

Home range, movement patterns and demography of *Didelphis albiventris* Lund (1840) in southeastern Brazil

Felipe Santana Machado¹, Aloysio S. de Moura², Dalmo A. de Barros³,
Ravi F. Mariano⁴, Marco Aurélio Leite Fontes⁵

¹ Universidade Estadual do Sudoeste da Bahia (UESB), BR-415, KM131, Bairro Jardim Morumbi, Itapetinga, BA. Email: felipe.machado@uesb.edu.br

² Agência UFLA de Inovação em Geotecnologias e Sistemas Inteligentes no Agronegócio – Zetta, Departamento de Ciências Florestais (DCF), Universidade Federal de Lavras (UFLA), CP3037, Lavras, MG, Brazil. E-mail: epilefsama@hotmail.com

³ Departamento de Ciências Florestais (DCF), Universidade Federal de Lavras (UFLA), CP3037, Lavras, MG, Brazil. E-mail: epilefsama@hotmail.com

⁴ Departamento de Ciências Florestais (DCF), Universidade Federal de Lavras (UFLA), CP3037, Lavras, MG, Brazil. E-mail: epilefsama@hotmail.com

⁵ Departamento de Ciências Florestais (DCF), Universidade Federal de Lavras (UFLA), CP3037, Lavras, MG, Brazil. E-mail: epilefsama@hotmail.com

Received in: 13/10/2025

Accepted in: 26/05/2026

Abstract

Population dynamics and spatial use by didelphid marsupials are fundamental for understanding gene flow, community structure, and ecosystem functioning, as these animals play key roles in seed dispersal, food web dynamics, metapopulation processes, and disease ecology. However, available data often show contradictory patterns across study areas. This study was developed in order to describe and analyze the home range of *Didelphis albiventris* in a broad landscape within the ecotonal region between the Atlantic Forest and Cerrado. Additionally, there were examined abundance, sex ratio, reproductive females, residence time or movement between fragments, and their relationships with body mass. Sampling was conducted over 14 months using Tomahawk, Sherman, and pitfall traps in a capture–mark–recapture design. Distances ranged from 0.20 to 4.16 km. Home ranges, based on three to six recaptures, varied from 2.10 to 8.49 km in perimeter and 0.0007 to 1.17 km² in area. There were captured 146 individuals (95 females and 51 males) with 126 recaptures. The mean litter size was six. The sex ratio favored females across all sampled fragments. The average residence time in fragments was 19.33 days. Regression analyses showed no significant relationship between body mass and displacement or permanence. Home ranges were larger than those previously reported. Females were more numerous and exhibited longer and more frequent movements between small forest fragments. Litter size was smaller than that reported for other regions of southeastern Brazil. Overall, *D. albiventris* in this region showed high abundance, a female-biased population, and expanded spatial use.

Keywords: Conservation. Ecology. Faunal management. Marsupial movement.

Introduction

The Didelphidae family occurs across all Brazilian biomes, exhibiting its greatest genetic and species diversity from the Amazon to the Atlantic Forest (Cáceres, Lessa, 2012; Nascimento *et al.*, 2019). Over the past decades, marsupials have been widely used as model organisms in population studies, providing insights across different domains, particularly the Atlantic Forest and the Cerrado (Lessa, Geise, 2010; Nascimento *et al.*, 2019). Many marsupial species are sympatric, and most have distribution ranges that encompass at least two morphoclimatic domains (Lessa, Costa, 2010; Nascimento *et al.*, 2019).

On average, five to ten species of marsupials may be found in the same region (Bergallo, 1994; Emmons, Feer, 1997; Fleck, Harder, 1995; Julien-Laferrrière, 1991). However, movements patterns are contradictory because they vary between forest fragments, morphoclimatic domains, and species, especially those with large body size and terrestrial habits (Lira *et al.*, 2007; Passamani, Fernandez, 2011; Pires *et al.*, 2002). Generally, larger species are individuals capable to reaching more distance fragments (Forero-Medina, Vieira, 2009). These movements can cover several kilometers, with home ranges reported from 30.00 to 46.00 ha (Forero-Medina, Vieira, 2009; Wright *et al.*, 2012).

The area used and the movements of an individual define its home range (Burt, 1943). Home ranges are influenced by landscape characteristics (Andreassen *et al.*, 1998), as human activities modify the environment to meet anthropogenic demands. Different landscape matrices have been associated with *Didelphis* and other marsupials, including forest cover (Kanda *et al.*, 2006), grasslands (Forero-Medina, Vieira, 2009), and urban environments (Wright *et al.*, 2012), among others. Typically, home ranges comprise a set of habitat fragments that serve as refuges (Oliveira *et al.*, 2014), through which individuals move, using landscape permeability (Prevedello *et al.*, 2010) to perform essential activities related to survival.

Understanding home range, movement and demography patterns is crucial for comprehending gene flow between populations, structuring communities (Cayuela *et al.*, 2018). Moreover, it is essential for the functioning, affecting seed dispersion (average distance of 800.00 m) (Cáceres, 2000a), trophic/food web dynamics, metapopulation structure (Tucker *et al.*, 2018) and dynamics of diseases, such as viruses (Cavalcante, Alencar, 2018; Duarte *et al.*, 2019) and parasites (Teodoro *et al.*, 2019). Nevertheless, many studies present results of movements restricted to a single biome, or with small sampling effort, highlighting a knowledge gap (Driscoll *et al.*, 2014).

Based on this context, this work was developed in order to describe and analyze the home range of *Didelphis albiventris* across a wide landscape (~40 km²) in the ecotonal region of the Atlantic Forest and Cerrado domains. Secondly, data is presented on abundance; sex ratio; presence of females with offspring; residence time or displacement between fragments; and the relationship between body mass and residence or displacement.

Material and methods

Study area

The study area is located in southeastern Brazil, in an area of Atlantic Forest that surrounds the Camargos and Itutinga reservoirs (21°18' S - 21°14' S and 44°39' W - 44°35' W) (Figure 1).

