

## Chapter 2

# Estimating Food Sources for Woolly Spider Monkeys (*Brachyteles* spp.) Using the Forest Structure

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### ABSTRACT

The source of food is a determinant of abundance for different taxa of animals. Plant populations in tropical forests are diverse and variable sources of food for herbivorous species. Our aim was to determine if the variation in the density and the basal area of tree species could determine the source of food for *Brachyteles* spp., two of the largest bodied endangered primate species in the Americas, without phenological information. Six Brazilian phytocenosis censuses for areas with woolly spider monkeys and with known forest structure were analyzed by means of multiple regressions. The following variables were included: the ratio of the basal area of food-resource genera to the basal area of non-resource genera (rg/nrg),

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the density of rg/nrg and the density of woolly spider monkeys. The density of *Brachyteles* was significantly related to the rg/nrg basal area, whereas, it was not significantly related to the rg/nrg density alone. The rg/nrg density was inversely related to the rg/nrg basal area. The enlargement of the basal area as a consequence of an enlargement of the trees and the decrease in their densities was significantly related to the increase in the *Brachyteles* abundance. These structural traits may be effects of late succession in forests. Resource genera were more diverse than non-resource genera. Furthermore, it is possible to apply only structural analysis to plan forest amendments intended for *Brachyteles* conservation. Conversion of disturbed areas in amended forests and corridors for *Brachyteles* conservation must establish a high richness of trees and a high number of plant species belonging to resource genera, especially species of later successional stages that produce larger trees.

**Keywords:** *Atelinae, Tropical forest, Succession, Carrying capacity, Conservation.*

## Introduction

Tropical forests are diverse and complex ecosystems that are energetically based upon their plant populations. The plant species distribution is quite heterogeneous in these ecosystems and can vary in terms of plant abundance, range and size, allowing occupation by numerous species of higher trophic levels (Hubbell, 2001).

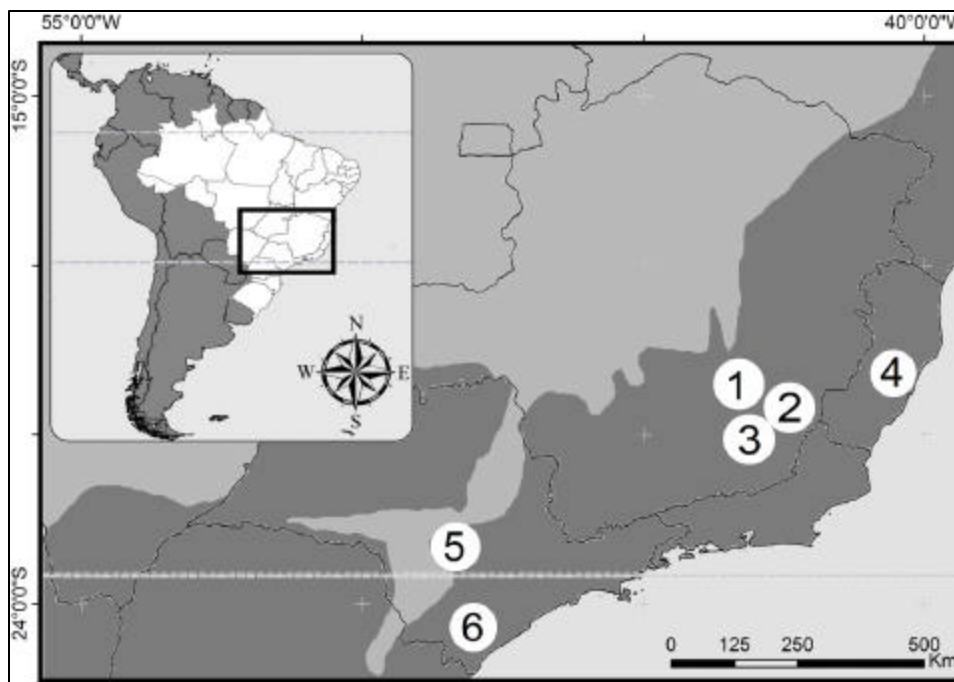
The source of food is considered to be a modulator of the abundance and distribution of organisms from different taxa of animals (Power, 1992; Johnson and Sherry, 2001; Sabo and Power, 2002; Chapman *et al.*, 2003; Frank van Veen and Murrell, 2005; Barlow *et al.*, 2007). Knowledge about the determinants of abundance of primate species is a central issue for ecologists who study the conservation of threatened primate species (Chapman and Peres, 2001).

Structural studies of woody plants can detect compositional variations and can organize populations by their abundance or by their size (Newton, 2007). For example, the absolute abundance of a population is the abundance of a population relative to one hectare of the phytocenosis sampled. Similarly, absolute basal area, a parameter of plant size, is the basal area of a population relative to one hectare of a sampled plant community (Mueller-Dombois and Ellenberg, 1974; McElhinny *et al.*, 2005). Thus, using the structural parameters in a sampled area, absolute abundance and basal area parameters can be calculated. In this way, some primatological studies have been carried out along with structural studies of the vegetation (O'Driscoll-Worman and Chapman, 2006). Structural traits can be used to evaluate the abundance, distribution and size of plant species that are food sources for populations of herbivorous primates.

Long-term phenological studies of tropical forests, in addition to structural investigations, have been used to improve the determination of the availability of food resources for primates in Africa, and these phenological have detected minor oscillations over time (Chapman *et al.*, 2005). However, large interannual variability of rainfall is common in neotropical forests, which are affected by the El Niño Southern Oscillation (Bouchert, 1998; Windsor, 1990; Hagnauer, 1993; Williamson *et al.*, 2000;

Lewis *et al.*, 2004). These forests are adapted to such variations, and this adaptation allows high resistance against catastrophic droughts (Leigh *et al.*, 1990; Condit *et al.*, 1997). For example, after the 1992 drought in eastern Amazonia, Nepstad *et al.* (1994) reported that restoration of soil water reserves to pre-drought levels required two years of normal rainfall. Therefore, neotropical forest phenology is a complex subject even for long-term investigations. In assessments covering only a few years, the habitat of woolly spider monkeys has been studied based on vegetation structure, and significant results have been obtained without phenological data (Silva-Junior *et al.*, 2009; Silva-Junior *et al.*, 2010).

The woolly spider monkey genera comprises only two species, *Brachyteles arachnoides* and *B. hypoxanthus*, also known respectively as southern and northern muriquis. The *Brachyteles* habitat is Atlantic forests (Figure 2.1). Aguirre (1971) reported a preference of the genera *Brachyteles* for mature forests. In contrast, *Brachyteles hypoxanthus* has been observed in high abundance in patches of secondary forests that are not late successional forests (Strier, 1991). Recently, Silva-Junior *et al.* (2009) showed a significant positive relationship between the abundance of *B. hypoxanthus*



**Figure 2.1: Location of the Study Sites**

**1: Rio Doce State Park (PERD); 2: Mata do Sossego Private Reserve (Sossego); 3: Brigadeiro State Park (PESB); 4: Biological Reserves Augusto Ruschi/Santa Lucia (RBAR); 5: Private Reserve Barreiro Rico Farm (FBR); 6: Intervales State Park (PEI). In the larger map, dark grey is the Brazilian Atlantic Forest distribution. Sites 1, 2, 3, 4 are of *Brachyteles hypoxanthus* and 5, 6 of *B. arachnoides*. 1, 2, 3 are in Minas Gerais State, 4 in Espirito Santo State, 5 and 6 are in Sao Paulo State.**

and the basal area (square meters per hectare) of forests. Basal area is positively correlated with the abundance of frugivorous primates of Africa and Asia (O'Driscoll-Worman and Chapman, 2006), whereas, folivorous primate densities are positively correlated with the protein to fiber ratio (PF) of leaves (Chapman *et al.*, 2002). *B. hypoxanthus* has been reported to spend more than 50 per cent of its annual feeding time eating leaves and 32 per cent of its annual feeding time eating fruits (Strier, 1991). Silva-Junior *et al.* (2009) showed that the basal area is more important as an explanatory variable for the abundance of *B. hypoxanthus* than the PF ratio of leaves. Thus, these monkeys could be better described as frugivorous. Nevertheless, the relationship between the primate abundance and the basal area reported by Silva-Junior *et al.* (2009) could have been caused by the presence of large trees of any one species because there is a high connectivity of their crowns. Those connected crowns would benefit the monkeys as safe pathways (Fimbel, 1994).

The structural traits of *B. arachnoides* habitats are supposed to be the same of those of *B. hypoxanthus*. Nevertheless, it is not known for certain if the structural traits of the habitat of *B. hypoxanthus* are the same as those for the habitat of *B. arachnoides*. Furthermore, it is unknown if structural traits of tropical forests can be correlated with *Brachyteles* abundance to determine food resource in the same way as for *Brachyteles hypoxanthus*.

This work addresses the relationship between the abundance of the two species of *Brachyteles*, *B. hypoxanthus* and *B. arachnoides*, and the abundances and sizes of food sources (plants used as food) to test the hypothesis that analysis of the forest structure can determine the food source in the habitats of woolly spider monkeys. In particular, we hypothesized that it is possible to apply only structural analysis to plan forest amendments intended for *Brachyteles* conservation.

## Materials and Methods

### Qualitative Determination of Food Sources

This qualitative survey of food source taxa for woolly spider monkeys was compiled from previous primatological and vegetative censuses. All genera cited as food sources were considered, regardless of the parts (*e.g.* fruits, leaves, or flowers) that were eaten by monkeys or seasonal availability. The primatological reports used were those of Torres de Assumpção (1983), Milton (1984), Strier (1991), Moraes (1992), Petroni (1993, 2000), Carvalho Junior (1996), Rímoli and Ades (1997), Martins (2005), Talebi *et al.* (2005), Mourté (2006), Nogueira (2006) and Pereira (2006), and other plants directly observed to be eaten at Brigadeiro State Park (PESB), Rio Doce State Park (PERD) and Mata do Sossego Private Reserve (Sossego) forests were also included.

Patches in each forest in the latest successional stage were studied (Cesar and Leitão-Filho, 1990; Almeida-Scabbia, 1996; Thomaz, 1996; Silva-Junior *et al.*, 2009, 2010). For each forest, the plant genera were described as resource or non-resource, and their structural parameters were recorded and summed (Tables 2.1–2.13).

The genus was the taxonomic level for the analysis of the quality and quantity of food because there is more precise information for the consumption of plants that refer to genera than to species as food resources. For the forests with occurrences of

**Table 2.1: Forests with *Brachyteles* spp. Occurrence**

	Forests					
	PERD	Sossego	PESB	FBR	PEI	RBAR
D (ind./Km <sup>2</sup> )	1.81	4.8989	7.34	19.5	3.2	1.1
<b>Resource Genera</b>						
NTR	323	623	1239	542	1007	1540
SDRG	40.74	77.8	77.52	45.12	79.72	72.94
SBARG	51.18	78.4	79.7	70.1	84.52	61.8
IVCR	91.92	156.1	157.23	115.22	164.24	134.74
<b>Non-Resource Genera</b>						
NTNR	477	177	361	660	228	654
SDNRG	59.26	22.3	22.59	54.8	18.52	29.93
SBANRG	48.82	21.6	20.3	29.9	14.73	38.17
IVCNR	108.8	43.9	42.81	84.78	33.25	68.81
<b>Ratio</b>						
RN	0.68	3.52	3.44	0.82	4.42	2.35
RRD	0.68	3.52	3.44	0.82	4.3	2.44
RRBA	1.05	3.63	3.93	2.34	5.74	1.62
RIVCR	0.84	3.55	3.67	1.36	4.94	1.96

[PERD–Rio Doce State Park (Silva-Junior *et al.*, 2009a, b), Sossego–Private Reserve Mata do Sossego (Silva-Junior *et al.*, 2009a, b), PESB–Brigadeiro State Park (Silva-Junior *et al.*, 2009a, b), FBR–Private Reserve of Barreiro Rico Farm (Cesar and Leitao-Filho, 1990), PEI–Intervales State Park (Almeida-Scabbia, 1996), RBAR–Biological Reserve Augusto Ruschi (Thomaz, 1996)] and synthetic values of its populations: D = density of *Brachyteles*, NTR = number of trees of resource genera, SDRG = Sum of percentage of density of resource genera, SBARG = Sum of percentage of basal area of resource genera, IVCR = Cover Value Index of resource genera, NTNR = number of trees of non resource genera, SDNRG = Sum of percentage of density of non resource genera, SBANRG = Sum of percentage of basal area of non resource genera, IVCNR = Cover Value Index of non resource genera, Ratio = resource to non-resource ratio, RN = NTR/NTNR, RRD = SDRG/SDNRG, RRBA= SBARG/SBANRG, RIVCR = IVCR/IVCNR.

**Table 2.2: Abundances of Species of Resource Genera (N), Percentage of Density of Resource Genera (DRG), Percentage of Basal Area of Resource Genera (BARG) of Rio Doce State Park forest–PERD (Silva-Junior *et al.*, 2009, 2010)**

Species	N	DRG	BARG
<i>Acacia polyphylla</i>	5	0.63	0.95
<i>Acacia sp</i>	1	0.13	0.25
<i>Alibertia sessilis</i>	2	0.25	0.48
<i>Andira fraxinifolia</i>	2	0.25	0.04
<i>Andira sp</i>	1	0.13	0.14
<i>Annona cacans</i>	1	0.13	0.07

Contd...

Table 2.2–Contd...

