

**ANTHROPOGENIC DISTURBANCES IN A POPULATION OF BROWN-THROATED SLOTHS OF THE SPECIES *BRADYPUS VARIEGATUS* SCHINZ, 1825 IN URBAN ATLANTIC FOREST FRAGMENTS IN PANDEMIC PERIOD**

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Abstract

The Central Campus of the Federal University of Paraíba, located in João Pessoa, has 12 forest fragments with approximately 84 ha of Atlantic Forest where a population of *Bradypus variegatus* Schinz, 1825 inhabits and has been exposed to anthropogenic disturbances. The present study aims to identify, describe and analyze anthropogenic disturbances on the population of *B. variegatus* that inhabits the Atlantic forest fragments on the Central Campus of the Federal University of Paraíba, located in João Pessoa, Paraíba, Northeastern Brazil. Observations were carried out from September 2021 to January 2022 using the ad libitum method through daily 4-hour walks around the fragments. Locomotion behavior was recorded in 16% (n=45) of the 269 observations. An average of 24.5 (n=3 to 61) sloth sightings were recorded per fragment. The correlation between disturbances and the number of recorded sightings was positive and significant, which demonstrates the resilience of *B. variegatus* in an urbanized environment. Situations classified as low risks prevailed, probably due to the social isolation imposed by the period of COVID-19 pandemic. High risks were 17.5% (n=47) for vehicles, 14.9% (n=40) for domestic animals and 1% (n=3) for people. Results showed that the human activities surrounding the forest fragments cause disturbances in the population of *B. variegatus* and efforts to mitigate the disturbances caused to these animals must be done, such as forest densification, the accumulation of litter in areas between fragments to avoid falls into the impervious surface and forest connection through rope bridge arboreal overpasses in hotspot areas with a higher density of sloths.

Keywords: Brown-throated sloth. Urban Matrix. Atlantic Forest fragments.

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1 Introduction

The brown-throated sloth, *Bradypus variegatus* Schinz, 1825 is a medium-sized mammal endemic to Neotropical regions. It is one of the few surviving species of the super order Xenarthra (sloths, armadillos and anteaters), a lineage of mammals endemic and originating in South America (Gaudin; Croft, 2015). This arboreal species is forest-dependent, having a low survival rate in captivity (Diniz; Oliveira, 1999).

Despite its wide geographic distribution, which covers Argentina, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Honduras, Panama, Paraguay, Peru, Venezuela (Wetzel, 1982), and the connectivity between the populations of these South American countries (Xavier et al., 2015), the species *B. variegatus* is found in the Appendix II of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES, 2011), which lists animals that are threatened if the illegal trade is not closely controlled and monitored.

The evaluation of extinction risk of *B. variegatus* is low as it is in the category Least Concern - LC of the Red List of the International Union for Conservation of Nature - IUCN (Moraes-Barros et al., 2014), as well as in the list of species threatened of extinction of the Chico Mendes Institute for Biodiversity Conservation - ICMBIO (Xavier et al., 2015) and in the list of the state of São Paulo, Brazil (Vivo et al., 2009).

B. variegatus is one of the few xenarthran with a apparently good conservation status despite 88.8% of the living Xenarthra being threatened due to deforestation that promotes the fragmentation of forests and the reduction of natural habitat (Xavier et al., 2015). However, in Paraná state, currently among the five states of the Brazilian territory that were most deforested between the years 2020 and 2021 (SOS Mata Atlântica, 2022), *B. variegatus* is considered Regionally Extinct (Mickish, Bérnils, 2004; Brasil, 2010).

Populations decline due to inbreeding, reduction of genetic variability due to population isolation in disconnected fragments, and the advance of urbanization promotes the expansion of the road and energy matrices, fatal to individuals of *B. variegatus*, in addition to the susceptibility to harvesting for animal trafficking (Cullen et al., 2001; Xavier et al., 2015; Magalhães, 2015; Pedrosa, 2016; Silva et al., 2017a; De Andrade et al., 2020; Pedrosa et al., 2021).

Also, molecular studies indicate that the threat levels for *B. variegatus* should be evaluated at the population level (Silva et al., 2017a).