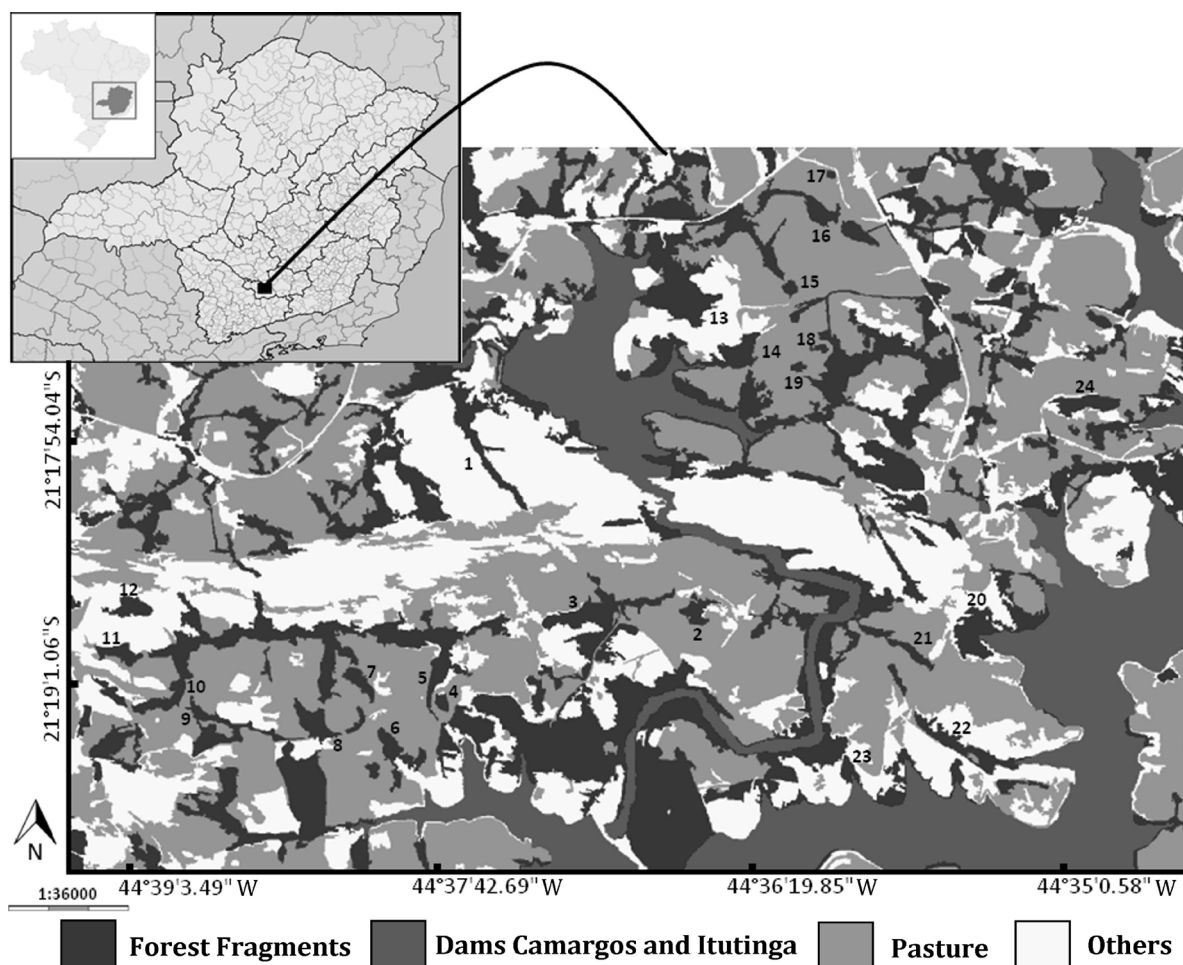
The region is located in an ecotone between two hotspots, the Atlantic Forest and the Cerrado biome (Myers *et al.*, 2000), in southeastern Brazil. The sampled area corresponds to 24 fragments of seasonal semideciduous forest, each less than 50.00 ha. The shortest distance between the fragments was 235.00 m and the longest 8.45 km (SD 362.60 m).

According to the Köppen classification, the climate is Cwa (Alvares *et al.*, 2013), characterized as mesothermal, with mild summers and dry winters. The mean annual temperature is 19.6 °C, ranging from 16.0 to 21.8 °C. The mean annual precipitation is 1,517 mm, concentrated between October and March, with peak values reaching up to 2,933 mm (Berg, Oliveira-Filho, 1999). According to the Brazilian Soil Classification System (Solos, 2013), the soils range from Haplic Cambisols (Tb) to Yellow Acric Latosols.

Sample design

Sampling was conducted over a 14-month period. During two seven-month phases, 12 forest fragments were surveyed for seven consecutive days per month (12 fragments from October 2012 to April 2013 and the remaining 12 from June 2013 to December 2013). Fragments were randomly selected based on logistical feasibility within the landscape. Traps were installed near the center of each fragment. Monthly sampling was carried out over seven days using Sherman and Tomahawk traps and four days using pitfall traps. Non-linear transects were established, consisting of ten sampling points equipped with two types of traps: a Sherman trap (30.0 × 8.0 × 9.0 cm)

Figure 1. Location of the forest fragments located in the ecotonal region between the Atlantic forest and the Cerrado biome, in the south of the state of Minas Gerais, southeastern Brazil. Graphic scale in meters.



Source: map by Machado *et al.* (2021).

and a Tomahawk trap (68.0 × 33.0 × 37.0 cm) (Lambert *et al.*, 2005). At each sampling point, one trap was placed on the ground and another at an average height of 1.60 m. Sampling points were spaced 4.0 m apart.

Linear transections were also deployed, consisting of six pitfall traps interconnected with wooden piles and plastic bags; two buckets with 65.00 L capacity were arranged at the ends, two with 45.00 L buckets were placed in the middle and two with 35.00 L buckets were placed in the center of the transect. The traps were 6.00 m apart and 3.00 map art from the transection of the traps (similar to Machado *et al.*, 2021). Thus, a total of 30,576 traps-day (7,056 pitfall-day and 23,520 traps-day) were used.

The Mark-Recapture method was used and the captured individuals received metallic ear tags or small numbered plastic rings in their ears. Biometric measurements were also recorded, such as weight, head-body length, tail, ear and foot length, as well as sex and reproductive condition for females, since males expose their scrotum permanently (Kühl, Burghard, 2013). The fieldwork was carried out with authorization from IBAMA-ICMBio nº 18528-2.

Data analysis

Relative abundance was calculated considering only initial captures for each fragment (Pinto-Coelho, 2009). The presence of females with offspring was reported numerically

as a percentage. The sex ratio was analyzed using the chi-square (χ^2) test, comparing the observed frequencies of males and females with the expected 1:1 proportion. This analysis was performed for the total sample and separately for subsets of fragments, in order to evaluate possible spatial variation in sex ratio. The significance level adopted was 5 % ($p < 0.05$).

Residence time in each fragment was estimated by counting the number of days between the first and the last capture of each individual of each sex, according to Gentile and Cerqueira (1995). The average residence time for the total number of sampled individuals was estimated through the relationship between the permanence period and the number of individuals of each sex (Graipel, Dos Santos Filho, 2006). Mann-Whitney U test at 5.00 % significance level was used to verify differences in the mean residence time between the sexes in the fragments (Aguar, Valentin, 2010). Simple regression analyzes between body mass and displacement and permanence data were also performed. For these analyses, the BioEstat software was used (Ayres *et al.*, 2007).