Species	N	DRG	BARG
<i>Apuleia leiocarpa</i>	1	0.13	0.34
<i>Aspidosperma parvifolium</i>	1	0.13	0.01
<i>Aspidosperma pyricollum</i>	1	0.13	0.02
<i>Astronyum cf. graveolens</i>	1	0.13	0.31
<i>Banara kuhlmannii</i>	3	0.38	1.44
<i>Bathysia cuspidata</i>	3	0.38	0.07
<i>Campomanesia sp</i>	1	0.13	0.03
<i>Campomanesia xanthocarpa</i>	1	0.13	0.12
<i>Cariniana estrellensis</i>	1	0.13	0.58
<i>Cariniana legalis</i>	3	0.38	4.97
<i>Carpotroche brasiliensis</i>	1	0.13	0.02
<i>Casearia commersoniana</i>	1	0.13	0.06
<i>Casearia guianensis</i>	2	0.25	0.2
<i>Casearia mariquitensis</i>	1	0.13	0.01
<i>Casearia ulmifolia</i>	2	0.25	0.43
<i>Cedrella fissilis</i>	1	0.13	0.14
<i>Celtis sp</i>	1	0.13	0.02
<i>Chrysophyllum gonocarpum</i>	4	0.5	0.88
<i>Chrysophyllum sp</i>	1	0.13	0.07
<i>Clarisia ilicifolia</i>	4	0.5	0.08
<i>Copaifera langsdorffii</i>	2	0.25	0.04
<i>Cordia bullata</i>	2	0.25	0.09
<i>Cordia sp</i>	1	0.13	0.04
<i>Cordia sylvestris</i>	3	0.38	0.05
<i>Croton sp</i>	3	0.38	0.57
<i>Cryptocarya moschata</i>	1	0.13	0.01
<i>Dalbergia sp</i>	1	0.13	0.06
<i>Eriotheca candolleana</i>	1	0.13	0.03
<i>Eriotheca pentaphylla</i>	4	0.5	0.27
<i>Eriotheca sp</i>	1	0.13	0.01
<i>Erythroxylum pelleterianum</i>	1	0.13	0.01
<i>Eugenia cf. florida</i>	1	0.13	0.02
<i>Eugenia cf. uniflora</i>	1	0.13	0.03
<i>Eugenia sp.1</i>	5	0.63	0.33

Contd...

Table 2.2–Contd...

Species	N	DRG	BARG
<i>Eugenia sp.2</i>	2	0.25	0.15
<i>Eugenia sp.3</i>	1	0.13	0.03
<i>Eugenia sp.4</i>	1	0.13	0.05
<i>Euterpe edulis</i>	3	0.38	0.12
<i>Ficus cf.pertusa</i>	1	0.13	0.08
<i>Ficus gomelleira</i>	1	0.13	11.75
<i>Ficus sp</i>	4	0.5	1.82
<i>Galipea multiflora</i>	2	0.25	0.08
<i>Gallesia integrifolia</i>	1	0.13	0.05
<i>Gomidesia spectabilis</i>	2	0.25	0.04
<i>Guapira aff.opposita</i>	1	0.13	0.01
<i>Guapira opposita</i>	3	0.38	0.05
<i>Guarea kunthiana</i>	5	0.63	0.17
<i>Guarea macrophylla</i>	14	1.75	0.87
<i>Guatteria acutitepala</i>	25	3.13	2.53
<i>Guatteria schomburgkiana</i>	2	0.25	0.16
<i>Helicostylis tomentosa</i>	8	1	1.02
<i>Illex sp</i>	3	0.38	0.05
<i>Inga capitata</i>	1	0.13	0.01
<i>Inga cylindrica</i>	1	0.13	0.02
<i>Inga laurina</i>	1	0.13	0.01
<i>Licania cf.octandra</i>	1	0.13	0.07
<i>Licania spicata</i>	1	0.13	0.01
<i>Matayba elaeagnoides</i>	1	0.13	0.03
<i>Maytenus evominoydes</i>	1	0.13	0.02
<i>Mollinedia cf.oligantha</i>	3	0.38	0.05
<i>Mollinedia fasciculata</i>	3	0.38	0.07
<i>Myrcia fallax</i>	3	0.38	0.29
<i>Myrciaria ciliolata</i>	3	0.38	0.11
<i>Myrciaria disticha</i>	4	0.5	0.07
<i>Myrciaria tenella</i>	2	0.25	0.02
<i>Ocotea cf. spectabilis</i>	1	0.13	1.33
<i>Ocotea corymbosa</i>	4	0.5	0.57
<i>Ocotea dispersa</i>	4	0.5	0.19
<i>Ocotea glauca</i>	1	0.13	0.08

Contd...

Table 2.2–Contd...

Species	N	DRG	BARG
<i>Ocotea odorifera</i>	6	0.75	0.15
<i>Ocotea sp.1</i>	5	0.63	0.29
<i>Ocotea sp.2</i>	9	1.13	0.79
<i>Ocotea teleiandra</i>	3	0.38	0.15
<i>Phyllostemonodaphne geminiflora</i>	1	0.13	0.06
<i>Plathymenia foliolosa</i>	2	0.25	0.86
<i>Platypodium elegans</i>	1	0.13	0.03
<i>Pourouma guianensis</i>	1	0.13	0.04
<i>Pouteria caimito</i>	4	0.5	0.16
<i>Pouteria guianensis</i>	2	0.25	0.03
<i>Pouteria macrophylla</i>	1	0.13	0.06
<i>Rollinia laurifolia</i>	2	0.25	0.05
<i>Rollinia sylvatica</i>	27	3.38	0.85
<i>Senna sp</i>	1	0.13	0.14
<i>Siparuna guianensis</i>	18	2.25	0.53
<i>Sloanea guianensis</i>	1	0.13	0.03
<i>Sloanea monosperma</i>	1	0.13	0.1
<i>Solanum leucodendron</i>	1	0.13	0.01
<i>Sorocea bonplandii</i>	5	0.63	0.54
<i>Sorocea guilleminiana</i>	8	1	0.36
<i>Sparatosperma leucanthum</i>	1	0.13	0.01
<i>Spondias dulcis</i>	4	0.5	0.58
<i>Swartzia apetala</i>	1	0.13	0.03
<i>Swartzia myrtifolia</i>	2	0.25	1.35
<i>Swartzia oblata</i>	2	0.25	0.66
<i>Swartzia sp</i>	1	0.13	0.01
<i>Symplocos sp</i>	2	0.25	0.03
<i>Tabebuia sp</i>	1	0.13	0.53
<i>Tapirira guianensis</i>	4	0.5	0.72
<i>Urbanodendron verrucosum</i>	2	0.25	0.04
<i>Viola gardneri</i>	12	1.5	6.43
<i>Xylopia sericea</i>	1	0.13	0.18
<i>Xylopia sp</i>	2	0.25	0.07
<i>Zollernia ilicifolia</i>	2	0.25	0.04
Total	323	40.74	51.18



**Table 2.3: Abundances of Species of Non-Resource Genera (N), Percentage of Density of Non-Resource Genera (DNRG), Percentage of Basal Area of Non-Resource Genera (BANRG) of Rio Doce State Park Forest–PERD (Silva-Junior *et al.*, 2009, 2010)**

<i>Species</i>	<i>N</i>	<i>DNRG</i>	<i>BANRG</i>
<i>Actinostemon lundianus</i>	10	1.25	0.2
<i>Anadenanthera colubrina</i>	1	0.13	0.84
<i>Anadenanthera peregrina</i>	3	0.38	0.94
<i>Anaxagorea dolichocarpa</i>	5	0.63	0.08
<i>Andradea floribunda</i>	11	1.38	0.43
<i>Astrocaryum aculeatissimum</i>	11	1.38	0.82
<i>Bixa arborea</i>	1	0.13	0.01
<i>Bombacaceae 1</i>	1	0.13	0.04
<i>Brosimum guianense</i>	4	0.5	0.15
<i>Calycorectes aff. Australis</i>	2	0.25	0.06
<i>Calycorectes sp</i>	3	0.38	0.16
<i>Calyptanthes cf tetraptera</i>	2	0.25	0.09
<i>Calyptanthes cf. lucida</i>	1	0.13	0.04
<i>Cupania oblongifolia</i>	4	0.5	0.37
<i>Cupania sp</i>	1	0.13	0.01
<i>Cybistax antisifilitica</i>	2	0.25	0.72
<i>Dasyphilum sp</i>	1	0.13	0.3
<i>Dialium divaricatum</i>	1	0.13	0.53
<i>Dialium guianense</i>	3	0.38	0.03
<i>Erythrina sp</i>	1	0.13	0.19
<i>Euphorbiaceae 1</i>	1	0.13	0.03
<i>Heisteria aff ovata</i>	1	0.13	0.03
<i>Hirtella sp</i>	1	0.13	0.06
<b>Indeterminada 1</b>	<b>1</b>	<b>0.13</b>	<b>0.15</b>
<b>Indeterminada 2</b>	<b>1</b>	<b>0.13</b>	<b>0.05</b>
<b>Indeterminada 3</b>	<b>1</b>	<b>0.13</b>	<b>0.51</b>
<b>Indeterminada 4</b>	<b>1</b>	<b>0.13</b>	<b>2.01</b>
<i>Jacaranda micrantha</i>	3	0.38	0.32
<i>Joannesia princeps</i>	4	0.5	0.72
<i>Kielmeyera sp</i>	1	0.13	0.05
<i>Lacistema pubescens</i>	2	0.25	0.15
<i>Lafoesia sp</i>	1	0.13	0.01
<i>Lecythis lurida</i>	2	0.25	0.61

Contd...

Table 2.3—Contd...

Species	N	DNRG	BANRG
<i>Lecythis pisonis</i>	2	0.25	9.8
<i>Leguminosa 2</i>	2	0.25	1.36
<i>Leguminosae 1</i>	1	0.13	0.04
<i>Luehea divaricata</i>	1	0.13	0.03
<i>Machaerium brasiliense</i>	1	0.13	0.32
<i>Machaerium sp.1</i>	1	0.13	0.04
<i>Machaerium sp.2</i>	1	0.13	0.02
<i>Machaerium sp.3</i>	1	0.13	0.01
<i>Neea aff.tristis</i>	1	0.13	0.01
<i>Neoraputia alba</i>	42	5.25	4.31
<i>Peltophorum dubium</i>	1	0.13	0.03
<i>Persea sp</i>	1	0.13	0.62
<i>Plinia sp</i>	1	0.13	0.02
<i>Pradosia lactescens</i>	1	0.13	0.04
<i>Protium sp</i>	3	0.38	0.09
<i>Protium warmingiana</i>	2	0.25	0.24
<i>Pterigota brasiliensis</i>	6	0.75	6.03
<i>Rhamnidium elaeocarpum</i>	2	0.25	0.09
<i>Salacia elliptica</i>	1	0.13	0.01
<i>Schoepfia cf. obliquifolia</i>	4	0.5	0.26
<i>Seguiera sp</i>	1	0.13	0.09
<i>Seguiera americana</i>	1	0.13	0.01
<i>Senefeldera multiflora</i>	272	34	11.24
<i>Simira sampaioana</i>	6	0.75	0.37
<i>Stryphnodendron polyphyllum</i>	2	0.25	0.11
<i>Tetrastylidium grandifolium</i>	1	0.13	0.05
<i>Toulicia laevigata</i>	1	0.13	0.01
<i>Trichilia emarginata</i>	2	0.25	0.03
<i>Trichilia martiana</i>	1	0.13	1.38
<i>Trichilia pallida</i>	5	0.63	0.16
<i>Trichilia silvatica</i>	20	2.5	1.24
<i>Tripterodendron filicifolium</i>	1	0.13	0.02
<i>Zanthoxylum rhoifolium</i>	1	0.13	0.01
Total	477	59.85	48.8

**Table 2.4: Abundances of Species of Resource Genera (N), Percentage of Density of Resource Genera (DRG), Percentage of Basal Area of Resource Genera (BARG) of Sossego Forest (Silva-Junior *et al.*, 2009, 2010)**

Species	N	DRG	BARG
<i>Alchornea triplinervia</i>	18	2.25	2.4
<i>Alibertia sp</i>	16	2	0.44
<i>Allophylus sericeus</i>	2	0.25	0.04
<i>Aspidosperma darienense</i>	4	0.5	0.48
<i>Byrsonima sp</i>	4	0.5	0.05
<i>Cabralea canjerana</i>	3	0.38	1
<i>Campomanesia guaviroba</i>	9	1.13	6.83
<i>Campomanesia sp1</i>	2	0.25	0.08
<i>Campomanesia sp2</i>	2	0.25	0.05
<i>Campomanesia xanthocarpa</i>	1	0.13	0.03
<i>Casearia lasiophylla</i>	7	0.88	2.45
<i>Casearia obliqua</i>	1	0.13	0.01
<i>Cecropia glaziovii</i>	2	0.25	0.17
<i>Cecropia hololeuca</i>	2	0.25	0.44
<i>Cedrela odorata</i>	1	0.13	0.02
<i>Chrysophyllum gonocarpum</i>	3	0.38	0.31
<i>Chrysophyllum marginatum</i>	1	0.13	0.13
<i>Chrysophyllum sp1</i>	5	0.63	1.93
<i>Clusia insignis</i>	9	1.13	8.8
<i>Cordia sellowiana</i>	3	0.38	0.07
<i>Cordia trachyphylla</i>	1	0.13	0.04
<i>Couepia venosa Prance</i>	20	2.5	2.05
<i>Croton sp</i>	5	0.63	0.47
<i>Cyathea delgadii</i>	38	4.75	1.76
<i>Cyathea rufa</i>	8	1	0.19
<i>Cyathea sp1</i>	2	0.25	0.05
<i>Cyathea sp2</i>	2	0.25	0.11
<i>Cyathea sp3</i>	3	0.38	0.05
<i>Cyathea sp4</i>	1	0.13	0.02
<i>Didymopanax sp</i>	1	0.13	0.01
<i>Emmotum nitens</i>	3	0.38	0.06
<i>Endlicheria paniculata</i>	1	0.13	0.02
<i>Eugenia cerasypholia</i>	1	0.13	0.16
<i>Eugenia polystachya</i>	10	1.25	4.64

Contd...

Table 2.4—Contd...

