

Mammals of Serra do Cipó National Park, southeastern Brazil

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ABSTRACT: The mammals of the Cerrado (Brazilian Savanna Biome) are still poorly known; only a few localities have been properly surveyed and studied. Hereby, we present a survey of the mammals of Serra do Cipó National Park, a protected area of Cerrado in Minas Gerais State, southeastern Brazil. A total of 55 species from eight orders were listed, which have been captured, observed or recorded in the literature. Some mammals are endemic or listed as threatened either by IUCN's red list or by the national and regional red lists. Serra do Cipó National Park is an important site for scientific research and conservation of Minas Gerais' biodiversity, though there is little information on mammal diversity and distribution in the park. We hope our study can help us fill this gap and improve the effectiveness of this national park in protecting Cerrado mammals and other vertebrates.

INTRODUCTION

The Cerrado is one of the most diverse and threatened ecosystems of the world ranking among the 34 biodiversity hotspots (Mittermeier *et al.* 2005). Only about 20% of its original forest cover still remains, and just 6.2% of the remaining areas are protected (Myers *et al.* 2000). Despite this current scenario, the Cerrado is well known for its high level of plant endemism (ca. 44% of 4 400 species), and vertebrate diversity (ca. 1 270 species) (Myers *et al.* 2000). However, endemism is rare among vertebrates. For mammals, for example, from the 196 species that occur in the Cerrado, only 18 are endemic to this biome (MMA 2002). The mammals of the Cerrado are still poorly known, in part because only a few localities have been adequately surveyed or subjected to long-term studies, and most studies have been concentrated in the central region of the biome.

Species inventories are extremely important for the elaboration of management plans for protected areas (Brito *et al.* 2004), as they provide basic information on the geographic distribution of species. They represent the second most common research topic among abstracts presented in the Brazilian Congress of Mammalogy (Brito *et al.* 2009), but, despite the importance of inventories, almost no studies do really come out as published papers (Brito *et al.* 2009).

Mammals are an important group for ecosystems due to their roles as regulators of lower trophic level populations (McLaren and Peterson 1994) and as seed predators and dispersers (Asquith *et al.* 1997; Cáceres *et al.* 1999; Grelle and Garcia 1999). Furthermore, several mammals are considered as flagship species, in other words they attract popular support that helps create and maintain protected areas. Our goal is to present the results of our mammal survey in a protected area within the State of Minas Gerais, the Serra do Cipó National Park, and to discuss the importance of this area for the conservation of threatened

and endemic Cerrado mammals of Minas Gerais.

MATERIALS AND METHODS

Study area

Serra do Cipó National Park is located within the municipalities of Santana do Riacho, Jaboticatubas, Itambé do Mato Dentro, and Morro do Pilar, (22°30' to 22°33' S; 42°15' to 42°19' W), state of Minas Gerais, southeastern Brazil (Figure 1). It covers ca. 33 800 ha of Cerrado. The vegetation is highly heterogeneous comprising *campo rupestre* (rocky field vegetation that usually occurs above 800 m a.s.l.), gallery forest, Cerrado *sensu stricto* (open savanna) and *cerradão* (forest savanna). Average temperatures range from 20 °C to 22 °C, with maximum values between 34 °C and 36 °C, and minimum between 0 °C and 4 °C. The average annual rainfall is 1622 mm and the altitude varies from 800 to 1 400 m a.s.l. (Meguro *et al.* 1996).

Species inventory

Small non-volant mammals were sampled with live-traps (Model Young 40 X 16 X 16 cm) distributed in eight areas with different vegetation types (*campo rupestre*: N = 2, gallery forest: N = 2, Cerrado *sensu stricto*: N = 2, *cerradão*: N = 1, and semi-deciduous forest: N = 1). The trapping points, 10 in each area, were set up either 10 or 20 m apart from each other. There were two live-traps at each trapping point: one on the ground and the other at 1.5 m on a tree branch, when possible. Each trap was baited with a mixture of banana, peanut butter, sardine oil, corn, and oat grains. In the areas of Cerrado *sensu stricto* and *campo rupestre*, two live traps were set on the ground separated by 10 m at each trap point. Small mammals captured for the first time were marked with coded ear tags (National-Band model 1005). The following data were recorded for each individual: species, ear tag code, sex, weight, and site of capture. After being examined, animals