The home range, defined by the records in more than three locations and their respective perimeters and areas were mapped on a two-dimensional map, using Google Earth® software (Google Earth, 2022). These home ranges were calculated for each individual using Minimum Convex Polygon (MCP) method (Mohr, 1947; Hayne, 1949).

Individuals were classified into age classes (juveniles and adults) based on body size and reproductive condition. Juveniles were identified by smaller body mass and absence of reproductive signs, whereas adults were identified by larger body size and, in the case of females, the presence of developed nipples, pregnancy, or offspring in the marsupium. Males were classified as adults based on the presence of scrotal testes, which are permanently exposed in this group.

The sex ratio was evaluated using the chi-square (χ^2) test, comparing the observed frequencies of males and females with the expected 1:1 proportion. This analysis was performed both for the total sample and for subsets of fragments, in order to assess possible spatial variation in sex ratio.

To ensure coherence between the analytical procedures and the objectives of the study, the following statistical hypotheses were adopted. For the chi-square (χ^2) test, the null hypothesis (H0) assumed that the sex ratio of *Didelphis albiventris* does not differ from the expected proportion (1:1) among sampled fragments, while the alternative hypothesis (H1) assumed a significant deviation from this proportion.

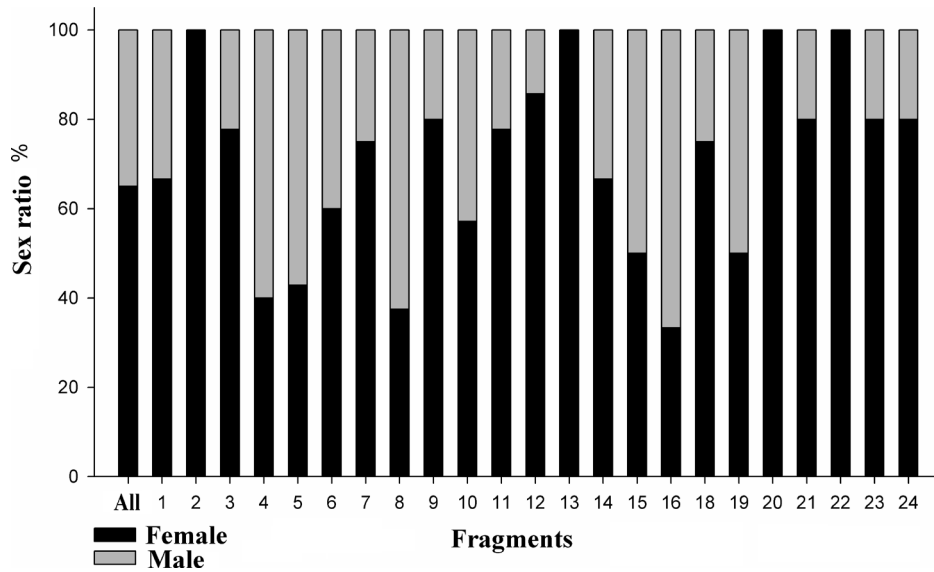
For the Mann-Whitney U test, the null hypothesis (H0) considered that there is no significant difference in residence time between males and females, whereas the alternative hypothesis (H1) assumed that residence time differs between sexes.

For the linear regression analyses, the null hypothesis (H0) assumed that there is no relationship between body mass and displacement or permanence of individuals, while the alternative hypothesis (H1) assumed the existence of a significant relationship between these variables.

Results

A total of 146 individuals of *Didelphis albiventris* were captured (95 females and 51 males) (Table 1). Fragment 17 was the only one with no captures; 55 individuals were recaptured, totaling 126 recaptures. From the total number of captured individuals, 120 were aged, being composed of 67 (55.83 %) adults and 53 (44.16 %) juveniles. The chi-square test indicated a significant difference in sex ratio between males and females for the total number of sampled fragments together (Table 2, Figure 2) with a higher proportion for females (Table 2, Figure 2).

Figure 2. General sexual ratio of *D. albiventris* for each sampled forest fragment in an ecotonal region between the Atlantic Forest and the Cerrado biome, in the south of the state of Minas Gerais, southeastern Brazil.



Source: authors (2026).

Table 1. Absolute abundance and relative abundance of *D. albiventris* for each sampled forest fragment in an ecotonal region between the Atlantic Forest and Cerrado, in the south of the state of Minas Gerais, southeastern Brazil.

Fragment	Area size (ha)	Absolute abundance	Relative abundance
1	8.96	7	4.79
2	1.74	2	1.37
3	8.53	9	6.16
4	0.99	5	3.42
5	3.36	7	4.79
6	4.21	6	4.11
7	3.09	9	6.16
8	7.80	9	6.16
9	1.67	5	3.42
10	6.85	7	4.79
11	4.65	9	6.16
12	4.26	8	5.48
13	12.24	9	6.16
14	4.41	3	2.05
15	1.05	5	3.42
16	3.26	4	2.74
17	0.26	0	0.00
18	0.49	6	4.11
19	0.89	6	4.11
20	4.52	2	1.37
21	3.67	6	4.11
22	2.19	7	4.79
23	2.05	10	6.85
24	4.97	5	3.42
Total	-	146	100

Source: authors (2026).

Table 2. Results of the chi-square analyzes to different male and female relationship of *D. albiventris* between forest fragments sampled in an ecotonal region between the Atlantic Forest and the Cerrado, in the south of the state of Minas Gerais, southeastern Brazil.

Male and female Relationships	X ²	P
Male and female in all fragments	9.00	0.003
Male and female in first 12 forest fragments	3.42	0,064*
Male and female in last 12 forest fragments	7.38	0.006
Male between first and last forest fragments	89.11	<0.0001
Female between sides first and last forest fragments	7.38	0.006

* Represents the values that did not show any significant difference.

Source: authors (2026).

On the 78 females captured, 55 were adults (70.51 %) and 23 (34.73 %) were juveniles. Of the total number of juvenile females, 21 (91.3 %) were captured in the wet/rainy season. The average number of offspring was six individuals (ranged from four to eight individuals).

Covered displacement distances ranged from 0.20 to 4.16 km, with average of 1.58 (SD \pm 1.13 km). The home ranges, based on three recaps to maximum of six recaptures, ranged from 2.10 to 8.49 km, with average of 5.09 (SD \pm 2.35 km) (perimeter), and 0.0007 to 1.54 km², with average of 0.45 (SD \pm 0.58 km²) (area). Four other females were found that are not in this table with 5, 6, 7, and 7 offspring (see details to each individual in Table 3, Figure 3).

The displacement and permanence events in the fragments demonstrated that of the 126 recaptures, 42 (33.33 %) were of individuals that moved and 84 (66.67 %) of individuals that remained in the same fragment (Table 4).

