

# Nonvolant mammals in habitats of the Caatinga scrub and cloud forest enclave at Serra da Guia, state of Sergipe

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## Run title: Nonvolant mammals of the Serra da Guia

**Abstract.** There were identified 19 species of nonvolant mammals on the Serra da Guia region, municipalities of Poço Redondo - Sergipe and Pedro Alexandre - Bahia. The samplings were conducted between December 2008 and August 2009, in two different areas: Caatinga dry scrub and a Cloud Forest enclave, in which were placed 10 Sherman type traps, within three nights per month. To mid and large mammals' species, existing transects of 1,000 m were traveled, searching for tracks, sightings, feces or vocalizations. Among sampled species, only *Leopardus tigrinus* is in the IUCN Red List, classified as Vulnerable (VU). Regarding the differences between the study sites, some species were sampled only in exclusive areas, as: *Monodelphis domestica* and *Thrichomys laurentius* to Caatinga dry scrub; and *Marmosops incanus*, *Trinomys albispinus* and *Oecomys catherinae* to Cloud Forest. Continued studies may provide more information about the mammal diversity and the role of Cloud Forest in the maintenance of such diversity, to the Caatinga Biome.

**Keywords:** Caatinga Biome, Brejo de Altitude, species richness, semiarid region

**Resumo. Mamíferos não-voadores em habitats de Caatinga arbustiva e enclave de brejo de altitude na Serra da Guia, estado de Sergipe.** Foram identificadas 19 espécies de mamíferos não voadores na região da Serra da Guia, nos municípios de Poço Redondo, Sergipe e Pedro Alexandre, Bahia. As amostragens foram realizadas nos meses de dezembro 2008 a agosto 2009 em duas áreas: caatinga arbustiva e brejo de altitude, nas quais foram colocadas 10 armadilhas tipo *Sherman*, com três noites de amostragem por mês, para a captura de mamíferos de pequeno porte.

No caso dos mamíferos de médio e grande porte, foram realizados transectos de 1.000 m em trilhas pré-existentes, na busca de rastros, visualizações, fezes e vocalizações. Dentre as espécies de amostradas, apenas *Leopardus tigrinus* consta na Lista Vermelha da IUCN, classificada como Vulnerável (VU). Em relação à distinção entre os ambientes, algumas espécies foram capturadas exclusivamente em determinadas áreas, como: *Monodelphis domestica* e *Thrichomys laurentius* para Caatinga arbustiva; e *Marmosops incanus*, *Trinomys albispinus* e *Oecomys catherinae*, para brejo de altitude. Com estudos contínuos podem ser fornecidas maiores informações sobre a diversidade de mamíferos não voadores e o papel dos brejos de altitude na manutenção da mesma, no bioma Caatinga.

**Palavras-chave:** Bioma Caatinga, Brejo de Altitude, riqueza de espécies, região semi-árida

## INTRODUCTION

In Brazil more than 680 species of mammals occurs (REIS *et al.*, 2011). Approximately 148 of these species occur in the semiarid Caatinga scrublands of the Brazilian Northeast, and 6.8% of these species are considered to be endemic to this biome (OLIVEIRA *et al.*, 2003; PAGLIA *et al.*, 2012; REIS *et al.*, 2011).

Ten of the mammalian species that occur in the Caatinga are listed as endangered (IUCN, 2012), and the most vulnerable are the top predators, such as the felids, with five of the six local species being threatened. The principal risks to the local fauna are typical of those of other Brazilian biomes, i.e., habitat loss and uncontrolled hunting (MMA, 2002). Habitat loss occurs primarily through the illegal extraction of lumber and charcoal and land clearance for cattle ranching and agriculture (CHIARELLO, 1999; NEIMAN, 1989).

