemorosa* and *Marlierea suaveolens*. For HF, in turn, there were *Alchornea triplinervia*, *Bathysa stipulata*, *Inga lanceifolia* and *Schefflera calva*.

ISA method takes into account parameters such as relative abundance and frequency of the species to generate indicator values for them. Thus, it is expected that the results of ISA analysis illustrate some structural features of the community that is being studied when associate to it a floristic ranking of indicative species. In fact, part of the results obtained,

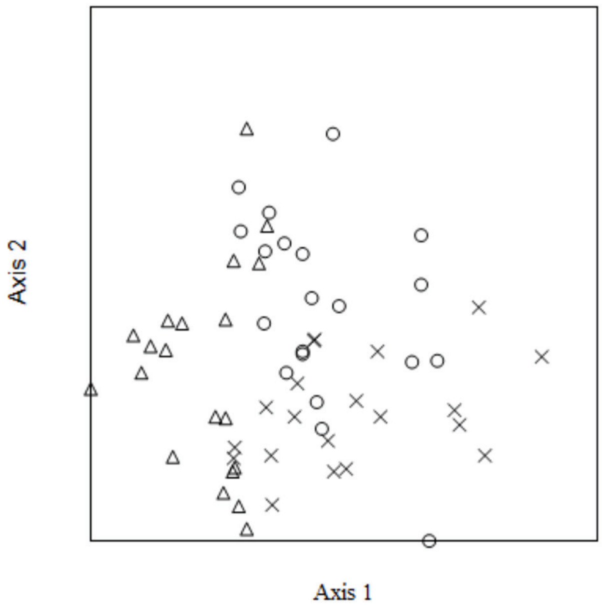

Figure 3. Two-dimensional plots ordination diagram derived from DCA. Triangles: Plots from riparian forest (RF); Crosses: Plots from valley forest (VF); Circles: Plots from hill forest (HF).

especially for RF and HF, corroborate structural data of the studied physiognomies that are discussed in Medeiros & Aidar (2011). In RF, for example, *Alsophila sternbergii* and *Eugenia* sp.1 show high density of trees and *Vernonanthura puberula* and *Myrcia pubipetala* show high values of frequency. In VF, *Psychotria suterella* show high density of trees and in HF, in turn, *Bathysa stipulata* highlights because of the density of trees and *Inga lanceifolia* for its frequency.

Thus, in general, the results presented in this work show that the evident structural variation among the phytophysiognomies, that led to their delimitation and was also discussed elsewhere (Medeiros & Aidar 2011), can be associated to some floristic variation too. We expect this work may be useful to decisions related to management and conservation of Núcleo Santa Virgínia forests, in general, since they provide a general idea about how vegetation is distributed in the area mapped and its ecological conditions. Moreover, the floristic characterization of

Table 3. List of families and species sampled in an Ombrophilous Dense Forest area at Núcleo Santa Virgínia, Parque Estadual da Serra do Mar, São Paulo State, Brazil, and indication of presence in physiognomies studied. RF: Riparian forest; VF: Valley forest; HF: Hill forest.

Family/Specie	RF	VF	HF
ANNONACEAE	-	-	-
Guatteria sp.	-	X	X
Annona dolabripetala Raddi	X	X	-
AQUIFOLIACEAE	-	-	-
Ilex paraguariensis A. St.-Hil.	-	X	-
ARALIACEAE	-	-	-
Schefflera angustissima (Marchal) Frodin	-	-	X
Schefflera calva (Cham.) Frodin & Fiaschi	-	-	X
ARECACEAE	-	-	-
Euterpe edulis Mart.	X	X	X
Syagrus romanzoffiana (Cham.) Glassman	-	-	X
ASTERACEAE	-	-	-
Piptocarpha macropoda (DC.) Baker	-	-	X
Vernonanthura divaricata (Spreng.) H. Rob.	X	-	X
Vernonianthura discolor (Spreng.) H. Rob.	X	-	-
Vernonanthura puberula (Less.) H. Rob.	X	X	X
Asteraceae sp.	X	-	-
BORAGINACEAE	-	-	-
Cordia trichoclada DC.	X	X	-

continue

Table 3 (continuation)