Species	N	DRG	BARG
<i>Eugenia sp 1</i>	9	1.13	1.59
<i>Euterpe edulis</i>	70	8.75	4.96
<i>Guapira opposita</i>	4	0.5	0.17
<i>Guatteria nigrescens</i>	3	0.38	0.09
<i>Guatteria schomburgkiana</i>	22	2.75	3.76
<i>Guatteria villosissima</i>	2	0.25	0.2
<i>Hieronyma alchorneoides</i>	2	0.25	0.89
<i>Huberia glazioviana</i>	2	0.25	0.08
<i>Illex microdonta</i>	2	0.25	0.03
<i>Illex thaezans</i>	1	0.13	0.03
<i>Inga laurina</i>	1	0.13	0.01
<i>Inga sessilis</i>	1	0.13	0.01
<i>Licania sp</i>	1	0.13	0.02
<i>Marleria suaveolens</i>	28	3.5	3.01
<i>Miconia 1</i>	1	0.13	0.02
<i>Miconia 2</i>	3	0.38	0.08
<i>Miconia 3</i>	15	1.88	0.38
<i>Miconia 4</i>	8	1	0.21
<i>Miconia 5</i>	12	1.15	1.3
<i>Miconia collatata</i>	1	0.13	0.01
<i>Miconia eichlerii</i>	10	1.25	0.17
<i>Miconia sellowiana</i>	5	0.63	0.19
<i>Miconia thaezans</i>	6	0.75	0.42
<i>Miconia urophylla</i>	15	1.88	0.41
<i>Miconia valtherii</i>	2	0.25	0.08
<i>Mollinedia schottiana</i>	1	0.13	0.2
<i>Mollinedia sp1</i>	10	1.25	2.69
<i>Mollinedia sp2</i>	5	0.63	0.38
<i>Myrcia fallax</i>	3	0.38	0.22
<i>Myrcia sp</i>	5	0.63	0.8
<i>Nectandra cuspidata</i>	26	3.25	5.26
<i>Nectandra megapotamica</i>	1	0.13	0.01
<i>Nectandra nitidula</i>	2	0.25	2.13
<i>Ocotea aciphyla</i>	1	0.13	0.02
<i>Ocotea corymbosa</i>	4	0.5	0.43

Contd...

Table 2.4—Contd...

Species	N	DRG	BARG
<i>Ocotea dispersa</i>	4	0.5	0.09
<i>Ocotea organensis</i>	8	1	0.54
<i>Ocotea sp</i>	1	0.13	0.03
<i>Ocotea spectabilis</i>	1	0.13	0.02
<i>Ocotea teleiandra</i>	2	0.25	0.05
<i>Piper gigantifolium</i>	10	1.25	0.15
<i>Prunus sellowii</i>	9	1.13	0.38
<i>Psidium cupreum</i>	1	0.13	0.01
<i>Psychotria sessilis</i>	20	2.5	0.85
<i>Randia armata</i>	1	0.13	0.2
<i>Roupala sp</i>	2	0.25	0.06
<i>Sapium biglandulosum</i>	3	0.38	0.04
<i>Sapium sp</i>	7	0.88	0.5
<i>Senna macranthera</i>	3	0.38	0.11
<i>Siphoneugenia sp</i>	3	0.38	0.33
<i>Sloanea guianensis</i>	5	0.63	1.43
<i>Solanum cinnamomeum</i>	4	0.5	1.22
<i>Solanum leucodendron</i>	4	0.5	0.78
<i>Solanum sp1</i>	1	0.13	0.45
<i>Solanum sp2</i>	1	0.13	0.03
<i>Solanum swartzianum</i>	2	0.25	0.19
<i>Sorocea bonplandii</i>	5	0.63	0.35
<i>Swartzia myrtifolia</i>	4	0.5	0.78
<i>Symplocos celastrinea</i>	7	0.88	0.37
<i>Symplocos guianensis</i>	1	0.13	0.02
<i>Symplocos sp</i>	1	0.13	0.05
<i>Tapirira guianensis</i>	1	0.13	0.01
<i>Tibouchina arborea</i>	3	0.38	0.6
<i>Tibouchina granulosa</i>	4	0.5	0.26
<i>Vernonia discolor</i>	15	1.88	1.59
<i>Vernonia polyanthes</i>	1	0.13	0.02
<i>Vochysia magnifica</i>	2	0.25	0.06
<i>Vochysia tucanorum</i>	12	1.5	1.19
Total	623	77.81	78.38

**Table 2.5: Abundances of Species of Non-Resource Genera (N), Percentage of Density of Non-Resource Genera (DNRG), Percentage of Basal Area of Non-Resource Genera (BANRG) of Sossego Forest (Silva-Junior *et al.*, 2009, 2010)**

<i>Species</i>	<i>N</i>	<i>DNRG</i>	<i>BANRG</i>
<i>Alsophyla setosa</i>	19	2.38	0.97
<i>Amaioua guianensis</i>	7	0.88	1.35
<i>Aniba firmula</i>	3	0.38	0.18
<i>Aureliana fasciculata</i>	1	0.13	0.01
<i>Calypthranthes brasiliensis</i>	3	0.38	0.14
<i>Calypthranthes sp1</i>	4	0.5	2.98
<i>Calypthranthes sp2</i>	9	1.13	0.9
<i>Calypthranthes sp3</i>	7	0.88	0.98
<i>Citronela megalophylla</i>	2	0.25	0.1
<i>Clethra scabra Pers</i>	27	3.38	2.03
<i>Cupania oblongifolia</i>	5	0.63	0.15
<i>Geonoma schottiana</i>	11	1.38	0.31
<i>Gordonia semiserrata</i>	10	1.25	1.46
<i>Hedyosmum brasiliensis</i>	3	0.38	0.32
<i>Hippocratea sp</i>	6	0.75	0.18
<i>Hornschuchia cauliflora</i>	1	0.13	0.73
<b>Indet 1</b>	<b>1</b>	<b>0.13</b>	<b>0.18</b>
<b>Indet 10</b>	<b>1</b>	<b>0.13</b>	<b>0.05</b>
<b>Indet 11</b>	<b>1</b>	<b>0.13</b>	<b>0.77</b>
<b>Indet 2</b>	<b>1</b>	<b>0.13</b>	<b>0.96</b>
<b>Indet 3</b>	<b>1</b>	<b>0.13</b>	<b>0.08</b>
<b>Indet 4</b>	<b>1</b>	<b>0.13</b>	<b>0.25</b>
<b>Indet 5</b>	<b>1</b>	<b>0.13</b>	<b>1.7</b>
<b>Indet 6</b>	<b>1</b>	<b>0.13</b>	<b>0.56</b>
<b>Indet 7</b>	<b>1</b>	<b>0.13</b>	<b>0.15</b>
<b>Indet 8</b>	<b>1</b>	<b>0.13</b>	<b>0.21</b>
<b>Indet 9</b>	<b>1</b>	<b>0.13</b>	<b>0.53</b>
<i>Lamanonia ternata</i>	6	0.75	0.95
<i>Leandra sp</i>	1	0.13	0.05
<i>Lobelia sp</i>	1	0.13	0.01
<i>Machaerium triste</i>	2	0.25	0.08
<i>Myrsine cf gardneriana</i>	4	0.5	0.55
<i>Myrsine ferruginea</i>	7	0.88	0.42
<i>Myrsine umbellata</i>	5	0.63	0.32
<i>Myrtaceae 1</i>	5	0.63	0.12

Contd...

**Table 2.5–Contd...**

<i>Species</i>	<i>N</i>	<i>DNRG</i>	<i>BANRG</i>
<i>Ouratea polygyna</i>	1	0.13	0.01
<i>Paussandra maurisiana</i>	3	0.38	0.05
<i>Persea pyrifolia</i>	10	1.25	0.67
<i>Plinia sp</i>	2	0.25	0.07
<i>Pristinaera andina</i>	1	0.13	0.02
Total	177	22.28	21.55

**Table 2.6: Abundances of Species of Resource Genera (N), Percentage of Density of Resource Genera (DRG), Percentage of Basal Area of Resource Genera (BARG) of Brigadeiro State Park–PESB (Silva-Junior *et al.*, 2009, 2010)**

<i>Species</i>	<i>N</i>	<i>DRG</i>	<i>BARG</i>
<i>Alchornea triplinervea</i>	87	5.44	7.21
<i>Allophylus edulis</i>	14	0.88	0.69
<i>Allophylus sericeus</i>	3	0.19	0.11
<i>Annona cacans</i>	5	0.31	0.27
<i>Aspidosperma darienense</i>	8	0.5	0.23
<i>Aspidosperma olivaceum</i>	1	0.06	0.01
<i>Aspidosperma parvifolium</i>	9	0.56	0.47
<i>Bathysa cuspidata</i>	2	0.13	0.03
<i>Bathysa meridionalis</i>	12	0.75	0.33
<i>Cabralea canjerana</i>	9	0.56	0.24
<i>Calyptantes clusifolia</i>	6	0.38	0.12
<i>Campomanesia guaviroba</i>	4	0.25	0.06
<i>Carpotroche brasiliensis</i>	2	0.13	0.05
<i>Casearia arborea</i>	45	2.81	1.04
<i>Casearia decandra</i>	2	0.13	0.03
<i>Casearia gossypiosperma</i>	1	0.06	0.01
<i>Casearia obliqua</i>	3	0.19	0.09
<i>Cecropia glaziovii</i>	13	0.81	0.89
<i>Cecropia hololeuca</i>	5	0.31	1.23
<i>Cedrella fissilis</i>	4	0.25	0.18
<i>Chrysophyllum gonocarpum</i>	2	0.13	0.15
<i>Cinnamomum glaziovii</i>	14	0.88	0.5
<i>Clusia arrudea</i>	8	0.5	0.9
<i>Cordia sellowiana</i>	17	1.06	0.54
<i>Cordia sp</i>	4	0.25	0.09

Contd...

Table 2.6—Contd...

Species	N	DRG	BARG
<i>Coussapoa microcarpa</i>	2	0.13	0.05
<i>Croton floribundus</i>	56	3.5	8.88
<i>Croton sp</i>	14	0.88	0.3
<i>Cyathea delgadii</i>	44	2.75	1.45
<i>Cyathea rufa</i>	14	0.88	0.6
<i>Dalbergia cf brasiliensis</i>	2	0.13	0.03
<i>Dalbergia foliolosa</i>	2	0.13	0.19
<i>Didimopanax calvus</i>	7	0.44	0.34
<i>Didimopanax sp</i>	4	0.25	0.49
<i>Endlicheria paniculata</i>	7	0.44	0.18
<i>Eugenia cerasiflora</i>	4	0.25	0.05
<i>Eugenia cuprea</i>	3	0.19	0.04
<i>Eugenia involucrata</i>	26	1.63	0.75
<i>Eupatorium angulicaule</i>	3	0.19	0.06
<i>Eupatorium inulaefolium</i>	9	0.56	0.32
<i>Euterpe edulis</i>	1	0.06	0.01
<i>Faramea sp</i>	8	0.5	0.13
<i>Gordonia semiserrata</i>	16	1	0.94
<i>Guapira opposita</i>	1	0.06	0.11
<i>Guatteria mexicae</i>	4	0.25	0.11
<i>Guatteria nigrens</i>	42	2.63	1.52
<i>Huberia sellowiana</i>	43	2.69	1.98
<i>Hyeronima alchomioides</i>	1	0.06	0.07
<i>Ilex cf taubertiana</i>	8	0.5	0.31
<i>Ilex paraguariensis</i>	3	0.19	0.21
<i>Ilex thezans</i>	7	0.44	0.39
<i>Inga laurina</i>	12	0.75	0.49
<i>Inga sessilis</i>	7	0.44	0.76
<i>Matayba elaeagnoides</i>	4	0.25	0.22
<i>Matayba sp</i>	3	0.19	0.02
<i>Maytenus evonymoides Reiss</i>	3	0.19	0.15
<i>Maytenus robusta</i>	4	0.25	0.08
<i>Miconia budlejoides</i>	3	0.19	0.11
<i>Miconia cf latecrenada</i>	2	0.13	0.15
<i>Miconia cinanomifolia</i>	1	0.06	0.05
<i>Miconia discolor</i>	5	0.31	0.12

Contd...



Table 2.6—Contd...

<i>Species</i>	<i>N</i>	<i>DRG</i>	<i>BARG</i>
<i>Miconia eichleri</i>	12	0.75	0.27
<i>Miconia forthergillae</i>	1	0.06	0.02
<i>Miconia ibaguensis</i>	1	0.06	0.01
<i>Miconia mendocaei</i>	1	0.06	0.01
<i>Miconia sellowiana</i>	12	0.75	0.54
<i>Miconia sp</i>	1	0.06	0.18
<i>Miconia theazens</i>	1	0.06	0.01
<i>Miconia tristis</i>	12	0.75	0.42
<i>Mollinedia argyrogyna</i>	2	0.13	0.1
<i>Mollinedia ovata</i>	4	0.25	0.09
<i>Mollinedia triflora</i>	6	0.38	0.11
<i>Myrcia fallax</i>	1	0.06	0.01
<i>Myrcia splendens</i>	24	1.5	1.4
<i>Nectandra cuspidata</i>	5	0.31	0.32
<i>Nectandra lanceolata</i>	26	1.63	1.52
<i>Nectandra oppositifolia</i>	9	0.56	1.89
<i>Nectandra reticulata</i>	1	0.06	0.09
<i>Nectandra rigida</i>	5	0.31	0.19
<i>Ocotea cernua</i>	8	0.5	0.16
<i>Ocotea cf acutangula</i>	1	0.06	0.01
<i>Ocotea dispersa</i>	1	0.06	0.02
<i>Ocotea grandiflora Ness</i>	3	0.19	0.26
<i>Ocotea minarum</i>	3	0.19	0.09
<i>Ocotea nitidula Meissm</i>	1	0.06	0.14
<i>Ocotea odorifera</i>	16	1	0.56
<i>Ocotea teliandra</i>	1	0.06	0.01
<i>Ocotea velutina</i>	1	0.06	0.02
<i>Piper gigantifolium</i>	4	0.25	0.11
<i>Piper sp1</i>	5	0.31	0.07
<i>Piper sp2</i>	1	0.06	0.01
<i>Piptocarpha macropoda</i>	7	0.44	0.69
<i>Pouteria laurifolia</i>	3	0.19	0.07
<i>Pouteria macahensis</i>	4	0.25	0.07
<i>Pouteria sp</i>	1	0.06	0.52
<i>Prunus sellowi</i>	2	0.13	0.08
<i>Psychotria capitata</i>	28	1.75	0.84

Contd...