Small enclaves of humid or cloud forest – known locally as “brejos de altitude” – can be found at a number of localities within the semiarid Caatinga (ANDRADE-LIMA, 1982). These enclaves are typically located on high plateaus subject to the formation of orographic precipitation, which results in relatively humid environments suitable for the establishment of dense rainforest, quite distinct from the typical Caatinga scrub (SALES *et al.*, 1998). The vegetation of these enclaves may include elements typical of the Caatinga, Atlantic Forest, and Amazonian Hylea (TABARELLI & SANTOS, 2004; RODAL *et al.*, 2005; RODRIGUES *et al.*, 2008). Historically, these enclaves appear to have expanded considerably during periods of more humid climate, providing the basis for formation of corridors of rainforest vegetation linking the Atlantic Forest to the Amazon basin (CLAPPERTON, 1993; VIVO, 1997), and more recently, refuges for different components of the faunas of these biomes.

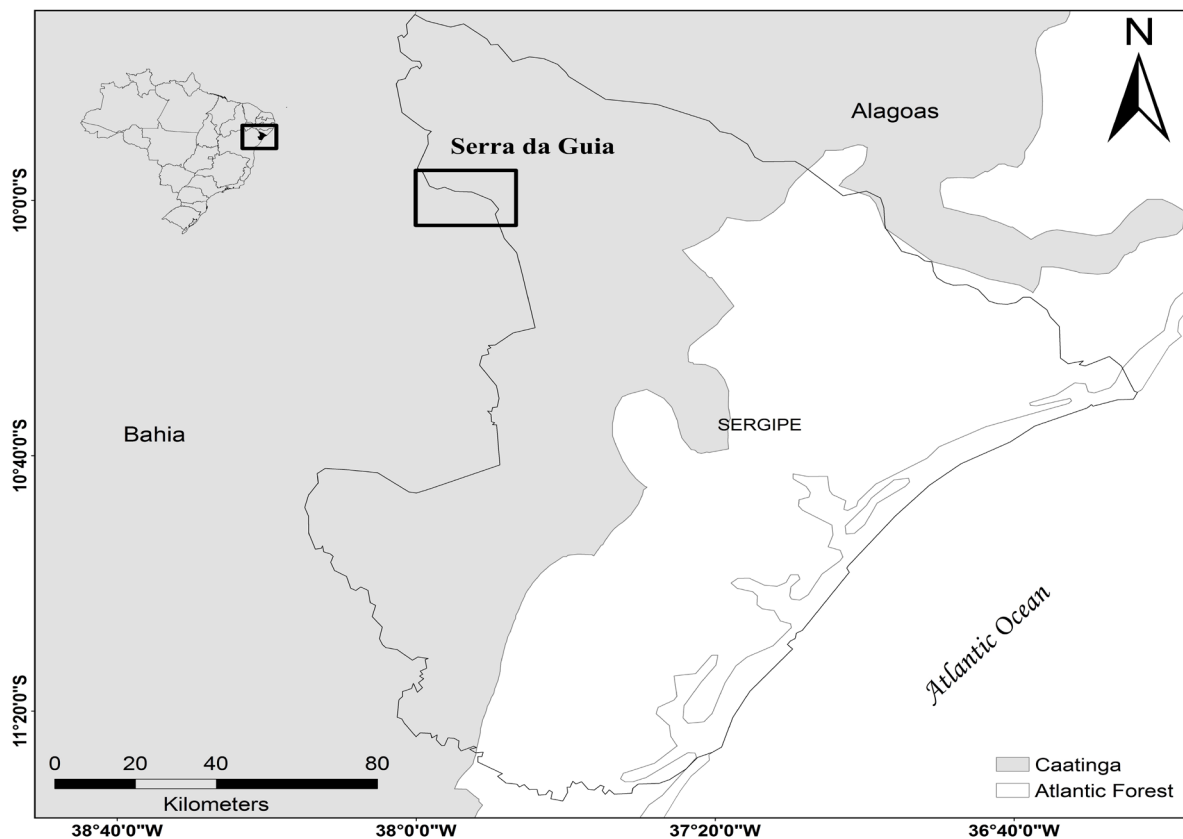
The mammalian fauna of the Caatinga is relatively poorly known in comparison with the other groups of animals that inhabit this biome (MONTEIRO DA CRUZ *et al.*, 2005), and as it probably the most threatened by ongoing anthropogenic impacts, in general, more reliable data on species diversity and distributions will be necessary in order to guarantee the effective protection of local populations. In particular, rodents, marsupials, and bats make up approximately two-thirds of the diversity of Brazilian mammals (BRITO, 2004), but are also the least well-known groups in relation to their overall diversity. In this context, any information on the composition and distribution