Family/Specie	RF	VF	HF
CARDIOPTERIDACEAE	-	-	-
Citronella paniculata (Mart.) R.A. Howard	X	-	X
CELASTRACEAE	-	-	-
Maytenus sp.1	-	X	-
Maytenus sp.2	-	-	X
CHRYSOBALANACEAE	-	-	-
Licania kunthiana Hook. f.	-	X	X
CLUSIACEAE	-	-	-
Garcinia gardneriana (Planch. & Triana) Zappi	-	-	X
CYATHEACEAE	-	-	-
Alsophila sternbergii (Sternb.) D.S. Conant	X	X	X
Cyathea delgadii Sternb.	X		X
Cyathea phalerata Mart.	X	X	X
ELAEOCARPACEAE	-	-	-
Sloanea hirsuta (Schott) Planch. *ex* Benth.	-	X	X
EUPHORBIACEAE	-	-	-
Alchornea triplinervia (Spreng.) Müll. Arg.	X	X	X
Tetrorchidium rubrivenium Poepp.	X	-	X
FABACEAE	-	-	-
Inga cf. *lanceifolia* Benth.	X	-	-
Inga cf. *arenicola* T.D. Penn.	-	X	-
Inga lanceifolia Benth.	-	X	X
Inga marginata Willd.	X	-	X
Inga sessilis (Vell.) Mart.	-	-	X
Pterocarpus rohrii Vahl	X	-	X
LAURACEAE	-	-	-
Cryptocarya mandioccana Meisn.	-	X	X
Cryptocarya moschata Nees & Mart.	X	-	-
Cryptocarya saligna Mez	-	-	X
Nectandra membranacea (Sw.) Griseb.	-	-	X
Nectandra puberula (Schott) Nees	X	-	-
Ocotea catharinensis Mez	-	-	X
Ocotea daphnifolia (Meisn.) Mez	-	X	-
Ocotea dispersa (Nees & Mart.) Mez	X	X	X
Ocotea glaziovii Mez	X	-	X
Rhodostemonodaphne macrocalyx (Meisn.) Rohwer *ex* Madriñán	-	-	X
MAGNOLIACEAE	-	-	-
Magnolia ovata (A.St.-Hil.) Spreng.	-	-	X

continue

Table 3 (continuation)

Family/Specie	RF	VF	HF
MALPIGHIACEAE	-	-	-
Byrsonima sp.	-	X	-
MELASTOMATACEAE	-	-	-
Leandra barbinervis (Cham. *ex* Triana) Cogn.	X	X	X
Miconia cabucu Hoehne	-	X	-
Miconia sp.	-	-	X
Tibouchina pulchra Cogn.	X	-	X
MELIACEAE	-	-	-
Cabralea canjerana (Vell.) Mart.	X	X	X
Cedrela fissilis Vell.	X	X	-
Guarea macrophylla Vahl	X	-	X
Trichilia pallens C.DC.	X	X	-
MONIMIACEAE	-	-	-
Mollinedia argyrogyna Perkins	-	X	X
Mollinedia blumenaviana Perkins	-	X	X
Mollinedia engleriana Perkins	X	X	X
Mollinedia schottiana (Spreng.) Perkins	-	X	-
MORACEAE	-	-	-
Sorocea bonplandii (Baill.) W.C. Burger, Lanj. & Wess. Boer	-	-	X
MYRSINACEAE	-	-	-
Myrsine gardneriana A. DC.	X	-	X
Myrsine hermogenesii (Jung-Mend. & Bernacci) M.F.-Freitas & Kin.-Gouv.	-	-	X
MYRTACEAE	-	-	-
Blepharocalyx salicifolius (Kunth) O. Berg	X	-	-
Calyptranthes lucida Mart. *ex* DC.	-	X	X
Calyptranthes strigipes O. Berg	-	-	X
Campomanesia guaviroba (DC.) Kiaersk.	X	X	X
Eugenia cf. *cerasiflora* Miq.	-		X
Eugenia oblongata O. Berg.	X	-	-
Eugenia platysema O. Berg	X	-	-
Eugenia prasina O. Berg	-	-	X
Eugenia ternatifolia Cambess.	X	X	X
Eugenia sp.1	X	X	X
Eugenia sp.2	-	-	X
Marlierea cf. *excoriata* Mart.	-	-	X
Marlierea cf. *racemosa* (Vell.) Kiaersk.	-	X	-
Marlierea obscura O. Berg	-	X	X
Marlierea silvatica (O. Berg) Kiaersk.	X	X	-

continue

Table 3 (continuation)