Table 2.6—Contd...

Species	N	DRG	BARG
<i>Psychotria sessilis</i>	20	1.25	0.31
<i>Psychotria sp1</i>	1	0.06	0.04
<i>Qualea sp</i>	4	0.25	0.54
<i>Randia armata</i>	1	0.06	0.01
<i>Rheedia gardneriana</i>	2	0.13	0.04
<i>Rollinia laurifolia</i>	4	0.25	0.09
<i>Rollinia sericea</i>	2	0.13	0.01
<i>Rollinia sylvatica</i>	1	0.06	0.29
<i>Roupala brasiliensis</i>	1	0.06	0.04
<i>Sapium glandulosum</i>	99	6.19	6.55
<i>Sclerolobium rugosum</i>	4	0.25	0.57
<i>Sclerolobium sp</i>	6	0.38	0.89
<i>Sloanea guianensis</i>	2	0.13	0.13
<i>Sloanea monosperma</i>	1	0.06	0.15
<i>Sloanea sp</i>	1	0.06	0.21
<i>Solanum cinnanomeum</i>	50	3.13	5.3
<i>Solanum leucodendron</i>	66	4.13	7.16
<i>Solanum swartzianum</i>	19	1.19	0.71
<i>Sorocea bomplandii</i>	8	0.5	0.2
<i>Styrax cf ferrugineus</i>	1	0.06	0.04
<i>Styrax sp</i>	6	0.38	0.39
<i>Swartzia sp</i>	1	0.06	0.01
<i>Symplocos celastrina</i>	1	0.06	0.06
<i>Symplocos cf variabilis</i>	1	0.06	0.05
<i>Symplocos pubecens Klotzsch ex</i>	1	0.06	0.02
<i>Symplocos sp</i>	3	0.19	0.17
<i>Symplocos uniflora</i>	20	1.25	1.7
<i>Tapirira guianensis</i>	4	0.25	0.14
<i>Tibouchinia arborea</i>	1	0.06	0.01
<i>Tibouchinia forthergillae</i>	2	0.13	0.08
<i>Tibouchinia granulosa</i>	8	0.5	0.24
<i>Tibouchinia sp</i>	1	0.06	0.03
<i>Vernonanthura discolor</i>	2	0.13	0.22
<i>Vernonia diffusa</i>	14	0.88	1.59
<i>Vochysia magnifica</i>	9	0.56	3.6
<i>Vochysia schwaqueana</i>	3	0.19	0.07
Total	1239	77.52	79.7

**Table 2.7: Abundances of Species of Non-Resource Genera (N), Percentage of Density of Non-Resource Genera (DNRG), Percentage of Basal Area of Non-Resource Genera (BANRG) of Brigadeiro State Park–PESB (Silva-Junior *et al.*, 2009, 2010)**

Species	N	DNRG	BANRG
<i>Acalypha brasiliensis</i>	20	1.25	1.19
<i>Actinostemom sp</i>	1	0.06	0.01
<i>Aegiphyla selowiana</i>	6	0.38	0.25
<i>Aloysia virgata</i>	3	0.19	0.12
<i>Amaioua guianensis</i>	28	1.75	0.49
<i>Aniba firmula</i>	2	0.13	0.18
<i>Astronium sp</i>	1	0.06	0.03
<i>Cedrela odorata</i>	1	0.06	0.03
<i>Citronela megaphyla</i>	2	0.13	0.17
<i>Clethra scabra</i>	37	2.31	1.76
<i>Cupania vernalis</i>	8	0.5	0.17
<i>Dasyphilum microcephala</i>	6	0.38	0.42
<i>Dyctioloma vandelianum</i>	1	0.06	0.25
<i>Eremanthus erythropapa</i>	4	0.25	0.91
<i>Erythrina falcata</i>	8	0.5	0.64
<i>Euplassa sp</i>	2	0.13	0.02
<i>Fuchsia sp</i>	1	0.06	0.01
Indeterminada 1	2	0.13	0.03
Indeterminada 2	5	0.31	0.57
Indeterminada 3	2	0.13	0.78
indeterminada 4	2	0.13	1.05
indeterminada 5	4	0.25	0.28
indeterminada 6	4	0.25	0.17
<i>Ixora gardneriana</i>	42	2.63	1.21
<i>Kyelmeiera albopunctata</i>	4	0.25	0.04
<i>Lamanonia ternata</i>	15	0.94	0.5
Lauraceae 1	3	0.19	1.24
Lauraceae 2	2	0.13	0.26
<i>Leandra lacunosa</i>	1	0.06	0.07
<i>Lonchocarpus muelbergianus</i>	2	0.13	0.75
<i>Machaerium cf vestitum</i>	5	0.31	0.11
<i>Marleria sp</i>	1	0.06	0.02
Melastomataceae 1	1	0.06	0.1
<i>Meliosma itatiaie</i>	1	0.06	0.1

Contd...

Table 2.7–Contd...

<i>Species</i>	<i>N</i>	<i>DNRG</i>	<i>BANRG</i>
<i>Meriania sp</i>	2	0.13	0.03
<i>Micropholis crassipedicellata</i>	1	0.06	0.06
<i>Micropholis sp</i>	1	0.06	0.14
<i>Myrcine ferruginea</i>	20	1.25	0.69
<i>Myrcine lineata</i>	1	0.06	0.02
<i>Myrcine umbelata</i>	21	1.31	0.73
<i>Myrsine schwaqueana</i>	9	0.56	0.24
<i>Myrtaceae 1</i>	1	0.06	0.03
<i>Myrtaceae 2</i>	1	0.06	0.02
<i>Myrtaceae 3</i>	11	0.69	0.29
<i>Parapiptadenia sp</i>	1	0.06	0.01
<i>Pausandra morisiana</i>	1	0.06	0.05
<i>Persea pyrifolia</i>	14	0.88	1.77
<i>Persea sp</i>	1	0.06	0.25
<i>Picramnia ciliata</i>	1	0.06	0.02
<i>Rubiaceae 1</i>	1	0.06	0.01
<i>Sapotaceae 1</i>	1	0.06	0.02
<i>Siparuna sp</i>	1	0.06	0.47
<i>Tovomitopsis saldanhae</i>	20	1.25	0.47
<i>Trichillia hirta</i>	3	0.19	0.31
<i>Trichillia magnifoliola</i>	7	0.44	0.12
<i>Trichillia pallida</i>	2	0.13	0.18
<i>Trichillia sylvatica</i>	3	0.19	0.12
<i>Vitex megapotamica</i>	3	0.19	0.08
<i>Vitex triflora</i>	3	0.19	0.07
<i>Zanthoxylum rhoifolium</i>	4	0.25	0.18
Total	361	22.59	20.31

Table 2.8: Abundances of Species of Resource Genera (N), Percentage of Density of Resource Genera (DRG), Percentage of Basal Area of Resource Genera (BARG) of Private Reserve of Barreiro Rico Farm–FBR (Cesar and Leitao-Filho, 1990)

<i>Species</i>	<i>N</i>	<i>DRG</i>	<i>BARG</i>
<i>Acacia polyphylla</i>	10	0.83	0.42
<i>Alchornea triplinervea</i>	5	0.42	2.37
<i>Annona cacans</i>	1	0.08	0.05
<i>Aspidosperma memorale</i>	22	1.83	4.13

Contd...

Table 2.8—Contd...

Species	N	DRG	BARG
<i>Aspidosperma polyneuron</i>	14	1.17	7.23
<i>Astronium graveolens</i>	20	1.67	2.65
<i>Cabralea glaberrima</i>	1	0.08	0.73
<i>Cariniana estrellensis</i>	1	0.17	0.18
<i>Casearia inaequilatera</i>	1	0.08	0.01
<i>Casearia sylvestris</i>	7	0.58	0.24
<i>Cecropia holeuca</i>	2	0.17	0.34
<i>Celtis iguanae</i>	4	0.33	0.1
<i>Celtis spinosa</i>	5	0.42	0.51
<i>Chrysophyllum gonocarpum</i>	2	0.17	0.07
<i>Copaifera langsdorfii</i>	9	0.75	1.67
<i>Cordia sellowiana</i>	2	0.08	0.36
<i>Coussarea contracta</i>	34	2.83	0.62
<i>Croton floribundus</i>	8	0.67	2.19
<i>Cryptocaria moschata</i>	6	0.5	1.39
<i>Dalbergia frutesces</i>	2	0.17	0.02
<i>Didymopanax morototoni</i>	1	0.08	0.28
<i>Duguetia lanceolatum</i>	12	1	1.25
<i>Esenbeckia febrifuga</i>	12	1	0.12
<i>Esenbeckia intermedia</i>	64	5.33	2.14
<i>Esenbeckia leiocarpa</i>	30	2.5	5.31
<i>Esenbeckia paniculata</i>	4	0.33	2.26
<i>Eugenia ligustrina</i>	2	0.17	0.05
<i>Eugenia pluriflora</i>	11	0.92	0.59
<i>Eugenia pyriformis</i>	4	0.33	2.42
<i>Eugenia sphenophylla</i>	4	0.33	0.12
<i>Eugenia umbelliflora</i>	3	0.25	0.07
<i>Faramea umbellifera</i>	2	0.17	0.02
<i>Ficus citrifolia</i>	3	0.25	0.13
<i>Ficus sp</i>	1	0.08	1.75
<i>Guapira opposita</i>	3	0.25	0.12
<i>Guatteria subsessilis</i>	1	0.08	0.02
<i>Hymenaea courbaril</i>	7	0.58	3.61
<i>Inga affinis</i>	1	0.08	0.24
<i>Inga striata</i>	10	0.83	0.42
<i>Ixora gardneriana</i>	11	0.92	0.8
<i>Ixora venulosa</i>	2	0.17	0.01
<i>Jacaratia spinosa</i>	4	0.33	1.19

Contd...

Table 2.8—Contd...

Species	N	DRG	BARG
<i>Mabea fistulifera</i>	1	0.08	0.13
<i>Matayba elaeagnoides</i>	2	0.17	0.43
<i>Miconia candoleana</i>	4	0.33	0.52
<i>Mollinedia widgrenii</i>	5	0.42	1.05
<i>Mouriri chamissoana</i>	34	2.83	3.26
<i>Myrcia guayavaefolia</i>	1	0.08	0.02
<i>Myrciaria sp</i>	3	0.25	0.1
<i>Ocotea acutifolia</i>	4	0.33	0.8
<i>Ocotea brasiliensis</i>	2	0.17	0.12
<i>Ocotea catharinensis</i>	3	0.25	0.36
<i>Ocotea diospyrifolia</i>	2	0.17	0.09
<i>Ocotea pretiosa</i>	1	0.08	0.03
<i>Ocotea pulchela</i>	1	0.08	0.07
<i>Ocotea spixiana</i>	9	0.75	5.83
<i>Pera obovata</i>	1	0.08	0.03
<i>Piptadenia gonoacantha</i>	2	0.17	0.48
<i>Piptocarpha macropoda</i>	5	0.42	0.53
<i>Prunus sellowii</i>	3	0.25	0.27
<i>Qualea jundiahi</i>	10	0.83	1.72
<i>Qualea multiflora</i>	4	0.33	0.19
<i>Rheedia gardneriana</i>	1	0.08	0.03
<i>Roupala brasiliensis</i>	4	0.33	1.11
<i>Rudgea jasminioides</i>	50	4.17	0.85
<i>Siparuna guianensis</i>	6	0.5	0.07
<i>Sloanea monosperma</i>	3	0.25	0.98
<i>Solanum inaequale</i>	1	0.08	0.01
<i>Solanum swartzianum</i>	5	0.42	0.08
<i>Strychnos brasiliensis</i>	1	0.08	0.03
<i>Syagrus romanzoffiana</i>	1	0.08	0.23
<i>Symplocos sp</i>	3	0.25	0.32
<i>Tabebuia vellosi</i>	2	0.17	0.04
<i>Tapirira guianensis</i>	3	0.25	0.18
<i>Terminalia brasiliensis</i>	5	0.42	0.28
<i>Vernonia diffusa</i>	2	0.17	0.03
<i>Vitex sp</i>	1	0.08	0.07
<i>Xylopiya brasiliensis</i>	4	0.33	0.57
<i>Zollernia ilicifolia</i>	4	0.33	0.49
<i>Zollernia securidacifolia</i>	1	0.08	0.49
Total	542	45.12	70.09

**Table 2.9: Abundances of Species of Non-Resource Genera (N), Percentage of Density of Non-Resource Genera (DNRG), Percentage of Basal Area of Non-Resource Genera (BANRG) of Private Reserve of Barreiro Rico Farm–FBR (Cesar and Leitao-Filho, 1990)**

<i>Species</i>	<i>N</i>	<i>DNRG</i>	<i>BANRG</i>
<i>Actinostemon estrellensis</i>	156	13	4.71
<i>Aegiphilla lhotskiana</i>	1	0.08	0.02
<i>Aparistimum cordatum</i>	14	1.17	0.96
<i>Bauhinia fusconervis</i>	1	0.08	0.01
<i>Bernardinia fluminensis</i>	1	0.08	0.03
<i>Calyptranthes lucida</i>	3	0.25	0.14
<i>Couratea hexandra</i>	1	0.08	0.03
<i>Cupania vernalis</i>	1	0.08	0.02
<i>Diatenopterix sorbifolia</i>	3	0.25	0.26
<i>Galipea jasminiflora</i>	17	1.42	0.21
<i>Gochnatia polymorpha</i>	2	0.17	0.1
<i>Guazuma ulmifolia</i>	4	0.33	0.13
<i>Machaeriu vestitum</i>	2	0.17	0.07
<i>Machaerium stiptatum</i>	3	0.25	0.14
<i>Maprounea brasiliensis</i>	4	0.33	0.8
<i>Metrodorea nigra</i>	211	17.58	4.59
<i>Neomitranthes obscura</i>	58	4.83	1.29
<i>Ouratea salicifolia</i>	3	0.25	0.06
<i>Pachystroma ilicifolium</i>	9	0.75	7.09
<i>Peschieria fuchsiaefolia</i>	3	0.25	0.03
<i>Pilocarpus pauciflorus</i>	50	4.17	1.94
<i>Prockia crucis</i>	2	0.17	0.08
<i>Rapanea guianensis</i>	3	0.25	0.11
<i>Rapanea lancifolia</i>	2	0.08	0.33
<i>Rhamnidium elaeocarpum</i>	3	0.17	0.2
<i>Savia dyctiocarpa</i>	53	4.42	5.47
<i>Sebastiana Klotschiana</i>	26	2.17	0.28
<i>Trichilia catigua</i>	6	0.5	0.07
<i>Trichilia claussoni</i>	3	0.25	0.04
<i>Trichilia pallida</i>	10	0.83	0.21
<i>Villaresia mucronata</i>	1	0.08	0.05
<i>Zanthoxylum rhoifolium</i>	2	0.17	0.36
<i>Zeyhera tuberculosa</i>	2	0.17	0.14
Total	660	54.83	29.97