were released at the site of their capture. Each trapping session comprised four consecutive nights per month, and each area was sampled monthly for 36 months (July 2001 to August 2003). At least one individual of each species captured was collected and deposited in the scientific collection of the Museu de Ciências Naturais PUC Minas. Some specimens were sent to Museu Nacional do Rio de Janeiro for identification by specialists, after which they were also deposited in the Museu de Ciências Naturais PUC Minas (Appendix 1). Captures were made under the permits 049/2002, 074/2005 and 10838-1 granted by the Brazilian Institute of Environment and Renewable Natural Resources.

Any medium and large mammals observed within the park while the traps were checked were also recorded in this study. In addition, we used information from the literature (Oliveira *et al.* 2003; Leal *et al.* 2008; Oliveira *et al.* 2009) to complement our survey, especially concerning medium and large mammals that were not targeted by our sampling. In these studies, medium and large mammals were recorded mainly in the region of the park open for tourist visitation (see Oliveira *et al.* 2009 for details).

RESULTS AND DISCUSSION

In a total of 21 360 trap nights, we captured 25 species of mammals: eight species of marsupials, 16 species of rodents, and one species of lagomorph. Two species of marsupials (*Cryptonanus* sp. and *Monodelphis kunsii*) were captured outside our sampling areas in a non-systematic sampling of other areas inside the park's limits. The

capture success was 14%, with 2 985 captures of 1 014 individuals (Table 1). The most abundant species was the rodent *Cerradomys subflavus*, followed by *Rhipidomys mastacalis* (Table 1).

Other additional 30 species of mammals were recorded in the literature or *ad libitum* by our field team. One specimen of *Alouatta clamitans* was found dead (roadkilled) in the park. The specimen was deposited in the Museu de Ciências Naturais PUC Minas in Belo Horizonte. A total of eight orders, 20 families and 55 species of mammals were recorded for Serra do Cipó National Park (Table 2). Several of those species are listed as threatened at some level (local, national or worldwide) (Table 2).

The mammal richness found in the park was similar to other Cerrado sites when comparing the same sampled groups of mammals (Table 3).

The mammals recorded in Serra do Cipó National Park correspond to 27.5 % of the mammal species known for the Cerrado (MMA 2002). However, future studies will surely document the presence of many other species, especially if they sample bats, which were not included in this study. Such future studies will be particularly useful if they use multiple additional sampling methods (*e.g.* mist nets, ultrasonic detectors, and harp traps for bats, pitfall and camera-traps for terrestrial mammals), and sample in other areas of the park. Most species recorded have large geographical distributions and also occur in other biomes, such as the Caatinga and the Atlantic Forest (Reis *et al.* 2011). According to previous studies, the Cerrado has less species and endemics than would be expected by its