Family/Specie	RF	VF	HF
Marlierea suaveolens Cambess.	-	X	-
Marlierea sp.	-	X	-
Myrceugenia glaucescens (Cambess.) D. Legrand & Kausel	-	-	X
Myrceugenia myrcioides (Cambess.) O. Berg	X	X	-
Myrceugenia seriatoramosa (Kiaersk.) D. Legrand & Kausel	-	-	X
Myrcia amazonica DC.	-	-	X
Myrcia cf. *guianensis* (Aubl.) DC.	-	-	X
Myrcia pubipetala Miq.	X	X	X
Myrcia spectabilis DC.	-	-	X
Myrcia splendens (Sw.) DC.	X	-	X
Myrcia tenuivenosa Kiaersk.	X	-	-
Myrcia tijucensis Kiaersk.	-	X	X
Myrcia sp.	-	X	X
Myrciaria floribunda (H. West *ex* Willd.) O. Berg	X	X	X
Myrciaria sp.	-	X	-
Myrtaceae sp.	-	X	X
NYCTAGINACEAE	-	-	-
Guapira areolata (Heimerl) Lundell	X	X	X
Guapira opposita (Vell.) Reitz	-	-	X
OLACACEAE	-	-	-
Heisteria silvianii Schwacke	-	X	-
PHYLLANTHACEAE	-	-	-
Hieronyma alchorneoides Allemão	X	-	-
RUBIACEAE	-	-	-
Alseis floribunda Schott	X	X	X
Bathysa australis (A. St.-Hil.) K. Schum.	X	-	-
Bathysa stipulata (Vell.) C. Presl	X	X	X
Posoqueria latifolia (Rudge) Roem. & Schult.	-	-	X
Psychotria nemorosa Gardner	-	X	-
Psychotria suterella Müll. Arg.	X	X	X
Psychotria vellosiana Benth.	-	X	-
Rudgea sp.	-	-	X
Rubiaceae sp.	-	-	X
SALICACEAE	-	-	-
Casearia decandra Jacq.		X	-
Casearia obliqua Spreng.	X	-	-
Casearia sylvestris Sw.	X	X	-
SAPINDACEAE	-	-	-
Allophylus edulis (A. St.-Hil., A. Juss. & Cambess.) Hieron. *ex* Niederl.	X	-	-

continue

Table 3 (continuation)

Family/Specie	RF	VF	HF
Cupania oblongifolia Mart.	X	-	-
Cupania vernalis Cambess.	-	X	X
Cupania sp.	X	-	X
Matayba guianensis Aubl.	X	X	X
SAPOTACEAE	-	-	-
Chrysophyllum viride Mart. & Eichler	X	X	-
Micropholis crassipedicellata (Mart. & Eichler *ex* Miq.) Pierre	X	X	-
Pouteria caimito (Ruiz & Pav.) Radlk.	-	X	X
Pouteria psammophila (Mart.) Radlk.	-	X	-
SCHOEPFIACEAE	-	-	-
Schoepfia brasiliensis A.DC.	-	X	-
SIPARUNACEAE	-	-	-
Siparuna brasiliensis (Spreng.) A. DC.	-	X	-
SOLANACEAE	-	-	-
Cestrum schlechtendalii G. Don	-	X	-
Solanum cf. *didymum* Dunal	-	X	-
THYMELAEACEAE	-	-	-
Daphnopsis schwackeana Taub.	-	X	X
URTICACEAE	-	-	-
Coussapoa microcarpa (Schott) Rizzini	-	X	X

some of the identified physiognomies can also serve as a basis for such decisions, since they provide data about the heterogeneity of species groups in the study area.

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