**Table 2.10: Abundances of Species of Resource Genera (N), Percentage of Density of Resource Genera (DRG), Percentage of Basal Area of Resource Genera (BARG) of Intervalles State Park forest–PEI (Almeida-Scabbia, 1996)**

<i>Species</i>	<i>N</i>	<i>DRG</i>	<i>BARG</i>
<i>Alchornea glandulosa</i>	125	9.06	14.5
<i>Alchornea triplinervea</i>	13	1.28	1.43
<i>Alibertia myrcifolia</i>	3	0.21	0.07
<i>Allophylus edulis</i>	1	0.07	0.06
<i>Andira antelmia</i>	6	0.57	0.4
<i>Aspidosperma aff monocarpum</i>	3	0.21	0.21
<i>Aspidosperma olivaceum</i>	14	1	0.65
<i>Bathysa meridionalis</i>	41	2.92	1.53
<i>Buchenavia kleinii</i>	3	0.21	0.18
<i>Byrsonima ligustrina</i>	10	1	0.31
<i>Cabralea canjerana</i>	17	1.21	3.37
<i>Campomanesia guaviroba</i>	8	0.57	0.56
<i>Campomanesia xanthocarpa</i>	3	0.21	0.15
<i>Capsicodendrum dinisii</i>	6	0.43	0.77
<i>Cariniana estrelensis</i>	6	0.43	0.59
<i>Casearia sylvestris</i>	8	0.57	0.32
<i>Cedrella fissilis</i>	12	0.86	1.26
<i>Chrysophyllum inornatum</i>	9	0.64	1.22
<i>Chrysophyllum viridae</i>	26	1.85	3.49
<i>Copaifera trapezifolia</i>	17	1.43	1.72
<i>Cordia sellowiana</i>	7	0.5	0.24
<i>Coussapoa microcarpa</i>	11	0.86	1.12
<i>Croton urucurana</i>	7	0.5	0.57
<i>Cryptocaria moschata</i>	9	0.64	0.96
<i>Cyathea sp</i>	13	0.93	0.21
<i>Dalbergia brasiliensis</i>	11	1.07	0.52
<i>Dalbergia variabilis</i>	2	0.14	0.34
<i>Didimopanax augustissimus</i>	5	0.36	0.21
<i>Didimopanax calvum</i>	3	0.36	0.2
<i>Duguetia lanceolata</i>	4	0.36	0.27
<i>Eugenia bracteola</i>	4	0.36	0.23
<i>Eugenia cerasifolia</i>	7	0.57	0.66
<i>Eugenia excelsa</i>	3	0.21	0.14
<i>Eugenia involucrata</i>	2	0.14	0.3

Contd...



Table 2.10–Contd...

<i>Species</i>	<i>N</i>	<i>DRG</i>	<i>BARG</i>
<i>Eugenia kleinii</i>	5	0.36	0.18
<i>Eugenia nedeliana</i>	1	0.07	0.08
<i>Eugenia prunosa</i>	2	0.14	0.1
<i>Eugenia strictosepala</i>	2	0.14	0.03
<i>Eugenia sulcata</i>	2	0.21	0.13
<i>Eugenia vernucosa</i>	1	0.07	0.09
<i>Euterpe edulis</i>	10	0.71	0.13
<i>Faramea montevidensis</i>	1	0.14	0.23
<i>Ficus organensis</i>	3	0.29	7.15
<i>Gomidesia anacardifolia</i>	2	0.14	0.04
<i>Gomidesia fensliana</i>	11	1.14	0.74
<i>Gomidesia schaueriana</i>	7	0.5	0.37
<i>Gomidesia tijucensis</i>	4	0.29	0.41
<i>Guapira opposita</i>	28	2.21	1.83
<i>Guatteria australis</i>	12	1.36	0.55
<i>Guatteria ducenii</i>	2	0.14	0.11
<i>Hyeronima alchomioides</i>	14	1	0.76
<i>Hymenaea courbaril</i>	2	0.14	0.32
<i>Inga capitata</i>	2	0.14	0.05
<i>Inga marginata</i>	4	0.29	0.09
<i>Inga sessilis</i>	2	0.14	0.09
<i>Jacatia spinosa</i>	1	0.07	0.35
<i>Licania hoehrii</i>	1	0.07	0.06
<i>Licania octandra</i>	5	0.5	0.3
<i>Marlieria reitzii</i>	1	0.07	0.07
<i>Marlieria tomentosa</i>	7	0.5	0.28
<i>Matayba guianensis</i>	4	0.36	0.3
<i>Matayba jungladifolia</i>	3	0.21	0.05
<i>Maytenus cestrifolia</i>	30	2.7	3.19
<i>Maytenus robusta</i>	7	0.57	0.3
<i>Miconia cabucu</i>	3	0.21	0.04
<i>Miconia latecrenada</i>	2	0.14	0.02
<i>Mollinedia gilgiana</i>	2	0.21	0.09
<i>Mollinedia schottiana</i>	8	0.57	0.29
<i>Myciaeugetia myrcioides</i>	7	0.5	0.2

Contd...

Table 2.10–Contd...

<i>Species</i>	<i>N</i>	<i>DRG</i>	<i>BARG</i>
<i>Myrcia cuspidata</i>	2	0.14	0.04
<i>Myrcia pubipetala</i>	8	0.57	0.59
<i>Myrcia rostrata</i>	24	2.07	0.7
<i>Myrocarpus frondosus</i>	8	0.57	0.19
<i>Nectandra membranaceae</i>	4	0.29	0.67
<i>Nectandra oppositifolia</i>	3	0.21	0.52
<i>Nectandra puberula</i>	2	0.14	0.2
<i>Ocotea aciphylla</i>	21	1.85	1.13
<i>Ocotea corymbosa</i>	5	0.5	0.37
<i>Ocotea diospyrifolia</i>	10	0.93	1.57
<i>Ocotea dispersa</i>	5	0.36	0.19
<i>Ocotea divaricata</i>	4	0.29	0.47
<i>Ocotea elegans</i>	15	1.14	0.87
<i>Ocotea glaziovii</i>	6	0.5	0.39
<i>Ocotea lanceolata</i>	4	0.36	0.12
<i>Ocotea laxa</i>	1	0.07	0.08
<i>Ocotea odorifera</i>	17	1.43	0.61
<i>Ocotea porosa</i>	29	2.21	2.92
<i>Ocotea puberula</i>	5	0.43	0.48
<i>Ocotea pulchella</i>	2	0.14	0.14
<i>Ocotea silvestris</i>	2	0.14	0.13
<i>Pera glabrata</i>	6	0.5	0.24
<i>Piptadenia adantoides</i>	9	0.64	0.62
<i>Posoqueria latifolia</i>	5	0.36	0.24
<i>Pouteria bullata</i>	29	2.21	1.77
<i>Pouteria caymito</i>	7	0.5	0.63
<i>Pouteria grandiflora</i>	2	0.14	0.06
<i>Prunus sellowii</i>	4	0.29	0.09
<i>Psidium cattleianum</i>	1	0.14	0.05
<i>Psychotria longipes</i>	1	0.14	0.06
<i>Psychotria suturella</i>	5	0.36	0.19
<i>Rollinia sericea</i>	12	0.86	0.98
<i>Roupala cf meisneri</i>	1	0.07	0.08
<i>Roupala rhombifolia</i>	2	0.21	0.09
<i>Rudgea gardnerioides</i>	2	0.21	0.21

Contd...

**Table 2.10–Contd...**

<i>Species</i>	<i>N</i>	<i>DRG</i>	<i>BARG</i>
<i>Rudgea jasminioides</i>	2	0.14	0.03
<i>Sapium glandulatum</i>	4	0.29	0.67
<i>Sclerobium denudatm</i>	8	0.86	1.33
<i>Sloanea monosperma</i>	2	0.14	0.08
<i>Solanum inaequale</i>	1	0.07	0.07
<i>Solanum rufescens</i>	13	1.14	0.75
<i>Solanum swartzianum</i>	5	0.36	0.24
<i>Sorocea bomplandii</i>	2	0.14	0.04
<i>Swartzia aff. acutifolia</i>	5	0.36	0.36
<i>Symplocos falcata</i>	2	0.14	0.07
<i>Talauma ovata</i>	6	0.43	0.74
<i>Tapirira guianensis</i>	18	1.43	1.35
<i>Tibouchina granulosa</i>	1	0.14	0.06
<i>Tibouchina pulchra</i>	31	3.07	1.79
<i>Vernonia polyanthes</i>	5	0.43	0.24
<i>Virola oleifera</i>	5	0.36	0.26
<i>Xylopiya brasiliensis</i>	12	0.86	0.34
<i>Zollernia ilicifolia</i>	5	0.36	0.63
Total	1007	79.72	84.52

**Table 2.11: Abundances of Species of Non-Resource Genera (N), Percentage of Density of Non-Resource Genera (DNRG), Percentage of Basal Area of Non-Resource Genera (BANRG) of Intervalles State Park forest–PEI (Almeida-Scabbia, 1996)**

<i>Species</i>	<i>N</i>	<i>DNRG</i>	<i>BANRG</i>
<i>Abarema langsdorfii</i>	12	1	0.52
<i>Aiouea acarodonatifera</i>	4	0.43	0.27
<i>Amaioua guianensis</i>	2	0.14	0.08
<i>Aniba firmula</i>	3	0.29	0.06
<i>Bailschmedia emarginata</i>	10	0.71	1.45
<i>Calycorectes acutalus</i>	1	0.07	0.08
<i>Calypthrantes concina</i>	6	0.43	0.19
<i>Calypthrantes grandiflora</i>	1	0.07	0.12
<i>Celastraceae 1</i>	3	0.29	0.46
<i>Chronanthus trichotomus</i>	13	1	0.44
<i>Chrysobalanaceae 1</i>	1	0.07	0.2

Contd...

Table 2.11–Contd...

Species	N	DNRG	BANRG
<i>Citronella megaphylla</i>	2	0.14	0.1
<i>Clethra scabra</i>	9	0.64	0.31
<i>Coccoloba warmingi</i>	1	0.14	0.11
<i>Connarus rostratus</i>	3	0.21	0.07
<i>Cupania oblongifolia</i>	5	0.36	0.33
<i>Cupania racemosa</i>	1	0.07	0.07
<i>Cupania zanthoxyloides</i>	3	0.21	0.11
<i>Drymis brasiliensis</i>	2	0.14	0.12
<i>Gordonia fruticosa</i>	21	2.07	1.64
<i>Heistena silvianii</i>	11	0.78	0.41
<i>Hirtela hebeclada</i>	8	0.57	0.2
Indeterminad	1	0.14	0.13
<i>Jacaranda puberula</i>	5	0.36	0.27
<i>Lamanonia ternata</i>	4	0.5	0.26
<i>Machaerium nictitans</i>	2	0.14	0.44
<i>Neomithrantes glomerata</i>	15	1.07	1.25
<i>Newmania pinnata</i>	1	0.07	0.06
<i>Nseis floribunda</i>	2	0.14	0.29
<i>Ormosia minor</i>	16	1.28	0.55
<i>Ouratea cf parviflora</i>	2	0.21	0.06
<i>Persea pyrifolia</i>	3	0.29	0.17
<i>Persea venosa</i>	2	0.21	0.21
<i>Phytolacca dioica</i>	4	0.29	0.44
<i>Platimiscium floribundum</i>	3	0.21	0.11
<i>Protium heptaphyllum</i>	22	1.93	1.41
<i>Pterocarpus rhoni</i>	9	0.64	0.64
<i>Rapanea umbellata</i>	6	0.5	0.23
<i>Vannilosmopsis erythropappa</i>	1	0.14	0.04
<i>Vitex polygama</i>	4	0.29	0.64
<i>Weinnannia paulinifolia</i>	2	0.14	0.13
<i>Zanthoxylum rhoifolium</i>	2	0.14	0.06
Total	228	18.52	14.73

**Table 2.12: Abundances of Species of Resource Genera (N), Percentage of Density of Resource Genera (DRG), Percentage of Basal Area of Resource Genera (BARG) of Biological Reserve Augusto Ruschi forest–RBAR (Thomaz, 1996)**

<i>Species</i>	<i>N</i>	<i>DRG</i>	<i>BARG</i>
<i>Alchornea triplinervia</i>	4	0.18	0.25
<i>Alibertia sp1</i>	1	0.05	0.05
<i>Alibertia sp2</i>	2	0.09	0.03
<i>Allophylus laevigatus</i>	5	0.23	0.23
<i>Allophylus petiolulatus</i>	3	0.14	0.25
<i>Andira fraxinifolia</i>	1	0.05	0.04
<i>Aparisthium cordatum</i>	7	0.32	0.1
<i>Aspidosperma cf. parvifolium</i>	4	0.18	0.19
<i>Aspidosperma melanocalyx</i>	1	0.05	0.2
<i>Banara sp</i>	4	0.18	0.17
<i>Bathysa australis</i>	6	0.27	0.07
<i>Bathysa stipullata</i>	4	0.18	0.04
<i>Buchenavia sp</i>	6	0.27	0.27
<i>Byrsonima sp</i>	6	0.27	0.19
<i>Byrsonima variabilis</i>	10	0.46	0.33
<i>Cabralea canjerana</i>	1	0.05	0.01
<i>Calyptranthes sp11</i>	2	0.09	0.14
<i>Campomanesia laurifolia</i>	1	0.05	0.01
<i>Campomanesia sp</i>	2	0.09	0.2
<i>Campomanesia xanthocarpa</i>	1	0.05	0.01
<i>Casearea sp3</i>	7	0.32	0.11
<i>Casearia cf. brasiliensis</i>	3	0.14	0.08
<i>Casearia commersoniana</i>	7	0.32	0.22
<i>Casearia sp2</i>	1	0.05	0.03
<i>Casearia sp4</i>	5	0.23	0.1
<i>Cecropia hololeuca</i>	2	0.09	0.09
<i>Cecropia pachystachya</i>	2	0.09	0.15
<i>Chrysophyllum flexuosum</i>	1	0.05	0.02
<i>Chrysophyllum gonocarpum</i>	3	0.14	0.04
<i>Cinnamomum riedelianum</i>	3	0.14	0.06
<i>Cinnamomum sp1</i>	5	0.23	0.12
<i>Cinnamomum sp2</i>	3	0.14	0.18
<i>Cinnamomum sp3</i>	1	0.05	0.01
<i>Clusia sp1</i>	2	0.09	0.19
<i>Clusia sp2</i>	2	0.09	0.08

Contd...