The Mann-Whitney test did not show any significant differences between male and female residence times (Table 4). The average residence time of individuals in the fragments was 19.33 days, with a minimum of one day and a maximum of 70 days. Regression analyzes showed no significant relationship between body mass and displacement or permanence of individuals (to displacement $r = 0,001$ and $p = 0,31$; to permanence $r = 0,04$ and $p = 0,11$) (Figure 4).

Discussion

A larger home range (perimeter and area) was found in this study compared with other studies (Almeida *et al.*, 2008; Sanches *et al.*, 2012). This aspect is likely attributed to the regional scale of the study area, where forest fragments are up to 10.00 km apart. The movements can reach many kilometers away, with living areas ranging from 30.00 to 46.00 ha (Forero-Medina, Vieira, 2009; Wright *et al.*, 2012). This dispersion capacity has implications for understanding the dispersion of genes between populations, community structure (Gentile, Cerqueira, 1995), seed dispersal, food chain dynamics, metapopulation structure (Tucker *et al.*, 2018) and diseases dynamics (Duarte *et al.*, 2019; Teodoro *et al.*, 2019). For this reason, this dispersion is described as a metapopulation within a given area due to low aggregation (Gentile, Cerqueira, 1995).

A special observation should be highlighted about the displacements performed by the individuals in this study: their ability to disperse through different landscape matrices (Baguette *et al.*, 2013). Even the individual that covered the shortest distance (200.00 m) crossed a single pasture matrix, while the individual that covered the longest distance (4.16 km in linear distance) crossed pastures, semideciduous forests, *Cerrado sensu stricto*, rocky outcrop, and unpaved roads. This pattern demonstrates

Table 3. Individuals with recaptures and that presented displacements among the capture points of *D. albiventris* in an ecotonal region between Atlantic Forest and Cerrado, in the south of the state of Minas Gerais, southeastern Brazil.

ID	Displacement (km)	Polygon perimeter (km)	Home range (m ²)	Sex
B 154	2.53	0.00	0.00	Female (w/ 6 offspring)
B 158	1.75	0.00	0.00	Male
B 159	2.36	5.46	819.50	Male
B 169	1.97	0.00	0.00	Female
B 171	0.2	0.00	0.00	Male
B 172	1.8	0.00	0.00	Female (w/ 8 offspring)
B 173	0.48	0.00	0.00	Male
B 174	1.99	0.00	0.00	Female
B 182	2.36	5.20	690.80	Female
C B24	0.87	0.00	0.00	Female
C B27	0.95	0.00	0.00	Male
C B13	1.00	0.00	0.00	Female
C B19	0.87	0.00	0.00	Male
C B21	1.68	0.00	0.00	Female
C B22	3.23	7.32	1,540,225.00	Male
C B27	0.92	0.00	0.00	Male
C B28	1.06	3.00	445,584.00	Male
C B31	0.36	0.00	0.00	Female
C B37	1.00	0.00	0.00	Female
C B38	4.16	0.00	0.00	Female
C B41	4.15	8.49	1,176,849.00	Female
C B43	1.16	2.35	63,206.00	Male
C B92	0.85	2.10	180,735.00	Male
C B93	3.78	0.00	0.00	Female
C B94	0.54	0.00	0.00	Female (w/ 4 offspring)
B184	0.58	0.00	0.00	Male
B186	0.23	0.00	0.00	Female
B194	2.35	4.74	154,967.00	Female
B197	0.56	0.00	0.00	Female
B198	1.66	0.00	0.00	Female (w/ 5 offspring)

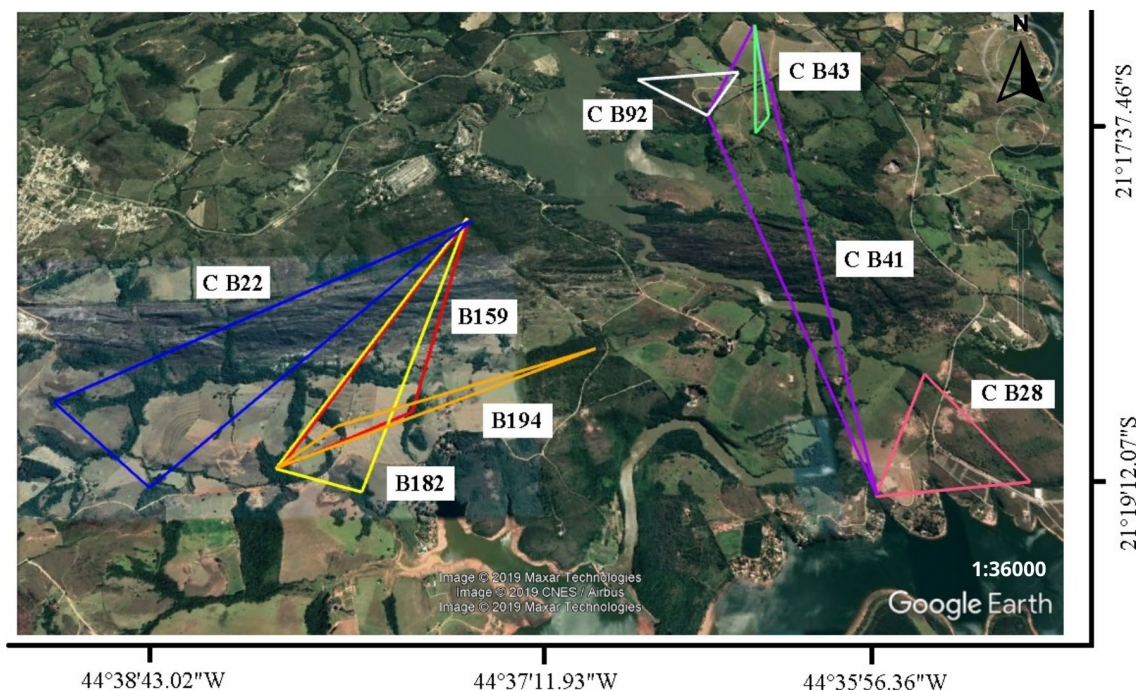
Source: authors (2026).

that this marsupial, depending on its current ecological needs, becomes nomadic with high implications for metapopulation management and genetic connectivity (Nascimento *et al.*, 2019).

Females had a higher proportion than males. Females had a greater number and longer displacements between small forest fragments.

The number of offspring was lower than that mentioned in the scientific literature (Dantas *et al.*, 2017). The high proportion of *D. albiventris* permanence corroborates other studies that evaluated the same genus, *Didelphis*, which found long residence and restricted movements of this marsupial. In addition, this study found a greater number of displacements by females relative to

Figure 3. Map of home range formed by the displacement of *D. albiventris* in forest fragments in an ecotonal region between the Atlantic Forest and the Cerrado biome, in the south of the state of Minas Gerais, southeastern Brazil. Image from 2013. Graphic scale in meters.