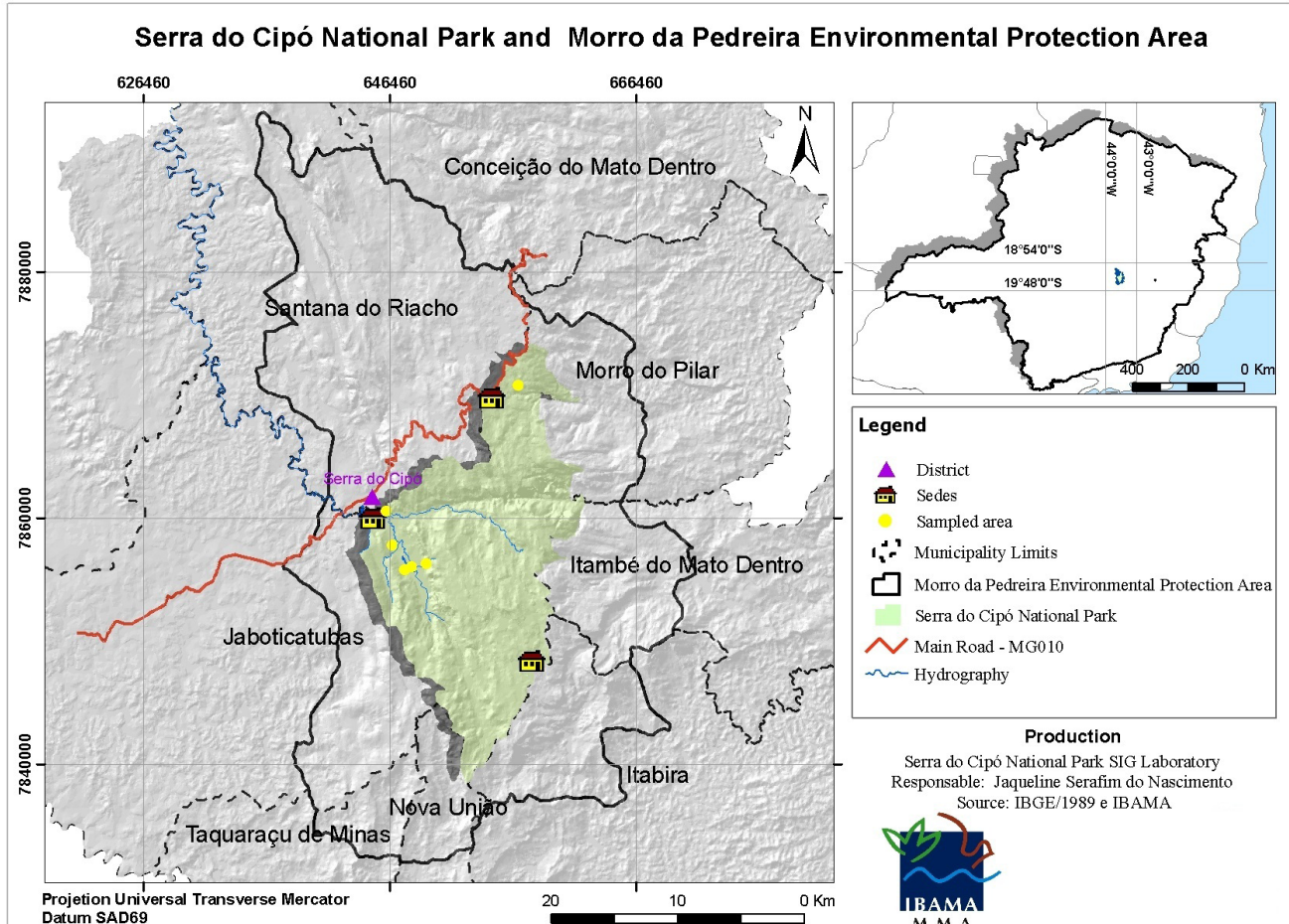


FIGURE 1. Serra do Cipó National Park, southeastern Brazil, showing our sampled areas.

size (Fonseca *et al.* 1999), but it is one of the biomes with highest number of threatened species (Costa *et al.* 2005). Our results are consistent with these findings. We recorded only two species endemic to the Cerrado, *Thalpomys lasiotis*, which was until now believed to be confined to central Brazil (Musser and Carleton 2005), and *Monodelphis kunsii*. At the same time, we recorded 10 species listed in both national (Machado *et al.* 2008) and regional (Biodiversitas 2007) red lists in the categories 'Vulnerable' and 'Near Threatened'. An important result was the record of species in the category 'Data Deficient': two in the regional list (Biodiversitas 2007), one in the national list (Machado *et al.* 2008) and three in the worldwide list (IUCN 2011). It is well known that the insufficiency or lack of knowledge on species ranges hinders conservation (Vivo 1996). Thus, we hope our results can contribute with information about the geographical distribution of those species. The records of the species listed in red lists *per se* points out that Serra do Cipó National Park is an important protection area for mammals. The importance of Serra do Cipó National Park to the Cerrado Biome was already evidenced for many groups of invertebrates and vertebrates (Lara and Fernandes 1997; Eterovick and Fernandes 2001; Melo-Junior *et al.* 2001), with the description of several new species of mammals, reptiles, and amphibians, based