Table 2.12–Contd...

Species	N	DRG	BARG
<i>Copaifera lanfisdorfii</i>	5	0.23	0.42
<i>Cordia cf. taguahyensis</i>	3	0.14	0.09
<i>Cordia sp</i>	1	0.05	0.02
<i>Couepia grandiflora</i>	2	0.09	0.05
<i>Couepia macrophylla</i>	1	0.05	0.01
<i>Couepia venosa</i>	3	0.14	0.08
<i>Coussapoa cf. glaberrima</i>	2	0.09	0.05
<i>Coussapoa microcarpa</i>	19	0.87	1.67
<i>Coussapoa pachyphylla</i>	13	0.59	0.81
<i>Crhysophyllum sp1</i>	5	0.23	0.06
<i>Croton floribundus</i>	1	0.05	0.05
<i>Cryptocarya sp1</i>	11	0.5	0.32
<i>Cryptocarya sp2</i>	2	0.09	0.02
<i>Cryptocarya sp3</i>	3	0.14	0.2
<i>Cryptocarya sp4</i>	3	0.14	0.05
<i>Crysophyllum splendens</i>	10	0.46	0.26
<i>Dalbergia foliolosa</i>	1	0.05	0.04
<i>Dalbergia miscolobium</i>	1	0.05	0.05
<i>Dalbergia sp</i>	2	0.09	0.18
<i>Didymopanax angustissimum</i>	2	0.09	0.04
<i>Didymopanax claussonianum</i>	1	0.05	0.05
<i>Didymopanax morototoni</i>	3	0.14	0.22
<i>Didymopanax sp1</i>	3	0.14	0.68
<i>Duguetia sp</i>	2	0.09	0.04
<i>Endlicheria paniculata</i>	1	0.05	0.01
<i>Endlicheria sp1</i>	1	0.05	0.02
<i>Endlicheria sp2</i>	4	0.18	0.17
<i>Eriotheca macrophylla</i>	46	2.1	2.86
<i>Eriotheca sp</i>	4	0.18	0.07
<i>Erythroxyllum sp</i>	1	0.05	0.05
<i>Erythroxyllum aff. macrophyllum</i>	1	0.05	0.01
<i>Erythroxyllum cuspidifolium</i>	1	0.05	0.01
<i>Eugenia aff. copacabanensis</i>	4	0.18	0.6
<i>Eugenia aff. egensis</i>	7	0.32	0.17
<i>Eugenia aff. neoglomerata</i>	1	0.05	0.01
<i>Eugenia aff. pruniformis</i>	6	0.27	0.93

Contd...

Table 2.12–Contd...

Species	N	DRG	BARG
<i>Eugenia aff. xiriricana</i>	7	0.32	0.21
<i>Eugenia cf. cerassiflora</i>	3	0.14	0.11
<i>Eugenia cf. itapemirimensis</i>	6	0.27	0.07
<i>Eugenia cf. neolanceolata</i>	3	0.14	0.07
<i>Eugenia monosperma</i>	1	0.05	0.02
<i>Eugenia oblongata</i>	4	0.18	0.05
<i>Eugenia persicifolia</i>	3	0.14	0.08
<i>Eugenia sp1</i>	6	0.27	0.15
<i>Eugenia sp10</i>	3	0.14	0.19
<i>Eugenia sp11</i>	2	0.09	0.02
<i>Eugenia sp12</i>	1	0.05	0.01
<i>Eugenia sp13</i>	1	0.05	0.01
<i>Eugenia sp14</i>	1	0.05	0.05
<i>Eugenia sp15</i>	5	0.23	0.08
<i>Eugenia sp2</i>	5	0.23	0.24
<i>Eugenia sp3</i>	2	0.09	0.04
<i>Eugenia sp4</i>	1	0.05	0.01
<i>Eugenia sp5</i>	2	0.09	0.03
<i>Eugenia sp6</i>	8	0.36	0.23
<i>Eugenia sp7</i>	1	0.05	0.01
<i>Eugenia sp8</i>	2	0.09	0.08
<i>Eugenia sp9</i>	3	0.14	0.41
<i>Eugenia tinguyensis</i>	6	0.27	0.05
<i>Euterpe edulis</i>	152	9.42	2.38
<i>Euterpe espiritosantensis</i>	2	0.09	0.02
<i>Faramea coerulea</i>	2	0.09	0.02
<i>Faramea sp1</i>	3	0.14	0.05
<i>Faramea sp2</i>	4	0.18	0.09
<i>Ficus citrifolia</i>	1	0.05	0.03
<i>Gomidesia cf. palustris</i>	1	0.05	0.01
<i>Gomidesia cf. pubescens</i>	4	0.18	0.04
<i>Gomidesia crocea</i>	8	0.36	0.13
<i>Gomidesia schaueriana</i>	1	0.05	0.02
<i>Guapira obtusata</i>	21	0.96	0.72
<i>Guapira opposita</i>	15	0.68	0.48
<i>Guapira sp1</i>	4	0.18	0.1

Contd...

Table 2.12–Contd...

<i>Species</i>	<i>N</i>	<i>DRG</i>	<i>BARG</i>
<i>Guapira sp2</i>	3	0.14	0.12
<i>Guapira sp3</i>	8	0.36	0.51
<i>Guapira venosa</i>	12	0.55	0.37
<i>Guarea macraphylla</i>	1	0.05	0.01
<i>Guatteria australis</i>	3	0.14	0.09
<i>Guatteria sp1</i>	9	0.41	0.37
<i>Guatteria sp2</i>	1	0.05	0.01
<i>Guatteria sp3</i>	2	0.09	0.06
<i>Guatteria sp4</i>	9	0.41	1.48
<i>Hyeronima alchomeoides</i>	1	0.05	0.02
<i>Hyeronima oblonga</i>	4	0.18	0.4
<i>Hymenaea aurea</i>	8	0.36	0.41
<i>Hymenaea courbaril</i>	2	0.09	0.02
<i>Hymenaea sp</i>	2	0.09	0.03
<i>Ilex affinis</i>	1	0.05	0.06
<i>Ilex paraguariensis</i>	2	0.09	0.05
<i>Ilex theezans</i>	2	0.09	0.02
<i>Inga capitata</i>	22	1	0.64
<i>Inga cf. dulcis</i>	1	0.05	0.01
<i>Inga cf. lenticellata</i>	3	0.14	0.08
<i>Inga cylindrica</i>	2	0.09	0.03
<i>Inga flageliformis</i>	1	0.05	0.04
<i>Inga subnuda</i>	2	0.09	0.06
<i>Inga tenuis</i>	2	0.09	0.13
<i>Inga thibaudiana</i>	5	0.23	0.12
<i>Inga vestita</i>	1	0.05	0.01
<i>Ixora sp</i>	2	0.09	0.12
<i>Jacaratia heptaphylla</i>	7	0.32	0.08
<i>Licania kunthiana</i>	2	0.09	0.17
<i>Licania leptostachya</i>	4	0.18	0.16
<i>Licania micrantha</i>	14	0.64	0.68
<i>Licania octandra</i>	3	0.14	0.03
<i>Licania parvifolia</i>	8	0.36	0.37
<i>Licania salzmanni</i>	2	0.09	0.3
<i>Licania sp</i>	2	0.09	0.11
<i>Marlierea obscura</i>	5	0.23	0.82

Contd...



Table 2.12–Contd...

Species	N	DRG	BARG
<i>Marlierea parvifolia</i>	6	0.27	0.15
<i>Marlierea regeliana</i>	3	0.14	0.04
<i>Marlierea silvatica</i>	3	0.14	0.04
<i>Marlierea sp2</i>	2	0.09	0.12
<i>Marlierea sp3</i>	1	0.05	0.04
<i>Matayba arborescens</i>	2	0.09	0.02
<i>Matayba cf. elaeagnoides</i>	1	0.05	0.05
<i>Matayba guianensis</i>	1	0.05	0.04
<i>Maytenus cf. communis</i>	12	0.55	0.11
<i>Maytenus cf. obtusifolia</i>	11	0.5	0.31
<i>Melanoxylon brauna</i>	3	0.14	0.05
<i>Miconia aff. cubatanensis</i>	3	0.14	0.04
<i>Miconia budlejoides</i>	3	0.14	0.04
<i>Miconia cf. hymenonervia</i>	1	0.05	0.01
<i>Miconia cf. saldanhaei</i>	2	0.09	0.05
<i>Miconia cf. stenostachya</i>	2	0.09	0.02
<i>Miconia cinnamomifolia</i>	2	0.09	0.13
<i>Miconia dodecandra</i>	4	0.18	0.06
<i>Miconia doriana</i>	1	0.05	0.01
<i>Miconia latecrenata</i>	3	0.14	0.09
<i>Miconia pepericarpa</i>	1	0.05	0.04
<i>Miconia pusilliiflora</i>	4	0.18	0.04
<i>Miconia pyrifolia</i>	1	0.05	0.01
<i>Miconia sp1</i>	7	0.32	0.09
<i>Miconia sp3</i>	1	0.05	0.01
<i>Mollinedia cf. gilgiana</i>	5	0.23	0.13
<i>Mollinedia aff. engleriana</i>	2	0.09	0.02
<i>Mollinedia aff. ligustrina</i>	2	0.09	0.07
<i>Mollinedia aff. salicifolia</i>	6	0.27	0.14
<i>Mollinedia fruticulosa</i>	8	0.36	0.13
<i>Mollinedia marquetiana</i>	2	0.09	0.03
<i>Mollinedia sp</i>	5	0.23	0.09
<i>Mouriri doriana</i>	4	0.18	0.59
<i>Mouriri sp</i>	3	0.14	0.09
<i>Myrceugenia pilotantha</i>	3	0.14	0.16
<i>Myrcia aff. acuminatissima</i>	1	0.05	0.01

Contd...

Table 2.12–Contd...

Species	N	DRG	BARG
<i>Myrcia aff. plusiantha</i>	10	0.46	0.38
<i>Myrcia cf. laurifoia</i>	16	0.73	0.34
<i>Myrcia cf. oocarpa</i>	2	0.09	0.04
<i>Myrcia fallax</i>	8	0.36	0.23
<i>Myrcia lancea</i>	2	0.09	0.03
<i>Myrcia multiflora</i>	2	0.09	0.04
<i>Myrcia pubipetala</i>	2	0.09	0.15
<i>Myrcia sp1</i>	4	0.18	0.11
<i>Myrcia sp2</i>	1	0.05	0.01
<i>Myrcia sp3</i>	1	0.05	0.01
<i>Myrcia sp4</i>	1	0.05	0.01
<i>Myrcia sp5</i>	2	0.09	0.02
<i>Myrcia sp6</i>	2	0.09	0.06
<i>Myrcia tenuivenosa</i>	1	0.05	0.01
<i>Myrciaria cf. floribunda</i>	2	0.09	0.03
<i>Myrciaria disticha</i>	1	0.05	0.01
<i>Nectandra aff. Nitidula</i>	2	0.09	0.04
<i>Nectandra sp</i>	2	0.09	0.72
<i>Ocotea aciphylla</i>	77	3.51	1.85
<i>Ocotea aff. brachybotra</i>	1	0.05	0.09
<i>Ocotea aff. catharinensis</i>	22	1	0.79
<i>Ocotea aff. daphnifolia</i>	6	0.27	0.1
<i>Ocotea aff. glomerata</i>	3	0.14	0.17
<i>Ocotea aff. lancifolia</i>	5	0.23	0.09
<i>Ocotea aff. teleiandra</i>	4	0.18	0.04
<i>Ocotea cf. elegans</i>	4	0.18	0.06
<i>Ocotea cf. leucoxyton</i>	4	0.18	0.05
<i>Ocotea dispersa</i>	3	0.14	0.09
<i>Ocotea divaricata</i>	9	0.41	0.64
<i>Ocotea domatiana</i>	3	0.14	0.13
<i>Ocotea longifolia</i>	3	0.14	0.21
<i>Ocotea odorifera</i>	11	0.5	0.62
<i>Ocotea organensis</i>	14	0.64	0.71
<i>Ocotea silvestris</i>	9	0.41	0.39
<i>Ocotea sp1</i>	6	0.27	0.15
<i>Ocotea sp10</i>	3	0.14	0.17

Contd...

Table 2.12–Contd...