of its mammals obviously represents an important advance in the understanding of the diversity and ecology of this biome. The present study focused on the mammalian fauna of the Serra da Guia, in the northeastern Brazilian state of Sergipe, surveying both the Caatinga scrub and a small enclave of cloud forest. This is the first study of the kind in this region.

## MATERIAL AND METHODS

### Study site

Serra da Guia (9°58' S, 37°52' W) is a small mountain range located within the semiarid



**Figure 1.** Location of the study area in the northeastern Brazilian state of Sergipe.

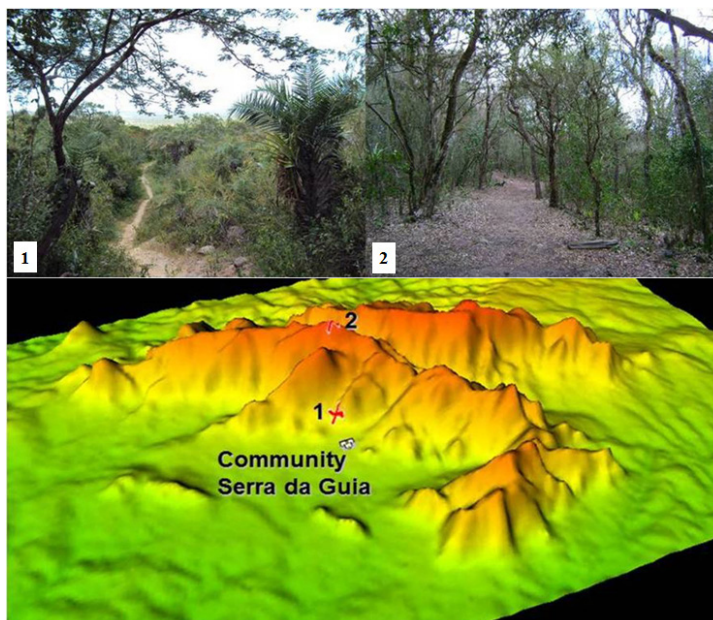
Brazilian Caatinga biome, and straddles the frontier between the states of Sergipe (municipality of Poço Redondo) and Bahia, in Pedro Alexandre (Figure 1). Altitude varies from 300 m above sea level, at the base of the range, to 750 m asl, at the top.

Two sampling points were selected within the study area (Figure 2), based on differences in elevation and habitat type. Point 1 (Figure 2.1) was located at the base of the range at an altitude of 300 m asl, in typical Caatinga scrub, characterized by a predominance of shrubs and small trees of the Fabaceae and Euphorbiaceae families, in particular *Caesalpinia pyramidalis* (catingueira) and *Amburana cearensis* (umburana), as well as ouricuri palms, *Syagrus coronata*. This natural vegetation is interspersed with extensive areas of cattle pasture and smaller subsistence plots plant with maize and beans.

Point 2 (Figura 2.2) is located at 750 m asl, and covers an area of approximately 20 hectares. This humid forest has emergent trees of between 10 m and 20 m in height, with a predominance of the Fabaceae and Poaceae families, and 13 species of orchid (MACHADO *et al.*, 2012).

### **Sampling Effort**

Nonvolant mammals were surveyed within the study area between December, 2008, and August, 2009. During this period, three-day field campaigns were conducted at each sampling point, with a total of 27 days accumulated for each of the habitats surveyed. Small-bodied mammals were collected in 20 Sherman-type traps (25 x 8 x 9 cm) set at 50 m intervals along existing trails. The traps were set at the end of the afternoon on each day of the field campaign, and baited with a mixture of



**Figure 2.** Relative position of the two sample points in the caatinga scrub (1) and cloud forest (2).

sardines and peanut butter. A total sampling effort of 270 trap-nights was collected in each area.