In João Pessoa city, capital of Paraíba, in northeastern Brazil, urban populations of *B. variegatus* remain in urban Atlantic forest fragments. The fragmentation process of the Atlantic Forest remnants of João Pessoa began with its foundation in 1585, but stalled until the 1960s. The implementation of highways (BR 101, BR 230) and, later by the construction of the Central Campus of the Federal University of Paraíba were among the major fragmentation events (Rosa; Rosa, 2013).

One of the measures implemented to maintain a viable population was the implementation of ten passages of canopy fauna were implemented on Central Campus in order to reduce the population isolation of arboreal species, such as *B. variegatus* (Medeiros, 2010; Martin, 2015; Silva et al., 2017a). The fauna passages allow the passage of mammals such as the marmoset (*Callithrix jacchus* Linnaeus, 1758), with sporadic records of use of the bridges by *B. variegatus* (T. A. Cordeiro, personal communication, March 26, 2018; M. C. P. Paz, personal observation, March 15, 2022), as well as vine snakes and iguanas (T. A. Cordeiro, personal communication, November 13, 2022).

One of the anthropogenic disorders that occur on Central Campus is the abandonment of dogs and, mainly, of domestic cats, given that these animals act as predators in forest remnants (Doherty et al., 2017; Allemand et al., 2019; De Andrade et al., 2020), and also they are hosts of important zoonoses. On Central Campus, sloths have been fatally attacked by dogs as they descended from trees.

Despite anthropogenic disturbances, the species *B. variegatus* persists in forest fragments inserted in the urban matrix (Martin, 2015; Silva et al., 2017a; De Andrade et al., 2020; Pedrosa et al., 2021). But sloths are strictly dependent upon forested habitats (Cassano et al., 2011; Neam; Lacher Junior, 2018) the species has greater vulnerability due to the reduction of its natural environment and the high susceptibility of the species to habitat changes, such as limited mobility, reduced home range and greater stress due anthropogenic disturbances (Moreno; Plese, 2006; Castro-Vásquez et al., 2010; Martin, 2015; Pedrosa, 2016; Silva; Paz; Cordeiro, 2017), which denotes their direct importance in maintaining the ecosystem where they live.

Because they are one of the few medium sized mammals in urban areas of South America, and because the need to study population level threats to sloths in urban settings (Pedrosa; Castro; Rocha, 2021), the present study aims to identify, describe and analyze anthropogenic disturbances on the population of *B. variegatus* that inhabits the Atlantic forest fragments on Central Campus of the Federal University of Paraíba, located in João Pessoa, Paraíba, Northeastern Brazil.

2 Material and Methods

The research was carried out at the Central of the Federal University of Paraíba (7° 8' 20.18" S and 34° 50' 45.22" W), located in the city of João Pessoa, Paraíba (Figure 1). The tropical climate is well defined in the coastal strip, with abundant rainfall during autumn and winter and drought in summer, resulting in an annual average above 1800 mm, and temperature ranging from 20 °C in the central region during the winter to 27 °C in the coastal region (Paraíba, 2014).

The Central Campus has a total area of approximately 119 ha, being 36 ha of impermeable area (18 ha of parking lots and 18 ha of buildings); 83 ha of forest remnants, totaling 12 fragments (Rosa; Rosa, 2013). The University is inserted in the domains of the Atlantic Forest biome, with forest characteristic called Matas de Tabuleiros and phytophysognomy of Semideciduous Seasonal Forest, with predominance of pioneer species (Barbosa, 1996), presenting vegetation in secondary successional stage (Brasil, 2007).

Data Collection

Data collection covered the period from September 22, 2021 to January 14, 2022, in shifts interspersed between morning and afternoon. An active search was carried out on paths that include sidewalks, gardens and traffic routes around 11 of the 12 forest fragments of campus (Figure 2), considering that one of them, the largest (39 ha) is outside the campus walls.

Therefore, the edges of the fragments inside the university were traversed, leaving out the external area and the edge areas that it is not possible to transit due to the construction of buildings and the presence of fences. The sequence of the edges of the fragments traversed and the shifts of the observations were defined by drawing lots in order to avoid biases in the sample.

The walks were carried out slowly (about 1.5 km/h), with stops every 20 meters traveled. When a sloth was found the stops ranged from 5 to 10 minutes for the record (Martin, 2015). The observations were performed using the ad libitum method (Altmann, 1974), in which the behaviors are recorded in detail and continuously in the time interval that are displayed.