Species	N	DRG	BARG
<i>Ocotea sp11</i>	4	0.18	0.12
<i>Ocotea sp2</i>	2	0.09	0.15
<i>Ocotea sp3</i>	3	0.14	0.37
<i>Ocotea sp5</i>	2	0.09	0.16
<i>Ocotea sp6</i>	3	0.14	0.05
<i>Ocotea sp7</i>	10	0.46	0.52
<i>Ocotea sp8</i>	4	0.18	0.77
<i>Ocotea sp9</i>	2	0.09	0.24
<i>Ocotea spixiana</i>	1	0.05	0.07
<i>Ocotea velutina</i>	1	0.05	0.02
<i>Ormosia friburguensis</i>	2	0.09	0.16
<i>Ormosia sp</i>	6	0.27	0.52
<i>Pera leandri</i>	1	0.05	0.02
<i>Pithecelobium cochliocarpum</i>	3	0.14	0.04
<i>Posoqueria aculifolia</i>	3	0.14	0.05
<i>Posoqueria latifolia</i>	1	0.05	0.01
<i>Pourouma bicolor sub. digitata</i>	2	0.09	0.02
<i>Pourouma guianensis</i>	7	0.32	0.31
<i>Pouteria aff. psammophila</i>	8	0.36	0.29
<i>Pouteria bangii</i>	6	0.27	0.55
<i>Pouteria cuspidata</i>	6	0.27	0.06
<i>Pouteria gardneri</i>	9	0.41	0.58
<i>Pouteria grandiflora</i>	3	0.14	0.13
<i>Pouteria macahensis</i>	2	0.09	0.16
<i>Pouteria sp1</i>	13	0.59	0.72
<i>Pouteria sp10</i>	14	0.64	0.4
<i>Pouteria sp11</i>	5	0.23	0.26
<i>Pouteria sp3</i>	16	0.73	0.45
<i>Pouteria sp4</i>	2	0.09	0.01
<i>Pouteria sp5</i>	3	0.14	0.21
<i>Pouteria sp6</i>	8	0.36	0.33
<i>Pouteria sp7</i>	3	0.14	0.09
<i>Pouteria sp8</i>	2	0.09	0.19
<i>Pouteria sp9</i>	15	0.68	0.46
<i>Pouteria torta</i>	2	0.09	0.04
<i>Prunus brasiliensis</i>	1	0.05	0.01

Contd...

Table 2.12–Contd...

Species	N	DRG	BARG
<i>Prunus sellowii</i>	3	0.14	0.04
<i>Prunus sp</i>	4	0.18	0.08
<i>Psidium sp</i>	3	0.14	0.17
<i>Psychotria carthaginensis</i>	4	0.18	0.12
<i>Psychotria cf. hancorniaefolia</i>	3	0.14	0.08
<i>Psychotria mapoureooides</i>	1	0.05	0.09
<i>Psychotria velloziana</i>	11	0.5	0.5
<i>Quiina glaziovii</i>	7	0.32	0.34
<i>Rollinia laurifolia</i>	1	0.05	0.07
<i>Rollinia sp</i>	1	0.05	0.04
<i>Roupala aff. rhombifolia</i>	2	0.09	0.05
<i>Roupala comsimilis</i>	11	0.5	0.22
<i>Roupala sp</i>	3	0.14	0.15
<i>Rudgea sp</i>	3	0.14	0.05
<i>Sclerolobium cf. densiflorum</i>	6	0.27	0.45
<i>Sclerolobium striatum</i>	2	0.09	0.02
<i>Senna multijuga</i>	2	0.09	0.06
<i>Siparuna glossostyla</i>	17	0.77	0.41
<i>Sloanea sp2</i>	7	0.32	0.19
<i>Sloanea aff. garkeana</i>	2	0.09	0.04
<i>Sloanea aff. obtusifolia</i>	4	0.18	1.91
<i>Sloanea guianensis</i>	16	0.73	0.86
<i>Sloanea monosperma</i>	4	0.18	0.09
<i>Sloanea nitida</i>	3	0.14	0.19
<i>Sloanea sp1</i>	24	1.09	0.77
<i>Solanum cf. vellozianum</i>	3	0.14	0.07
<i>Sorocea guilliminiana</i>	10	0.46	0.39
<i>Strichnos trinervis</i>	5	0.23	0.4
<i>Swartzia acutifolia</i>	2	0.09	0.01
<i>Swartzia apetala</i>	14	0.64	0.58
<i>Swartzia myrtifolia</i>	2	0.09	0.02
<i>Syagrus pseudococus</i>	4	0.18	0.12
<i>Symplocos celastrina</i>	5	0.23	0.15
<i>Symplocos frondosa</i>	1	0.05	0.07
<i>Symplocos nitens</i>	4	0.18	0.4
<i>Tapirira guianensis</i>	5	0.23	0.15

Contd...

**Table 2.12–Contd...**

<i>Species</i>	<i>N</i>	<i>DRG</i>	<i>BARG</i>
<i>Tetrasilidium grandifolium</i>	10	0.46	0.37
<i>Vernonia sp</i>	5	0.23	0.07
<i>Virola gardneri</i>	12	0.55	1.53
<i>Vochysia bifalcata</i>	13	0.59	0.51
<i>Vochysia laurifolia</i>	5	0.23	0.82
<i>Xylopia brasiliensis</i>	4	0.18	0.04
<i>Zollernia magnifica</i>	2	0.09	0.03
Total	1540	72.94	61.85

**Table 2.13: Abundances of Species of Non-Resource Genera (N), Percentage of Density of Non-Resource Genera (DNRG), Percentage of Basal Area of Non-Resource Genera (BANRG) of Biological Reserve Augusto Ruschi Forest–RBAR (Thomaz, 1996)**

<i>Species</i>	<i>N</i>	<i>DRG</i>	<i>BARG</i>
<i>Abarema cf. obovatum</i>	1	0.05	0.01
<i>Affonsea densiflora</i>	6	0.27	0.06
<i>Amaioua cf. guianensis</i>	10	0.46	0.31
<i>Amaioua sp1</i>	3	0.14	0.17
<i>Amaioua sp2</i>	1	0.05	0.03
<i>Arapatiella sp</i>	2	0.09	0.14
<i>Attalea burretiana</i>	6	0.27	0.91
<i>Barnebia dispar</i>	1	0.05	0.01
<i>Beilschiedia sp2</i>	11	0.5	1
<i>Beilschmiedia aff. rigida</i>	8	0.36	0.73
<i>Beilschmiedia sp1</i>	10	0.46	0.35
<i>Bombacopsis calophylla</i>	3	0.14	0.07
<i>Brosimum cf. glazioui</i>	2	0.09	0.11
<i>Calycorectes cf. psidiiflorus</i>	8	0.36	0.14
<i>Calycorectes cf. sellowianus</i>	6	0.27	0.35
<i>Calyptanthes aff. clusiifolia</i>	1	0.05	0.03
<i>Calyptanthes cf. grandifolia</i>	5	0.23	0.05
<i>Calyptanthes lucia</i>	1	0.05	0.07
<i>Calyptanthes pulchella</i>	6	0.27	0.25
<i>Calyptanthes sp1</i>	2	0.09	0.06
<i>Calyptanthes sp10</i>	5	0.23	0.07
<i>Calyptanthes sp12</i>	2	0.09	0.02

Contd...

Table 2.13–Contd...

Species	N	DRG	BARG
<i>Calyptranthes sp13</i>	1	0.05	0.01
<i>Calyptranthes sp14</i>	2	0.09	0.04
<i>Calyptranthes sp2</i>	2	0.09	0.11
<i>Calyptranthes sp3</i>	3	0.14	0.05
<i>Calyptranthes sp4</i>	2	0.09	0.03
<i>Calyptranthes sp5</i>	1	0.05	0.03
<i>Calyptranthes sp6</i>	2	0.09	0.02
<i>Calyptranthes sp7</i>	3	0.14	0.11
<i>Calyptranthes sp8</i>	1	0.05	0.01
<i>Calyptranthes sp9</i>	6	0.27	0.29
<i>Capparis sp</i>	3	0.14	0.18
<i>Caryocar edule</i>	2	0.09	3.56
<i>Cheiloclinium aff. cognatum</i>	3	0.14	0.21
<i>Chionanthus cf. filiformis</i>	3	0.14	0.05
<i>Citronella sp</i>	6	0.27	0.61
<i>Coccoloba aff. alnifolia</i>	3	0.14	0.09
<i>Coccoloba aff. confusa</i>	2	0.09	0.03
<i>Connarus aff. eryanthus</i>	2	0.09	0.02
<i>Cupania cf. emarginata</i>	1	0.05	0.06
<i>Cupania cf. scrobiculata</i>	2	0.09	0.03
<i>Cupania furfuraceae</i>	6	0.27	0.21
<i>Daphnopsis aff. martii</i>	3	0.14	0.06
<i>Diplöon cuspidatum</i>	5	0.23	0.27
<i>Diploptropis incexis</i>	12	0.55	0.5
<i>Drimys brasiliensis</i>	3	0.14	0.04
<i>Drypetes cf. sessiflora</i>	3	0.14	0.15
<i>Ecclinusa ramiflora</i>	23	1.05	1.07
<i>Ferdinandusa sp</i>	1	0.05	0.02
<i>Garcinia brasiliensis</i>	2	0.09	0.02
<i>Garcinia gardneriana</i>	1	0.05	0.02
<i>Geonoma schottiana</i>	16	0.73	0.11
<i>Heisteria cf. silvianii</i>	5	0.23	0.1
<i>Heisteria perianthomega</i>	2	0.09	0.4
<i>Heisteria sp</i>	1	0.05	0.02
<i>Hidrogaster trinervis</i>	3	0.14	0.76
<i>Hirtella hebeclada</i>	11	0.5	0.48

Contd...

Table 2.13–Contd...

Species	N	DRG	BARG
<i>Hirtella</i> sp	2	0.09	0.27
<i>Hortia</i> sp	2	0.09	0.52
<i>Hymatanthus</i> cf. <i>lancifolius</i>	1	0.05	0.01
<i>Hymatanthus</i> <i>phagedaenicus</i>	3	0.14	0.43
<i>Hymatanthus</i> sp	3	0.14	0.22
<i>Hymenolobium</i> <i>janeisense</i>	2	0.09	0.04
<i>Jacaranda</i> <i>microcalix</i>	7	0.32	0.3
<i>Jacaranda</i> sp	3	0.14	0.15
<i>Kielmeyera</i> cf. <i>occhioniana</i>	1	0.05	0.01
<i>Lacistema</i> sp	8	0.36	0.18
<i>Lacmellea</i> sp	3	0.14	0.4
<i>Lamanonia</i> sp	3	0.14	0.22
<i>Lamanonia</i> <i>ternata</i>	1	0.05	0.05
<i>Licaria</i> cf. <i>armenica</i>	1	0.05	0.09
<i>Licaria</i> <i>guianensis</i>	2	0.09	0.03
<i>Macropelys</i> aff. <i>ligustrina</i>	3	0.14	0.04
<i>Maprounea</i> <i>guianensis</i>	5	0.23	0.37
<i>Margaritaria</i> <i>nobilis</i>	3	0.14	0.16
<i>Meliosma</i> aff. <i>itatiaiae</i>	4	0.18	0.06
<i>Meriania</i> <i>tetramera</i>	7	0.32	0.15
<i>Micropholis</i> <i>compta</i>	1	0.05	0.06
<i>Micropholis</i> <i>crassipedicellata</i>	4	0.18	0.52
<i>Micropholis</i> <i>gardneriana</i>	2	0.09	0.09
<i>Micropholis</i> <i>gnaphalocladus</i>	2	0.09	0.11
<i>Micropholis</i> <i>guyanensis</i>	11	0.5	0.93
<i>Micropholis</i> sp1	13	0.59	0.51
<i>Micropholis</i> sp2	5	0.23	0.66
<i>Micropholis</i> <i>venulosa</i>	12	0.55	0.96
<i>Moldenhawera</i> cf. <i>floribunda</i>	4	0.18	0.04
<i>Myrsine</i> aff. <i>ovalifolia</i>	3	0.14	0.12
<i>Myrsine</i> <i>umbellata</i>	13	0.59	1.35
<i>Neea</i> cf. <i>oppositifolia</i>	4	0.18	0.08
<i>Neomitranthes</i> <i>glomerata</i>	6	0.27	0.26
<i>Neomitranthes</i> <i>obscura</i>	1	0.05	0.01
<i>Ouratea</i> sp	4	0.18	0.07
<i>Oxandra</i> sp	3	0.14	0.15

Contd...

Table 2.13–Contd...

Species	N	DRG	BARG
<i>Parinari obtusifolia</i>	5	0.23	1.29
<i>Pausandra morisiana</i>	2	0.09	0.05
<i>Peltogyne angustiflora</i>	3	0.14	0.24
<i>Peritassa sp1</i>	1	0.05	0.02
<i>Peritassa sp2</i>	2	0.09	0.03
<i>Persea caesia</i>	4	0.18	0.15
<i>Persea sp1</i>	1	0.05	0.07
<i>Persea sp2</i>	3	0.14	0.12
<i>Pimenta pseudocaryophyllus</i>	1	0.05	0.39
<i>Pisonia ambigua</i>	2	0.09	0.11
<i>Plinia cf. stictophylla</i>	4	0.18	0.14
<i>Plinia ranatiana</i>	3	0.14	0.06
<i>Plinia rivularis</i>	3	0.14	0.14
<i>Plinia sp</i>	2	0.09	0.05
<i>Protium aff. aracouchini</i>	6	0.27	0.38
<i>Protium heptaphyllum</i>	2	0.09	0.1
<i>Protium sp</i>	3	0.14	0.1
<i>Pseudopiptadenia contorta</i>	2	0.09	0.17
<i>Pseudoxandra sp</i>	3	0.14	0.06
<i>Rapanea cf. guianensis</i>	1	0.05	0.02
<i>Rapanea ferrugineae</i>	3	0.14	0.06
<i>Rapanea venosa</i>	7	0.32	0.23
<i>Rauvolfia grandiflora</i>	8	0.36	0.17
<i>Rourea sp</i>	1	0.05	0.02
<i>Salacia amygdalina</i>	7	0.32	0.27
<i>Salacia sp</i>	9	0.41	0.57
<i>Sickingia sp</i>	2	0.09	0.11
<i>Simarouba amara</i>	2	0.09	0.03
<i>Simira aff. eliezeriana</i>	3	0.14	0.15
<i>Sparattanthelium botocudorum</i>	4	0.18	0.9
<i>Stephanopodium cf. blanchetianum</i>	3	0.14	0.06
<i>Tacgali sp</i>	2	0.09	0.17
<i>Talisia cerasina</i>	4	0.18	0.31
<i>Talisia sp1</i>	1	0.05	0.01
<i>Talisia sp2</i>	3	0.14	0.03
<i>Ternstroemia brasiliensis</i>	2	0.09	0.08

Contd...