Source: authors (2026).

males (18 females and 12 males), even though the male living area polygon was the largest. This contradicts the literature, since males have a lower proportion of permanence and a greater number of displacements in relation to females (Gentile, Cerqueira, 1995). Thus, these results

support the argument of behavioral changes due to a lack of resources and conditions for females (Mendel, Vieira, 2003), mainly when the landscape is formed by small fragments inserted in ecotonal region between Atlantic Forest and *Cerrado* (this study).

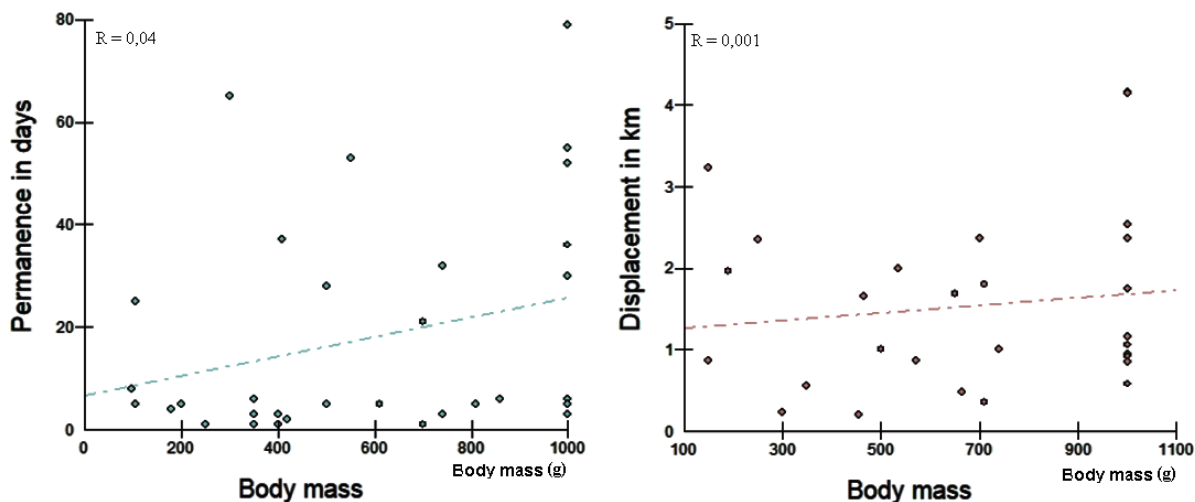
Table 4. Number of permanence and displacement events, average residence time and statistical test for males and females sampled of *D. albiventris* in forest fragments in an ecotonal region between the Atlantic Forest and Cerrado, in the south of the state of Minas Gerais, southeastern Brazil.

Event	Number of events	Average residence time (days)	
Female			
Displacement	24.00 (19.05 %)		
Permanence	64.00 (50.80 %)	20.17	
Male			
Displacement	18.00 (14.28 %)		
Permanence	20.00 (15.87 %)	16.90	
Mann-Whitney test		U	P
		124.00	0.49
Total	126.00	-	

Values in parentheses represent the relative frequency.

Source: authors (2026).

Figure 4. Regression analyses of body mass (g) and displacement or permanence of *D. albiventris* in forest fragments in an ecotonal region between the Atlantic Forest and the Cerrado biome, in the south of the state of Minas Gerais, southeastern Brazil.



Source: authors (2026).

Although not directly tested in this study, variables related to fragment structure, microhabitat characteristics, and landscape configuration may influence displacement and permanence patterns of *Didelphis albiventris*. These variables may act as ecological trade-offs, where more structured fragments with higher resource availability favor longer residence times, while less suitable environments promote increased movement between patches (Machado *et al.*, 2021). In this context, habitat fragmentation may also play a broader role in shaping population structure and dynamics. Studies on small mammals have suggested that fragmentation can influence social organization and act as a population regulatory mechanism, affecting how individuals distribute themselves across the landscape. Although such mechanisms were not explicitly evaluated here, the patterns observed in this study may reflect, at least partially, the influence of landscape configuration on individual behavior and population parameters. Future studies integrating habitat variables and demographic data would be essential to test these relationships more directly (Flesch, 2013).

The number of captures and recaptures of *D. albiventris* is high when compared with the absolute number of individuals in other studies

that focused on the same species in the Atlantic Forest or the *Cerrado* biome. However, the proportion of the number of individuals (captures and recaptures) in relation to the sampling effort presented an intermediate value [proportion (individuals captured + recaptured) / sampling effort (PICR/SE) of this study is 0.009] when compared to Cáceres (2000b) that registered 82 catches with 37 individuals, with an effort of 1,770 traps-nights (PICR/SE = 0.02); Oliveira *et al.* (2007) reached 26 catches for 12 individuals, with an effort of 7,115 traps-days (PICR/SE = 0.002); Sanches *et al.* (2012) reached 146 catches of 41 individuals, with 3,360 traps-days (PICR/SE = 0.01); and Rocha *et al.* (2017) reached 32 catches with 18 individuals, with 1,296 traps-nights (PICR/SE = 0.002). This abundance is a result of high sampling effort and immigration, as these have been registered among the main factors of the variation in the abundance of *Didelphis* (Cáceres, 2000b), because females form territories that no-overlapping territories during breeding season, similar to that described for *Didelphis* in Oliveira *et al.* (2007).

The highest proportion of females is common for anthropized environments (Santori *et al.*, 2012). However, this difference was not

considered significant by Cáceres (2000b). The females had, on average, nine offspring (Graipel, Dos Santos Filho, 2006), but this study presented six offspring, as mentioned by Mendel and Vieira (2003).

On average, five to ten species of marsupials may be found in the same region (Julien-Laferrère, 1991; Bergallo, 1994; Fleck, Harder, 1995; Emmons, Feer, 1997) and movements patterns are contradictory because they vary between forest fragments, morphoclimatic domains, and species, especially those with large body size and terrestrial habits (Pires *et al.*, 2002; Lira *et al.*, 2007; Passamani, Fernandez, 2011). Generally, species and individuals with large body sizes are able to reach fragments at greater distances (Forero-Medina, Vieira, 2009). This study did not find a relationship between body mass and permanence or displacement for individuals from *D. albiventris*.

Didelphis albiventris are described in the literature as seed dispersers (Cáceres, 2002; Cantor *et al.*, 2010), habitat generalists (Fonseca *et al.*, 1982; Talamoni, Dias, 1999; Paglia *et al.*, 2012), with ability to use matrix with reduced plant biomass, such as rural area (Carusi *et al.*, 2009), being considered synanthropic (Cáceres, 2000b; Oliveira *et al.*, 2014), and showing no activity changes in response to human disturbance (Mendes *et al.*, 2020). This phenotypic flexibility favors the distribution of the species in a large part of the national territory (Costa *et al.*, 2015) and their occurrence in large, medium (Mendel, Vieira, 2003; Sanches *et al.*, 2012; Dias *et al.*, 2019) and small forest fragments (Cáceres, 2000b; Cáceres, Machado, 2013).