on specimens collected in this park (Sazima *et al.* 1978; Sawaya and Sazima 2003; Pugliese *et al.* 2004). For mammals we can highlight the description of the bat *Lonchophyla bokermanni* (Sazima *et al.* 1978), which is listed as Endangered in the state's red list (Biodiversitas 2007) and considered as Data Deficient worldwide (IUCN 2011). Since the description of this species in 1978, it has not been observed again in Minas Gerais (Sampaio *et al.* 2008). Recently, we recorded a population of the endangered spiny rat *Trinomys moojeni* (IUCN 2011) inside the park (Corrêa *et al.* 2005). This was the first record after the species' description in 1954. Before our record, *T. moojeni* was known only from its type locality, Conceição do Mato Dentro, in a forest remnant under severe human pressure (Corrêa *et al.* 2005). However, three mammal species: *Myrmecophaga tridactyla*, *Speothos venaticus* and *Priodontes maximus*, which are believed to occur in the area, may be locally extinct (Oliveira *et al.* 2009).

Serra do Cipó National Park has been considered as an important area for scientific research in Minas Gerais State, though there is little information available on mammal diversity and its distribution within the park. We hope this study can help fill this gap of knowledge and provide useful information to implement the management plan for this protected area.

TABLE 1. Small mammals captured during the present study in Serra do Cipó National Park, state of Minas Gerais, southeastern Brazil. The nomenclature follows Wilson and Reeder 2005 and Weksler *et al.* 2006. * Species recorded outside the sample grid.
Weksler *et al.* 2006

SCIENTIFIC NAME	CAPTURES	INDIVIDUALS
Didelphimorphia		
<i>Caluromys philander</i> (Linnaeus, 1758)	1	1
* <i>Cryptonanus</i> sp. Voss, Lunde and Jansa, 2005	2	2
<i>Didelphis albiventris</i> Lund, 1840	34	23
<i>Gracilinanus agilis</i> (Burmeisterkn 1854)	93	50
<i>Marmosops incanus</i> (Lund, 1840)	221	65
<i>Monodelphis domestica</i> (Wagner, 1842)	85	42
* <i>Monodelphis kunsii</i> Pine, 1975	01	01
<i>Philander frenatus</i> (Olfers, 1818)	36	21
Rodentia		
<i>Akodon cursor</i> (Winge, 1887)	26	4
<i>Calomys tener</i> (Winge, 1887)	112	65
<i>Cavia aperea</i> Erxleben, 1777	16	9
<i>Cerradomys scotti</i> Langguth and Bonvincino, 2002 #	15	7
<i>Cerradomys subflavus</i> (Wagner, 1842) #	944	280
<i>Euryoryzomys russatus</i> (Wagner, 1848) #	2	2
<i>Necomys lasiurus</i> (Lund, 1841)	2	2
<i>Nectomys squamipes</i> (Brants, 1827)	16	12
<i>Oligoryzomys nigripes</i> (Olfers, 1818)	223	103
<i>Oxymycterus dasytrichus</i> (Schinz, 1821)	1	1
<i>Oxymycterus delator</i> Thomas, 1903	23	18
<i>Rhipidomys mastacalis</i> (Lund, 1840)	667	169
<i>Thalpomys lasiotis</i> Thomas, 1916	124	34
<i>Thrichomys apereoides</i> (Lund, 1839)	336	99
<i>Trinomys moojeni</i> Pessoa, Oliveira and Reis, 1992	1	1
<i>Trinomys setosus</i> (Lund, 1841)	6	5
Lagomorpha		
<i>Sylvilagus brasiliensis</i> (Linnaeus, 1758)	1	1

TABLE 2. Mammal species of Serra do Cipó National Park and their respective conservation status: EN= Endangered; VU= Vulnerable; DD= Data Deficient; NT = Near Threatened (category 'least concern' was not considered) in the state of Minas Gerais (MG), Brazil (BR) and worldwide (WW) following Biodiversitas (2007), Machado *et al.* (2008) and IUCN (2011) respectively. The nomenclature follows Wilson and Reeder 2005 and Weksler *et al.* 2006. # Weksler *et al.* 2006.