**Table 2.13–Contd...**

<i>Species</i>	<i>N</i>	<i>DRG</i>	<i>BARG</i>
<i>Tovomita brasiliensis</i>	3	0.14	0.04
<i>Tovomita sp1</i>	4	0.18	0.12
<i>Tovomita sp2</i>	6	0.27	0.24
<i>Tovomita sp3</i>	4	0.18	0.06
<i>Tovomitopsis sp</i>	3	0.14	0.06
<i>Trichilia catigua</i>	1	0.05	0.1
<i>Trichilia cf. lepdota</i>	11	0.5	0.88
<i>Trichilia quadrijuga</i>	13	0.59	0.45
<i>Trichilia sp2</i>	11	0.5	0.75
<i>Trichilia sp3</i>	6	0.27	0.75
<i>Trichillia aff. plena</i>	4	0.18	0.12
<i>Trichillia sp1</i>	1	0.05	0.01
<i>Unonopsis aff. Riedeliana</i>	47	2.14	0.87
<i>Vantanea compacta</i>	2	0.09	0.09
<i>Vantanea obovata</i>	18	0.82	2.12
<i>Vismia cf. martiana</i>	1	0.05	0.01
<i>Vitex onorinocensis</i>	2	0.09	0.15
<i>Vitex sp</i>	2	0.09	0.09
<i>Williamodendron cinnamomeum</i>	2	0.09	0.07
Total	654	29.93	38.17

woolly spider monkeys, and with structural surveys of vegetation, those plant genera reported as food source were considered resource genera, and those not reported as source were considered non-resource genera (Tables 2.1–2.13).

### Quantification of Food Resources

The plant populations from the tree stratum of forests are spread in many different ways throughout the phytocoenosis, with different abundances and sizes. Basal area is positively correlated to crown volume, and both are a proxy of food resource abundance (Chapman *et al.*, 1992; Hemmery *et al.*, 2005). Thus, using only the abundance of plant populations for estimates of food resources for the woolly spider monkeys, the quantitative abundance of food sources could be underestimated or overestimated. To quantify food resources for a phytocoenosis two synthetic parameters were used: 1) the ratio of the sum of the percentage of the density of plants from resource genera ( $\Sigma DRG$ ) to the sum of the percentage of the density of plants from non-resource genera ( $\Sigma DNRG$ ) and 2) the sum of the percentage of basal area of plants from resource genera ( $\Sigma BARG$ ) to the sum of the percentage of basal area of plants from non-resource genera ( $\Sigma BANRG$ ) (Tables 2.1–2.13). The formulae are:

$$\text{Rate of resource density or RRD} = \Sigma\text{DRG}/\Sigma\text{DNRG} \quad (1)$$

$$\text{Rate of resource basal area or RRBA} = \text{SBARG}/\text{SBANRG} \quad (2)$$

### Brachyteles Densities in the Forests

The density of *Brachyteles* was compiled from the literature for six forests. The most recent primatological survey was used when more than one census was available. When more than one census was available for the same period of observation for the same forest, the mean of their parameters was used. The surveys compiled were: Petroni (2007, unpublished data) for the Intervales State Park, SP; Martins (2005) for Barreiro Rico Farm, SP; Pinto *et al.* (1993) for the Augusto Ruschi Biological Reserve, ES; and Silva-Junior *et al.* (2010) for three reserves of Minas Gerais State: Rio Doce State Park, the Mata do Sossego Private Reserve and Brigadeiro State Park. *Brachyteles* densities were presented as the number of individuals per square kilometer of forest (N. Ind./km<sup>2</sup>). The locations of the six sites are shown in Figure 2.1.

These forests were chosen due to the coexistence of previous studies of vegetation structure and primatological surveys for the same communities under the same successional stage. Three out of six are in Minas Gerais State: Brigadeiro State Park (PESB), Rio Doce State Park (PERD) and Mata do Sossego Private Reserve (Sossego). Two are in the São Paulo State: Intervales State Park (PEI) and Private Reserve of Barreiro Rico Farm (FBR). One is in Espírito Santo State, at neighbors Biological Reserves Augusto Ruschi and Santa Lucia (RBAR), Santa Teresa municipality. PEI and FBR are surveys for *B. arachnoides*, whereas the others are surveys for *B. hypoxanthus*. One of the sites, RBAR, was adjacent to the site of a prior primatological survey in which the forest structure was analyzed. Both RBAR and this adjacent site belong to the same original forest patch and are in the same late successional stage.

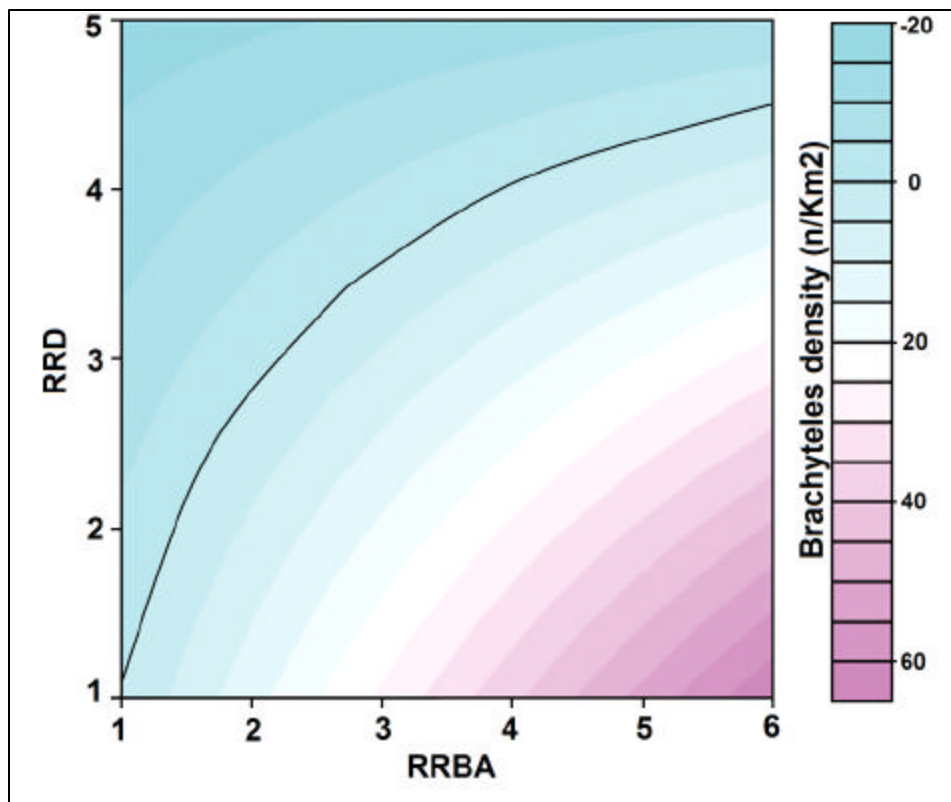
### Data Analysis

All analyses were made in the R statistical environment (R Development Core Team, 2005). For investigations between *Brachyteles* density and resource availability, multiple regressions were calculated (Generalized Linear Models-GLM) with Gaussian errors and residual analyses. In those analyses, the *Brachyteles* density was the dependent variable and SDRG, SBARG, RRD and RRBA were explanatory variables. Complete models were built by adding in explanatory variables from the simplest to the more complex. The model simplifications were carried out by removing the non-significant variables ( $p > 0.05$ ) from the most complex to the simplest. Then, ANOVA tests for the recalculation of variance from remnant variables were performed (Crawley, 2007).

### Results and Discussion

From the tested models, those with the explanatory variables SDRG, SBARG and RRD were not significant ( $p > 0.05$ ). Only RRBA and its interaction with RRD had a significance of  $p < 0.05$  for explaining *Brachyteles* densities in the forests analyzed (Figure 2.2).

Figure 2.2 depicts the correlations among the tested variables. The densest values of *Brachyteles* density coincide with higher basal areas of resource genera. On the



**Figure 2.2: Multiple Regression Among the Ratio of the Basal Area of Resource Genera to the Basal Area of Non-Resource Genera (RRBA, X axis), the Ratio of the Density of Food Resource Genera to the Density of Non-Resource Genera (RRD, Y axis) and Woolly Spider Monkey Density (Z axis, blue to purple scale at right). The solid line separates areas with positive values of *Brachyteles* carrying capacities from those without any carrying capacity (zero and negative values).**

other hand, the densest values of *Brachyteles* density do not coincide with the highest densities of resource genera.

A preference of *Brachyteles* for large trees has been reported in the recent decades (Aguirre, 1971; Lemos de Sá and Strier, 1992; Petroni, 2000). This behaviour was observed at the Private Reserve of Caratinga, where woolly spider monkeys had eaten preferentially on large trees in their ranging area (Moraes 1992). The same pattern was confirmed by Moraes (1992) in the Carlos Botelho State Park and by Petroni (1993) in PEI.

The results show that basal area and tree density are inversely related (Figure 2.2). It is supposed that early successional and denser forests have less biomass than late successional forests. Late succession means larger trees and lower densities because of lower recruitment (Silva-Junior *et al.*, 2010). Biomass increase of trees has

an effect of self-thinning the populations in uneven-aged forests (Yoda *et al.*, 1963; Kohyama, 1992; Luyssaert *et al.*, 2008). As a result of late succession, low densities of trees of resource genera can sustain high densities of woolly spider monkeys since the resource genera basal area (RRBA) is from two up to six times larger than that of non-resource genera basal area (Figure 2.2).

The role of large trees has been discussed in the literature from different viewpoints: they provide a suitable food resource for the high energetic requirement of large mammals; they allow for the formation of tight cohesion groups; and they promote secure pathways by making thick branches available for large bodied primates.

There is a strong correlation between the basal area and crown volume of trees (Hemmerly *et al.*, 2005; Kupka, 2007). According to Strier (1989) and Chapman *et al.* (1992), crown volume is a good estimate of food availability. Large bodied primates, such as *Brachyteles* (which grow up to 15 kg), require more food for their energetic needs (Clutton-Brock and Harvey, 1977). There is a positive correlation between the availability of a large amount of food and reproductive rates of mammals (Gaulin and Konner, 1977). Therefore, it is thought that large trees are a habitat trait that enhances the reproduction rates of large bodied primates.

The size of food sources influences the social behaviour of primates. The advantage of a group feeding behaviour is due to a diminished risk of predation and an increase in the chance of finding food. Large food sources allow for the formation of tight groups with decreasing intraset competition (Gaulin *et al.*, 1980; Lemos de Sá and Strier, 1992; Petroni, 2000). Nevertheless, the size of food sources is not the only determinant of group cohesion in *Brachyteles*. Moraes *et al.* (1997) found that although there were large sources of food at Carlos Botelho State Park, its woolly spider monkey group was more fluid than those studied at the Private Reserve of Caratinga. This later reserve is a more disturbed forest with smaller patches of food than those of Carlos Botelho State Park, but with higher plant richness of early successional species, a richer source of protein in leaves (Silva-Junior *et al.*, 2009). Cohesion, in this case, was due to feeding on leaves that could allow a diminished intraset competition for preferred items (*e.g.* fruits).

Large trees of late successional stages provide more secure pathways for *Brachyteles* (Silva-Junior *et al.*, 2009, 2010). It is supposed that a lower mass of adult primates in earlier forests is due to the requirement of thick branches that support individuals of a group (Fimbel, 1994). Hence, large trees of late successional forests can support larger populations, as reported by Fimbel (1994) in West Africa.

Large trees of resource genera are necessary for high densities of woolly spider monkeys. Their benefits include: providing food, decreasing predation due to the tightness of groups, securing pathways and providing safe resting sites. The results show that it is possible to use only structural traits of resource and non-resource genera of trees in determining the food source for woolly spider monkeys in forest habitats.

## Implications for Managing Forests for Woolly Spider Monkey Conservation

Recommended actions for the conservation of *Brachyteles* species are directed towards forest conservation and the amendment of disturbed areas of former forests in order to enlarge the native habitat and establish corridors between patches of indigenous vegetation (Chiarello, 1999; Mendes *et al.*, 2005).

Amendments of disturbed forests, which involve planting native species, need information concerning habitat requirements to succeed as habitat for *Brachyteles*. The species to be used must be from the same phytogeographical province, and their abundance and distribution should be arranged as in their natural populations (Rodrigues and Gandolfi, 1998). In the case of corridors, the use of preferred species raises the carrying capacity for target populations (Bennett, 2003). Our results concerning the carrying capacity for *Brachyteles* have become available in a moment during which the government is considering information for the establishment of corridors among major patches of Atlantic Forests in Minas Gerais State: PERD, PESB and Caparaó National Park. Between PERD and Caparaó National Park is Sossego Forest. Most of the tree species in the six forests studied are of resource genera for *Brachyteles* and would be used as an energetic resource for other herbivorous populations and for populations of higher trophic levels in such corridors. Hence, to increase the effectiveness of amendments and corridors, including more species from resource genera provides better quality habitat in terms of the needs of multi-species biological conservation (Mittermeier, 1988; Chapman and Peres, 2001).

Our results show that forests with a higher proportion of basal area of resource genera support larger populations of *Brachyteles* (Figure 2.2). Therefore, in amendments conducted for woolly spider monkey conservation, the utilization of a high proportion of saplings of resource genera (Tables 2.1–2.13), especially those of tree species of the late successional functional type is recommended (Silva-Junior *et al.*, 2010), which remain in the forest longer and tend to grow bigger than species of early successional functional types.

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