This is the first effort to understand the home range, population aspects and movement patterns of *Didelphis albiventris* in an ecotonal environment of the *Cerrado* and the Atlantic Forest biomes with fragments smaller than 50.00 ha in southeastern Brazil. The presence of small fragments is mentioned for different domains and

locations (Ribeiro *et al.*, 2009; Klink, Machado, 2005), where there is absence of medium and large animals (Young *et al.*, 2015a; Young *et al.*, 2015b; Young *et al.*, 2016a; Young *et al.*, 2016b). Therefore, the results of this research are fundamental for understanding the dynamics of synanthropic wild fauna and can be used as an argument by municipal managers for their preservation and conservation, as well as actions for disease control, since small terrestrial mammals can be intermediate and/or reservoir hosts (Duarte *et al.*, 2019; Teodoro *et al.*, 2019).

Conclusion

Didelphis albiventris exhibits a larger home range, high abundance, a higher sexual proportion of females, a greater number of female displacements, and a smaller litter when compared to other regions in southeastern Brazil. The animals can reach different fragments by moving through different matrices (pasture, monocultures, or *Cerrado stricto sensu*).

Acknowledgements

We thank the small owners who allowed the study to be developed. We thank the financial support to FSM that received research fellowship from Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG) (ID-11511); ASM received research fellowship from FAPEMIG (ID-11512); and RFM research fellowship from Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) (Code 001). We thank FUNDECC for the financial subsidy, the Federal University of Lavras – UFLA for the opportunity to develop this manuscript and the Laboratory of Studies and Projects in Forest Management – LEMAF and ZETTA/UFLA for the technical and scientific support. This research was conducted by Animal Care and Use permission released by the Environment Ministry in SISBIO System No. 18528-3.

References

- AGUIAR, A. A.; VALENTIN, J. L. Biologia e ecologia alimentar de elasmobrânquios (Chondrichthyes: Elasmobranchii): uma revisão dos métodos e do estado da arte no Brasil. **Oecologia Australis**, v. 14, n. 2, p. 464–489, 2010.
- ALMEIDA, A. J.; TORQUETTI, C. G.; TALAMONI, S. A. Use of space by Neotropical marsupial *Didelphis albiventris* (Didelphi morphia) in an urban forest fragment. **Revista Brasileira de Zoologia**, v. 25, p. 214–219, 2008.
- ALVARES, C. A.; STAPE, J. L.; SENTELHAS, P. C.; GONÇALVES, J. L. M.; SPAROVEK, G. Köppen's climate classification map for Brazil. **Meteorologische Zeitschrift**, v. 22, n. 6, p. 711–728, 2013.
- ANDREASSEN, H. P.; HERTZBERG, K.; IMS, R. A. Space-use responses to habitat fragmentation and connectivity in the root vole *Microtus oeconomus*. **Ecology**, v. 79, n. 4, p. 1223–1235, 1998.
- AYRES, M.; AYRES JUNIOR, M.; AYRES, D. L.; SANTOS, A. S. **BioEstat 5.0**: aplicações estatísticas nas áreas das ciências biomédicas. Belém: ONG Mamirauá, 2007. 364 p.
- BAGUETTE, M.; BLANCHET, S.; LEGRAND, D.; STEVENS, V. M.; TURLURE, C. Individual dispersal, landscape connectivity and ecological networks. **Biological Reviews**, v. 88, n. 2, p. 310–326, 2013.
- BERGALLO, H. G. Ecology of a small mammal community in an Atlantic Forest area in southeastern Brazil. **Studies on Neotropical Fauna and Environment**, v. 29, p. 197–217, 1994.
- BERG, E. V. D.; OLIVEIRA-FILHO, A. T. Spatial partitioning among tree species within an area of tropical gallery forest in south-eastern Brazil. **Flora**, v. 194, p. 249–266, 1999.
- BURT, W. H. Territoriality and home-range concepts as applied to mammals. **Journal of Mammalogy**, v. 24, p. 346–352, 1943.
- CÁCERES, N. C. **Dieta, adaptações morfológicas à alimentação e dispersão de sementes por marsupiais do sul do Brasil**. 2000. Tese (Doutorado em Zoologia) — Universidade Federal do Paraná, Curitiba, 2000a.
- CÁCERES, N. C. Population ecology and reproduction of the white-eared opossum *Didelphis albiventris* (Mammalia, Marsupialia) in an urban environment of Brazil. **Ciência e Cultura**, v. 52, n. 3, p. 171–174, 2000b.
- CÁCERES, N. C. Food habits and seed dispersal by the white-eared opossum, *Didelphis albiventris*, in southern Brazil. **Studies on Neotropical Fauna and Environment**, v. 37, n. 2, p. 97–104, 2002.
- CÁCERES, N. C.; LESSA, L. G. O papel de marsupiais na dispersão de sementes. In: CÁCERES, N. C. (org.). **Os marsupiais do Brasil: biologia, ecologia e conservação**. 2. ed. Campo Grande: Editora UFMS, 2012. p. 299–312.
- CÁCERES, N. C.; MACHADO, A. F. Spatial, dietary and temporal niche dimensions in ecological segregation of two sympatric, congeneric marsupial species. **The Open Ecology Journal**, v. 6, p. 10–23, 2013.
- CANTOR, M.; FERREIRA, L. A.; SILVA, W. R.; SETZ, E. Z. F. Potential seed dispersal by *Didelphis albiventris* (Marsupialia, Didelphidae) in a highly disturbed environment. **Biota Neotropica**, v. 10, n. 2, p. 45–51, 2010.
- CARUSI, L. C. P.; FARACE, M. I.; RIBICICH, M. M.; VILLAFANE, I. E. G. Reproduction