SPECIES	MG	BR	WW
Didelphimorphia			
<i>Caluromys philander</i> (Linnaeus, 1758)			
<i>Cryptonanus</i> sp. Voss, Lunde and Jansa, 2005			
<i>Didelphis albiventris</i> Lund, 1840			
<i>Gracilinanus agilis</i> (Burmeisterkn, 1854)			
<i>Marmosops incanus</i> (Lund, 1840)			
<i>Monodelphis domestica</i> (Wagner, 1842)			
<i>Monodelphis kunsii</i> Pine, 1975		DD	
<i>Philander frenatus</i> (Olfers, 1818)			
Cingulata			
<i>Cabassous unicinctus</i> (Linnaeus, 1758)	VU		
<i>Dasyus novemcinctus</i> Linnaeus, 1758			
<i>Euphractus sexcinctus</i> (Linnaeus, 1758)			
Pilosa			
<i>Tamandua tetradactyla</i> (Linnaeus, 1758)	EN		
Primates			
<i>Callithrix geoffroyi</i> (É Geoffroy in Humboldt 1812)			
<i>Callithrix penicillata</i> (É Geoffroy in Humboldt 1812)			
<i>Alouatta caraya</i> (Humboldt, 1812)			
<i>Alouatta clamitans</i> (Humboldt, 1812)	VU		
Carnivora			
<i>Cerdocyon thous</i> (Linnaeus, 1766)			
<i>Chrysocyon brachyurus</i> (Illiger, 1815)	VU	VU	NT
<i>Lycalopex vetulus</i> (Lund, 1842)	VU		
<i>Nasua nasua</i> (Linnaeus, 1766)			
<i>Procyon cancrivorus</i> (G. Cuvier, 1798)			
<i>Conepatus semistriatus</i> (Boddaert, 1784)			
<i>Eira barbara</i> (Linnaeus, 1758)			
<i>Galictis cuja</i> (Molina, 1782)			
<i>Lontra longicaudis</i> (Olfers, 1818)	VU		DD
<i>Leopardus pardalis</i> (Linnaeus, 1758)	VU	VU	
<i>Leopardus tigrinus</i> (Schreber, 1775)	VU	VU	VU
<i>Puma concolor</i> (Linnaeus, 1771)	VU	VU	
<i>Puma yagouaroundi</i> (Lacépède, 1809)	DD		
Artiodactyla			
<i>Mazama americana</i> (Erxleben, 1777)			DD
<i>Mazama gouazoubira</i> (G. Fischer, 1814)			DD
<i>Pecari tajacu</i> (Linnaeus, 1758)	VU		
Rodentia			
<i>Guerlinguetus ingrami</i> (Thomas, 1901)			
<i>Akodon cursor</i> (Winge, 1887)			
<i>Calomys tener</i> (Winge, 1887)			
<i>Cerradomys scotti</i> Langguth and Bonvincino, 2002 #			
<i>Cerradomys subflavus</i> (Wagner, 1842) #			
<i>Euryoryzomys russatus</i> (Wagner, 1848) #			
<i>Necomys lasiurus</i> (Lund, 1841)			
<i>Nectomys squamipes</i> (Brants, 1827)			
<i>Oecomys concolor</i> (Wagner, 1845)			
<i>Oligoryzomys nigripes</i> (Olfers, 1818)			
<i>Oxymycterus dasytrichus</i> (Schinz, 1821)			
<i>Oxymycterus delator</i> Thomas, 1903			
<i>Rhipidomys mastacalis</i> (Lund, 1840)			
<i>Thalpomys lasiotis</i> Thomas, 1916			
<i>Coendou prehensilis</i> (Linnaeus, 1758)			
<i>Cavia aperea</i> Erxleben, 1777			
<i>Hydrochoerus hydrochaeris</i> (Linnaeus, 1766)			

<i>Cuniculus paca</i> (Linnaeus, 1766)			
<i>Dasyprocta leporina</i> (Linnaeus, 1758)		NT	
<i>Trinomys moojeni</i> Pessoa, Oliveira and Reis, 1992		VU	EN
<i>Trinomys setosus</i> (Lund, 1841)		DD	
<i>Thrichomys apereoides</i> (Lund, 1839)			
Lagomorpha			
<i>Sylvilagus brasiliensis</i> (Linnaeus, 1758)			

TABLE 3. Number of mammal species recorded in different national parks in the Cerrado Biome, Brazil. CANASTRA = Serra da Canastra National Park; EMAS = Emas National Park; CIPÓ = Serra do Cipó National Park.