The records of the presence of sloths, the georeferenced locations, the behaviors exhibited, the substrates used for locomotion, the presence of people, domestic animals and vehicles, and the estimate of the distance of each of these elements of the sloth were recorded in a spreadsheet.

Risk classification

The risks, adapted from the study conducted by De Andrade et al. (2020), were categorized considering the presence and number of people on the routes, being low when up to 10 people were found and high when more than 11 people were found.

Meeting with 1 or more domestic animals (cat or dog) on campus was considered high risk for sloths. Vehicle traffic was classified as low when 1 to 3 vehicles passed at a distance > 5 m from the routes during observation, and high when more than 4 vehicles passed at a distance < 5 m (Table 1).

The locations of the sloths were georeferenced using the Global Position System - GPS through the ViewRanger mobile application.

The substrates of the urban matrix, used by sloths during locomotion between fragments, were classified as low and high risk, according to the degree of threat they pose to sloths.

The elements that present high risk are the high voltage electrical wiring, due to the possibility of death by electrocution; parking lots and traffic routes, due to the possibility of being run over; and tall canopy trees, isolated on pavements, due to the possibility of fatal fall on impermeable surface, or even on permeable soil without litter.

Substrates such as railings, barbed wire fences, sector nameplates, buildings and roofs have been classified as moderate risk due to the possibility of sloths suffering injuries from falling or through improper handling in which people pull them by the limbs with the intention of removing them, when in fact these animals are trapped by the claws. The trees on the edges of the fragments, due to the presence of litter capable of cushioning possible falls, were classified as low risk (Table 1).

Table 1: Substrates of the urban matrix used by individuals of *B. variegatus* on Central Campus for locomotion between fragments, presence of people, vehicles and distance, categorized into high, moderate and low risk (adapted from Andrade et al., 2020).

Risk	Substrates	Pets	People	Vehicles	Distance
Low	Trees Inside the Fragments	0	< 10	0	> 5m
High	Power Grid, Parking, Vehicles, Traffic Routes, Insulated Trees	>1	> 11	> 4	< 5m

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Figure 1: Location of the study area, showing Brazil in grayscale, the state of Paraíba in yellow, the municipality of João Pessoa in blue and the Central Campus of the Federal University of Paraíba (UFPB) in red. (Map prepared by the author - Google Earth/QGIS).



Figure 2: Map of Central Campus with the paths traveled in orange lines, the fauna passages suspended in red and the forest fragments in green polygons. F01 is a fragment located on behind the base of the security guards; F02 on the side of the athletics track; F03 behind the university residence; F04 the forest of the Center for Health Sciences; F05 behind the University Hall; F06 in the parking lot of the University Hospital; F07 on the side of the Center for Exact and Natural Sciences; F08 behind the Central Library; F09 in front of the Department of Digital Media; F10 on the side of the Technology Center, and F11 on the side of the Rectory. (Map prepared by the author - Google Earth/QGIS).

Definition of Sex-Age Classes

For the definition of the sex-age classes of the individuals of *B. variegatus* found on the routes, body size was used as a basis, being adult individuals with size from 58 to 70 cm (Dickman, 1995; Martins Bezerra et al., 2008), reaching 75 cm (Castro-Vásquez et al., 2010); juveniles were any individual less than half the size of an adult (< 40 cm) observed without association with other individuals; and offspring individuals permanently associated with the back or belly of adult females, or a few meters away from them (Dickman, 1995; Martins Bezerra et al., 2008; Castro-Vásquez et al., 2010). The presence of the dorsal speculum, present exclusively in adult males of the species *B. variegatus* (Pinheiro, 2008; Castro-Vásquez et al., 2010; Silva et al., 2013; Silva et al., 2017b), was used to identify males.

Statistical Analysis of Collected Data

Using linear regression analysis through the R software, using the *vegan* and *ggpubr* packages (R Core Team, 2021), the frequencies of the people, vehicles and domestic animals (dogs and/or cats), dependent variables, during the observations of sloths on the routes and locomotion behavior, independent variables, were analyzed. The analyses sought to explain the relationship of a dependent with an independent variable, adopting a significance level of 5%. The collinearity between variables wasn't previously tested.