- and parasitology of *Didelphis albiventris* (Didelphimorphia) in an agroecosystem landscape in central Argentina. **Mammalia**, v. 73, n. 2, p. 89–97, 2009.
- CAVALCANTE, K. K. S.; ALENCAR, C. H. Raiva humana: avaliação da prevalência das condutas profiláticas pós-exposição no Ceará, Brasil, 2007–2015. **Epidemiologia e Serviços de Saúde**, v. 27, n. 4, p. 2017547, 2018.
- CAYUELA, H.; ROUGEMONT, Q.; PRUNIER, J. G.; MOORE, J.; CLOBERT, J.; BESNARD, A.; BERNATCHEZ, L. Demographic and genetic approaches to studying dispersal in wild animal populations: a methodological review. **Molecular Ecology**, v. 27, n. 20, p. 3976–4010, 2018.
- COSTA, L. P.; DE MORAES, D. A.; BRITO, D.; SORIANO, P.; LEW, D.; DELGADO, C. *Didelphis albiventris*. In: **The IUCN red list of threatened species**. 2015. Available at: <https://www.iucnredlist.org/species/40489/22176404>. Accessed on: 8 out. 2025.
- DANTAS, M. S.; ALMEIDA, N. V.; MEDEIROS, I. S.; SILVA, M. D. Diagnóstico da vegetação associada em espaços urbanos. **Journal of Environmental Analysis and Progress**, v. 2, n. 1, p. 87–97, 2017.
- DIAS, D. M.; ALMEIDA, M. D. O. S.; ARAÚJO-PIOVEZAN, T. G.; DANTAS, J. O. Habitat selection by mammals in an isolated fragment of Brazilian Atlantic Forest. **International Journal of Tropical Ecology**, v. 21, e201903, 2019.
- DRISCOLL, D. A.; BANKS, S. C.; BARTON, P. S.; IKIN, K.; LENTINI, P.; LINDENMAYER, D. B.; SMITH, A. L.; BERRY, L. E.; BURNS, E. L.; EDWORTHY, A.; EVANS, M. J.; GIBSON, R.; HEINSOHN, R.; HOWLAND, B.; KAY, G.; MUNRO, N.; SCHEELE, B. C.; STIRNEMANN, I.; STOJANOVIC, D.; SWEANEY, N.; VILLASEÑOR, N. R.; WESTGATE, M. J. The trajectory of dispersal research in conservation biology: a systematic review. **PLoS One**, v. 9, n. 4, e95053, 2014.
- DUARTE, M. A.; SILVA, J. M. F.; BRITO, C. R.; TEIXEIRA, D. S.; MELO, F. L.; RIBEIRO, B. M.; NAGATA, T.; CAMPOS, F. S. Faecal virome analysis of wild animals from Brazil. **Viruses**, v. 11, n. 9, p. 803–826, 2019.
- EMMONS, L. H.; FEER, F. **Neotropical rainforest mammals: a field guide**. Chicago: University of Chicago Press, 1997. 396 p.
- FLECK, D. W.; HARDER, J. D. Ecology of marsupials in two Amazonian rain forests in northeastern Peru. **Journal of Mammalogy**, v. 76, p. 809–818, 1995.
- FLESCH, A. D. **Effects of local and landscape processes on animal distribution and abundance**. 2013. 206f. Tese (Doutorado em Organismal Biology and Ecology). University of Montana, Missoula, 2013.
- FONSECA, G. A. B.; REDFORD, K. R.; PEREIRA, L. A. Notes on *Didelphis albiventris* (Lund, 1841) of Central Brazil. **Ciência e Cultura**, v. 34, n. 1, p. 1359–1362, 1982.
- FORERO-MEDINA, G.; VIEIRA, M. V. Perception of a fragmented landscape by neotropical marsupials: effects of body mass and environmental variables. **Journal of Tropical Ecology**, v. 25, p. 53–62, 2009.
- GENTILE, R.; CERQUEIRA, R. Movement patterns of five species of small mammals in a Brazilian restinga. **Journal of Tropical Ecology**, v. 11, n. 4, p. 671–677, 1995.
- GOOGLE EARTH. Lavras, Minas Gerais, Brasil. 2022. Capturado em 9 nov. 2023. Available

at: <https://earth.google.com/>. Access on: 8 out. 2025.

GRAIPEL, M. E.; dos SANTOS FILHO, M. Reprodução e dinâmica populacional de *Didelphis aurita* Wied-Neuwied (Mammalia: Didelphimorphia) em ambiente periurbano na Ilha de Santa Catarina, Sul do Brasil. **Revista Biotemas**, v. 19, n. 1, p. 65-73, 2006.

HAYNE, D. W. Calculation of home range size. **Journal of Mammalogy**, v. 30, n. 1, p. 1-18, 1949.

JULIEN-LAFERRIÈRE, D. Organisation du peuplement de marsupiaux en Guyane Française. **Revue d'Écologie (Terre et Vie)**, v. 46, p. 125-144, 1991.

KANDA, L. L.; FULLER, T. K.; SIEVERT, P. R. Landscape associations of road-killed Virginia opossums (*Didelphis virginiana*) in central Massachusetts. **The American Midland Naturalist**, v. 156, n. 1, p. 128-134, 2006.

KLINK, C. A.; MACHADO, R. B. Conservation of the Brazilian Cerrado. **Conservation Biology**, v. 19, n. 3, p. 707-713, 2005.

KÜHL, H. S.; BURGHARDT, T. Biometria animal: quantificação e detecção da aparência fenotípica. **Trends in Ecology and Evolution**, v. 28, n. 7, p. 432-441, 2013.

LAMBERT, T. D.; MALCOLM, J. R.; ZIMMERMAN, B. L. Variation in small mammal species richness by trap height and trap type in southeastern Amazonia. **Journal of Mammalogy**, v. 86, n. 5, p. 982-990, 2005.

LESSA, L. G.; COSTA, F. N. Diet and seed dispersal by five marsupials (Didelphi morphia: Didelphidae) in a Brazilian Cerrado reserve. **Mammalian Biology**, v. 75, p. 10-16, 2010.

LESSA, L. G.; GEISE, L. Hábitos alimentares de marsupiais didelfídeos brasileiros. **Oecologia Australis**, v. 14, p. 901-910, 2010.

LIRA, P. K.; FERNANDEZ, F. A. Z.; CARLOS, H. S. A.; CURZIO, P. L. Use of a fragmented landscape by three species of opossum in south-eastern Brazil. **Journal of Tropical Ecology**, v. 23, p. 427-435, 2007.

MACHADO, F. S.; MOURA, A. S.; MARIANO, R. F.; SANTOS, R. M.; GARCIA, P. O.; OLIVEIRA, I. R. C.; FONTES, M. A. L. Small mammals in highly fragmented landscapes in Cerrado/Atlantic Forest ecotone, southeastern Brazil. **Iheringia, Série Zoológica**, v. 111, e2021022, 2021.

MENDEL, S. M.; VIEIRA, M. V. Movement distances and density estimation of small mammals using the spool-and-line technique. **Acta Theriologica**, v. 48, n. 3, p. 289-300, 2003.

MENDES, C. P.; CARREIRA, D.; PEDROSA, F.; BECA, G.; LAUTENSCHLAGER, L.; AKKAWI, P.; BERCE, W.; FERRAZ, K. M. P. M. B.; GALETTI, M. Landscape of human fear in Neotropical rainforest mammals. **Biological Conservation**, v. 241, e108257, 2020.

MOHR, C. O. Table of equivalent populations of North American small mammals. **American Midland Naturalist**, v. 1, p. 223-249, 1947.