One or two individuals of each species captured were retained as voucher specimens, and were prepared according to the guidelines of the American Society of Mammalogists (ANIMAL CARE AND USE COMMITTEE, 1998). The specimens were deposited in the Mammal Collection of the Federal University of Paraíba (UFPB) in João Pessoa and in the Federal University of Sergipe, Brazil.

### **Medium- and large mammals**

The occurrence of larger mammals within the study area was evaluated by surveying the same existing transects/trails (1 km-long) within each sampling point. During surveys, the transects were examined carefully for the presence of tracks and other vestiges, such as feces, as well as possible encounters and direct observation. The surveys were conducted by two observers during 1 hour each field day, with a total of 27 hours of observation per sample point.

## **RESULTS AND DISCUSSION**

A total of 19 species of nonvolant mammals were recorded during the present study, representing 10 families and seven orders (Tabela 1). Specimens of 12 species were captured, while the occurrence of the other seven species was confirmed by direct or indirect observations. Rodents (Rodentia) were the most diverse order, with seven species, followed by marsupials (Didelphimorphia), with four. One of

the species recorded – *Leopardus tigrinus* – is listed as vulnerable by the IUCN (2012). This species was recorded only once in the caatinga scrub, and may represent an indicator of the quality of the local habitat, given that top predators are particularly susceptible to habitat disturbance (CHIARELLO, 1999).

An interesting spatial pattern was observed in the occurrence of the different species, with only four of the total being observed at both sample points. Of the remaining 15 species, 10 were recorded exclusively in the Caatinga, and five in the cloud forest. In most cases, the occurrence of a given species in one or both habitats was probably at least partly a result of the vagaries of the sampling effort, given that the vast majority (15) of the species were recorded on only one or two occasions.

However, clear differences were recorded in the occurrence of a number of rodent and marsupial species, which appear to reflect habitat preferences and/or the geographic structuring of populations (CRISCI *et al.*, 2003; CARMIGNOTTO, 2005). In particular, didelphine *Monodelphis domestica* (Figura 3A) was captured exclusively in the caatinga scrub, while *Marmosops incanus* (Figura 3B) was collected only in the cloud forest, which is consistent with their known preferences for more arid and humid habitats, respectively (VANZOLINI, 1963; BONVICINO *et al.*, 2008; ROCHA *et al.*, 2012). The collection of all seven specimens of *Trinomys albispinus* in the cloud forest also appears to indicate a preference for this habitat.