3 Results and Discussion

Were registered 269 observations of sloths on the Central Campus forest fragments, with an average of 24.5 (n=3 to 61) sloth sightings recorded per fragment. The locomotion behavior was recorded in 16% (n=45). Regarding the frequency of people during the routes, only 3 records (1.1%) were of high risk, where a number greater than 11 people passed during the observations; and in 266 (98.9%) of the records the number of people was considered low risk, where 0 to 10 people passed the routes during the observations (Figure 3A).

The linear regression analysis of the presence of people during the observations of sloths by forest fragment points to a positive relationship, with the coefficient of determination (R) 85%, presenting a significant p value (< 0.05) (Figure 3B), the same analysis for the number of people in relation to the locomotion behavior of the sloths, presented a coefficient of determination (R) 87% and the significant p value (< 0.05) (Figure 3C).

Regarding the frequency of vehicles during the routes, 47 (17.5%) situations considered high risk were recorded, where 4 or more vehicles passed less than 5 meters from the sloths during the observations; and 222 (82.5%) records of the number of cars were considered low risk, where up to 4 cars passed more than 5 meters in the routes during the observations of sloths (Figure 4A).

A result similar to the risk involving people was found between vehicle traffic and the number of sloths observed, with the coefficient of determination (R) of 88%, presenting a significant p-value (< 0.05) (Figure 4B). In the result of the analysis for the number of vehicles in relation to the locomotion behavior of the sloths, the coefficient of determination (R) was 94% and the significant p value (<0.05) (Figure 4C). Regarding the frequency of domestic animals abandoned during the routes, 40 situations (14.9%) of high risk and 229 records (85.1%) of low risk were recorded (Figure 5A). The linear regression analysis of the presence of domestic animals during the observations of sloths per fragment points to a positive relationship, with the coefficient of determination (R) being 72%, presenting a significant p-value (< 0.05) (Figure 5B). The same analysis made between the number of domestic animals in relation to locomotion behavior did not have a significant result (Figure 5C).

The results of the analyses reinforce that, although low-risk situations were dominant in the observations of sloths, the positive correlations show that as the number of people, vehicles and domestic animals abandoned during the records of sloths observed in the study increases, so does the intensity of the high risks. The same applies to the display of locomotion behavior during the passage of people and vehicles, since data collection was carried out during the operation of essential services on Central Campus, when the number of people and vehicles was low. The increase in the daily flow of humans on Central Campus increases the possibility of interaction with sloths that have exhibited agonistic behavior in all cases in which they have been found in interaction with humans (Silva et al., 2017a) and behaviors related to fear and stress, such as limb stretching and vigilance, which occur in tourism with the manipulation of brown-throated sloths (Carder et al., 2018).

The sloths that inhabit Central Campus are surrounded by an urbanized environment, but despite this, the presence of juveniles and middle-aged individuals also could confirm the idea of a stable population (Martin, 2015). This suggests that sloths are resilient and able to live with anthropogenic disorders, reinforcing the importance of maintaining small forest fragments in the urban environment for the conservation of medium-sized herbivorous and arboreal mammals (De Andrade et al., 2020).

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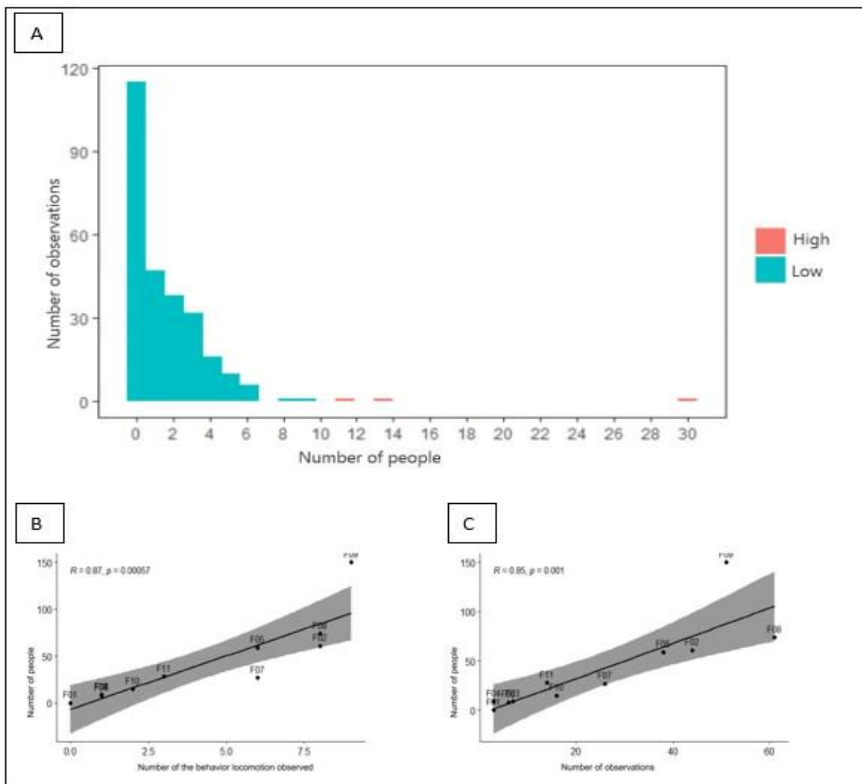