SPECIES	* CANASTRA	** EMAS	*** CIPÓ
Didelphimorphia	5	10	8
Pilosa	2	2	1
Cingulata	6	5	3
Chiroptera	12	24	NE
Primates	2	2	4
Carnivora	13	16	13
Perissodactyla	0	1	0
Artiodactyla	2	6	3
Rodentia	16	19	22
Lagomorpha	1	0	1
Total	59	85	55
W/o Chiroptera	47	61	55

NE= Not evaluated. The totals presented in the last two rows represent the total number of species with and without the order Chiroptera, which was sampled in the two former studies but not in ours. The total without this order was used here for comparison.

* Data from: Schneider *et al.* 2000

** Data from: Rodrigues *et al.* 2002

*** Data from: Oliveira *et al.* 2003; Leal *et al.* 2008; Oliveira *et al.* 2009 and fieldwork of this study.

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APPENDIX 1. Voucher numbers of small mammal specimens collected during this study in Serra do Cipó National Park, southeastern Brazil, and deposited in the Museu de Ciências Naturais da PUC Minas. The nomenclature follows Wilson and Reeder 2005 and Weksler *et al.* 2006. # Weksler *et al.* 2006.

SCIENTIFIC NAME	VOUCHER NUMBER
Didelphimorphia	
<i>Caluromys philander</i> (Linnaeus, 1758)	MCN-M 1428
<i>Cryptonanus</i> sp. Voss, Lunde and Jansa, 2005	MCN-M 1451, 1456
<i>Didelphis albiventris</i> Lund, 1840	MCN-M 874
<i>Gracilinanus agilis</i> (Burmeisterkn 1854)	MCN-M 885
<i>Marmosops incanus</i> (Lund, 1840)	MCN-M 873, 877, 932, 935
<i>Monodelphis domestica</i> (Wagner, 1842)	MCN-M 988
<i>Monodelphis kunsii</i> Pine, 1975	MCN-M 1465
<i>Philander frenatus</i> (Olfers, 1818)	MCN-M 951, 1639
Rodentia	
<i>Akodon cursor</i> (Winge, 1887)	MCN-M 890, 965, 966, 967
<i>Calomys tener</i> (Winge, 1887)	MCN-M 1085, 1096, 1118
<i>Cavia aperea</i> Erxleben, 1777	MCN-M 947
<i>Cerradomys scotti</i> Langguth and Bonvincino, 2002 #	MCN-M 1956
<i>Cerradomys subflavus</i> (Wagner, 1842) #	MCN-M 1240, 1577, 1578, 1579
<i>Euryoryzomys russatus</i> (Wagner, 1848) #	MCN-M 975
<i>Necomys lasiurus</i> (Lund, 1841)	MCN-M 926
<i>Nectomys squamipes</i> (Brants, 1827)	MCN-M 888, 939, 955, 1045
<i>Oligoryzomys nigripes</i> (Olfers, 1818)	MCN-M 1732
<i>Oxymycterus dasytrichus</i> (Schinz, 1821)	MCN-M 1063
<i>Oxymycterus delator</i> Thomas, 1903	MCN-M 973, 990, 991
<i>Rhipidomys mastacalis</i> (Lund, 1840)	MCN-M 870, 880, 948, 1347
<i>Thalpomys lasiotis</i> Thomas, 1916	MCN-M 966, 967, 968, 986
<i>Thrichomys apereoides</i> (Lund, 1839)	MCN-M 868, 869, 883
<i>Trinomys moojeni</i> Pessoa, Oliveira and Reis, 1992	MCN-M 1180; MCN-M 2012.
<i>Trinomys setosus</i> (Lund, 1841)	MCN-M 990