**Table 1.** Nonvolant mammals recorded in different habitats at Serra da Guia in Poço Redondo, Sergipe (Brazil).

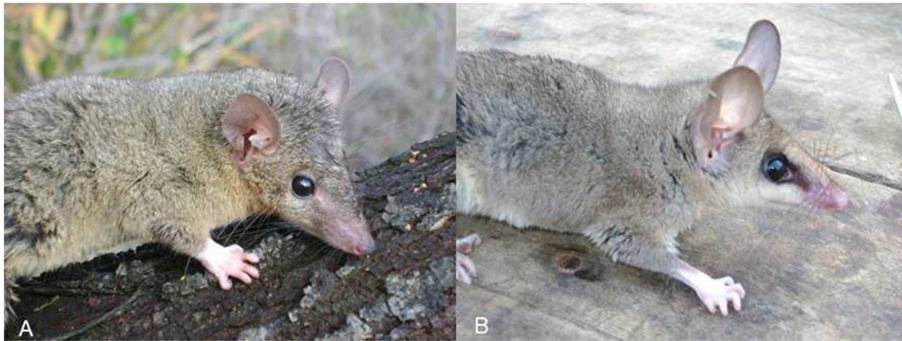
	Type of record <sup>1</sup>	N <sup>2</sup>	Habitat <sup>3</sup>	
			CF	CA
<b>Order Didelphimorphia</b>				
<b>Family Didelphidae</b>				
<b>Subfamily Didelphinae</b>				
<i>Didelphis albiventris</i> (LUND, 1840)	C/V	2	X	X
<i>Gracilinanus agilis</i> (BURMEISTER, 1854)	C	1		X
<i>Marmosops incanus</i> (LUND, 1840)	C	25	X	
<i>Monodelphis domestica</i> (WAGNER, 1842)	C	15		X
<b>Order Xenarthra</b>				
<b>Family Dasypodidae</b>				
<i>Euphractus sexcinctus</i> (LINNAEUS, 1758)	V	1		X
<i>Dasybus novemcinctus</i> (LINNAEUS, 1758)	V	1		X
<b>Order Primates</b>				
<b>Family Cebidae</b>				
<i>Callithrix jacchus</i> (LINNAEUS, 1758)	V	2	X	X
<b>Order Lagomorpha</b>				
<b>Family Leporidae</b>				
<i>Sylvilagus brasiliensis</i> (GRAY, 1867)	V	5	X	X
<b>Order Carnivora</b>				
<b>Family Felidae</b>				
<i>Leopardus tigrinus</i> (SCHREBER, 1775)	V	1		X
<i>Puma yaguarundi</i> (É. GEOFFROY SAINT-HILARE, 1803)	V	2		X
<b>Family Canidae</b>				
<i>Cerdocyon thous</i> (LINNAEUS, 1766)	V	2	X	X

Table 1. Continuação.

<b>Order Artiodactyla</b>				
<b>Familia Cervidae</b>				
<i>Mazama gouazoubira</i> (FISCHER, 1814)	C <sup>4</sup> /V	1		X
<b>Order Rodentia</b>				
<b>Familia Cricetidae</b>				
<b>Subfamilia Sigmodontinae</b>				
<i>Necomys lasiurus</i> (LUND, 1841)	C	1	X	
<i>Oecomys catherinae</i> (THOMAS, 1909)	C	1	X	
<i>Oligoryzomys</i> sp.	C	1	X	
<b>Family Caviidae</b>				
<b>Subfamily Caviinae</b>				
<i>Galea spixii</i> (WAGLER, 1831)	C	2		X
<b>Subfamily Hydrochoerinae</b>				
<i>Kerodon rupestris</i> (WIED, 1820)	C	15		X
<b>Family Echimyidae</b>				
<b>Subfamily Eumysopinae</b>				
<i>Trinomys albispinus</i> (I. GEOFFROY, 1838)	C	7	X	
<i>Thrichomys laurentius</i> (THOMAS, 1904)	C	1		X
Total de capturas		72		

1C = Captured; V = Visualized; 2N = number of individuals recorded; 3CF = Cloud Forest, CA = Caatinga; 4Skin obtained from local hunter.





**Figure 3.** The two most common didelphine species captured during the present study: (A) *Monodelphis domestica* (exclusive to the Caatinga), (B) *Marmosops incanus* (exclusive to the cloud forest).

While the data from the present study are scant, the occurrence of other species in one or other habitat is consistent with their known geographic ranges. For example, the distribution of *Thrichomys laurentius* coincides with the semiarid formations of central South America (VANZOLINI, 1963), while *Oecomys catherinae* is typical of the Atlantic rainforest biome (BONVICINO *et al.*, 2008), as is *M. incanus* (ROCHA *et al.*, 2012). This suggests a connection between the area of Serra da Guia and the Atlantic Forest on the coast of Sergipe, more than 100 km east and south, in the past, and would support the hypothesis that the cloud forest enclaves found in the Caatinga are relicts of more ample rainforest ecosystems (VIVO, 1997).

Population surveys are especially important for the accumulation of data on the diversity and distribution of mammals, in particular in the varied environments of northeastern Brazil, which are poorly-studied in general. Detailed studies of nonvolant mammal communities in Sergipe are still incipient (CHAGAS *et al.*, 2010; ROCHA *et al.*, in press; FREITAS *et al.* in press), and further studies are clearly

needed in order to better understand the diversity of this unique region.

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