MYERS, N.; MITTERMEIER, R. A.; MITTERMEIER, C. G.; FONSECA, G. A. B. da; KENT, J. Biodiversity hotspots for conservation priorities. **Nature**, v. 403, p. 853-858, 2000.

NASCIMENTO, D. C.; CAMPOS, B.; FRAGA, E. C.; BARROS, M. C. Genetic variability of populations of the white-eared opossum *Didelphis albiventris* Lund 1840 (Didelphimorphia; Didelphidae) in Brazil. **Brazilian Journal of Biology**, v. 79, n. 4, p. 594-602, 2019.

- OLIVEIRA, C. F.; ROSA, C. A.; PASSAMANI, M. Home range and shelter preferences of marsupial *Didelphis aurita* (Wied-Neuwied, 1826) in a fragmented area in southeastern Brazil. **Mammalia**, v. 79, n. 2, p. 237–240, 2014.
- OLIVEIRA, F. F.; NESSIM, R.; COSTA, L. P.; LEITE, Y. L. R. Small mammal ecology in an urban Atlantic Forest fragment in southeastern Brazil. **Lundiana**, v. 8, n. 1, p. 27–34, 2007.
- PAGLIA, A. P.; FONSECA, G. A. B. da; RYLANDS, A. B.; HERRMANN, G.; AGUIAR, L. M. S.; CHIARELLO, A. G.; LEITE, Y. L. R.; COSTA, L. P.; SICILIANO, S.; KIERULFF, M. C. M.; MENDES, S. L.; TAVARES, V. da C.; MITTERMEIER, R. A.; PATTON, J. L. **Annotated checklist of Brazilian mammals**. 2. ed. Arlington: Conservation International, 2012. (Occasional Papers in Conservation Biology, 6, 82 p.).
- PASSAMANI, M.; FERNANDEZ, F. A. S. Abundance of small mammals in fragmented Atlantic Forest of southeastern Brazil. **Journal of Natural History**, v. 45, p. 553–565, 2011.
- PIRES, A. S.; LIRA, P. K.; FERNANDEZ, F. A. S.; SCHITTINI, G. M.; OLIVEIRA, L. C. Frequency of movements of small mammals among Atlantic Coastal Forest fragments in Brazil. **Biological Conservation**, v. 108, p. 229–237, 2002.
- PINTO-COELHO, R. M. **Fundamentos em ecologia**. Porto Alegre: Artmed, 2009. 257 p.
- PREVEDELLO, J. A.; FORERO-MEDINA, G.; VIEIRA, M. V. Movement behaviour within and beyond perceptual ranges in three small mammals: effects of matrix type and body mass. **Journal of Animal Ecology**, v. 79, n. 6, p. 1315–1323, 2010.
- RIBEIRO, M. C.; METZGER, J. P.; MARTENSEN, A. C.; PONZONI, F. J.; HIROTA, M. M. The Brazilian Atlantic Forest: how much is left, and how is the remaining forest distributed? Implications for conservation. **Biological Conservation**, v. 142, n. 6, p. 1141–1153, 2009.
- ROCHA, P. A.; BELTRÃO-MENDES, R.; RUIZ-ESPARZA, J.; CUNHA, M. A. A.; SILVA, C. S.; FERRARI, S. F. Non-volant mammals of a remnant of the Atlantic Forest in northeastern Brazil. **Neotropical Biology and Conservation**, v. 12, n. 3, p. 191–199, 2017.
- SANCHES, V. Q. A.; GOMES, M. M. A.; PASSOS, F. C.; GRACIOLLI, G.; RIBAS, A. C. A. Home-range and space use by *Didelphis albiventris* (Lund, 1840) (Marsupialia, Didelphidae) in Mutum Island, Paraná River, Brazil. **Biota Neotropica**, v. 12, n. 4, p. 50–55, 2012.
- SANTORI, R. T.; LESSA, L. G.; ASTÚA, D. Alimentação, nutrição e adaptações alimentares de marsupiais brasileiros. In: CÁCERES, N. C. (org.). **Os marsupiais do Brasil: biologia, ecologia e conservação**. Campo Grande: UFMS, 2012. p. 385–406.
- SOLOS, Embrapa. **Sistema brasileiro de classificação de solos**. Centro Nacional de Pesquisa de Solos: Rio de Janeiro, v. 3, 2013. 353 p.
- TALAMONI, S. A.; DIAS, M. M. Population and community ecology of small mammals in southeastern Brazil. **Mammalia**, v. 63, n. 2, p. 167–182, 1999.
- TEODORO, A. K. M.; CUTOLO, A. A.; MOTOIE, G.; MEIRA-STREJEVITCH, C. S.; PEREIRA-CHIOCCOLA, V. L.; MENDES, T. M. F.; ALLEGRETTI, S. M. Gastrointestinal, skin and blood parasites in *Didelphis* spp. from urban and sylvatic areas in São Paulo State, Brazil. **Veterinary Parasitology: Regional Studies and Reports**, v. 16, e100286, 2019.

TUCKER, M. A.; BÖHNING-GAESE, K.; FAGAN, W.F.; *et al.* Moving in the Anthropocene: global reductions in terrestrial mammalian movements. **Science**, v. 359, n. 6374, p. 466–469, 2018.

WRIGHT, J. D.; BURT, M. S.; JACKSON, V. L. Influences of an urban environment on home range and body mass of Virginia opossums (*Didelphis virginiana*). **Northeastern Naturalist**, v. 19, n. 1, p. 77–86, 2012.

YOUNG, H.S.; BÖHNING-GAESE, K.; FAGAN, W. F.; *et al.* Large wildlife removal drives redistribution of immune defenses in rodents. **Functional Ecology**, v. 30, p. 799–807, 2015a.

YOUNG, H. S.; DIRZO, R.; MCCAULEY, D. J.; AGWANDA, B.; CATTANEO, L.; DITTMAR, K.; ECKERLIN, R. P.; PLEISCHER, R. C.; HELGEN, L. E.; HINTZ, A.; MONTENIERI, J.; ZHAO, S.; HELGEN, K. M. Drivers of intensity and prevalence of flea parasitism on small mammals in East African savannah ecosystems. **The Journal of Parasitology**, v. 101, p. 327–335, 2015b.

YOUNG, H. S.; DIRZO, R.; HELGEN, K. M.; MCCAULEY, D. J.; NUNN, C. L.; SNYDER, P.; VEBLEN, K. E.; ZHAO, S.; EZENWA, V. O. Large wildlife removal drives immune defense increases in rodents. **Functional Ecology**, v. 30, p. 799–807, 2016a.

YOUNG, H. S.; MCCAULEY, D. J.; GALETTI, M.; DIRZO, R. Patterns, causes and consequences of Anthropocene defaunation. **Annual Review of Ecology, Evolution, and Systematics**, v. 47, n. 1, p. 333–358, 2016b.