Figure 3: A) Frequency of risks in relation to the number of people on the routes; B) linear regression analysis of the number of people in relation to the number of records of sloths observed; C) linear regression analysis of the number of people in relation to the number of registered sloths performing the locomotion behavior. The black dots indicate the 11 forest fragments studied and the gray band the confidence interval.

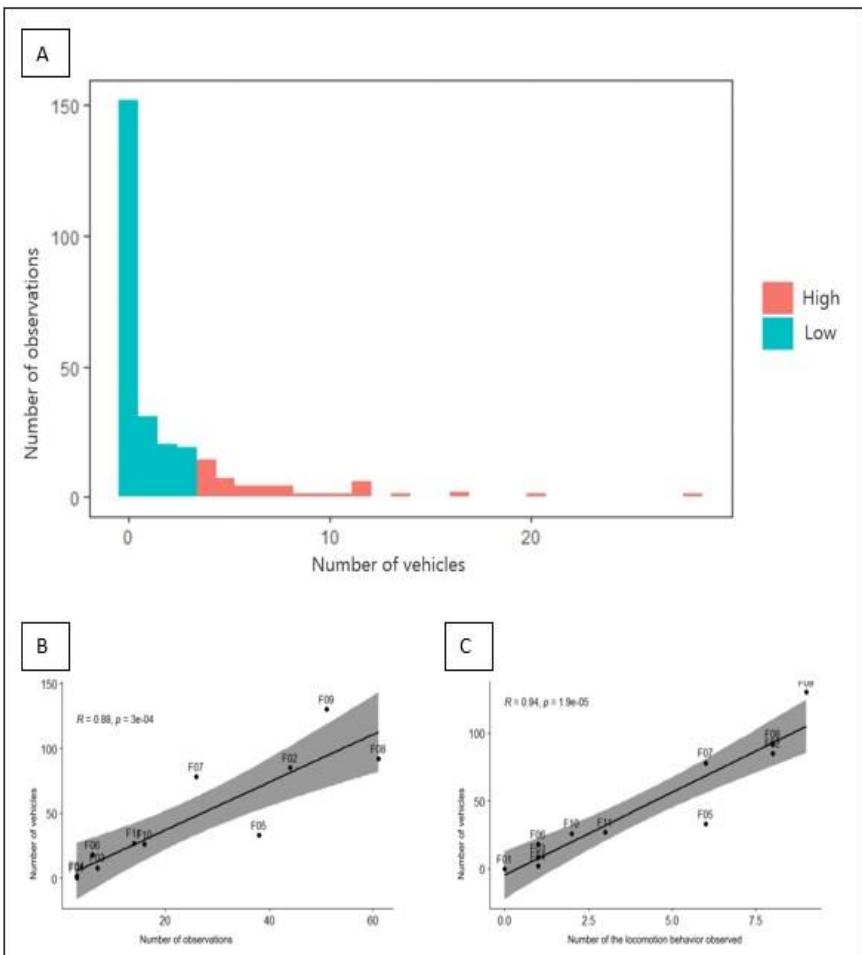


Figure 4: A) Frequency of risks regarding the number of vehicles on the routes; B) linear regression of the number of vehicles found in relation to the number of sloths registered per forest fragment; C) linear regression of the number of vehicles in relation to the number of registered sloths performing the locomotion behavior. The black dots indicate the 11 forest fragments studied and the gray band the confidence interval.

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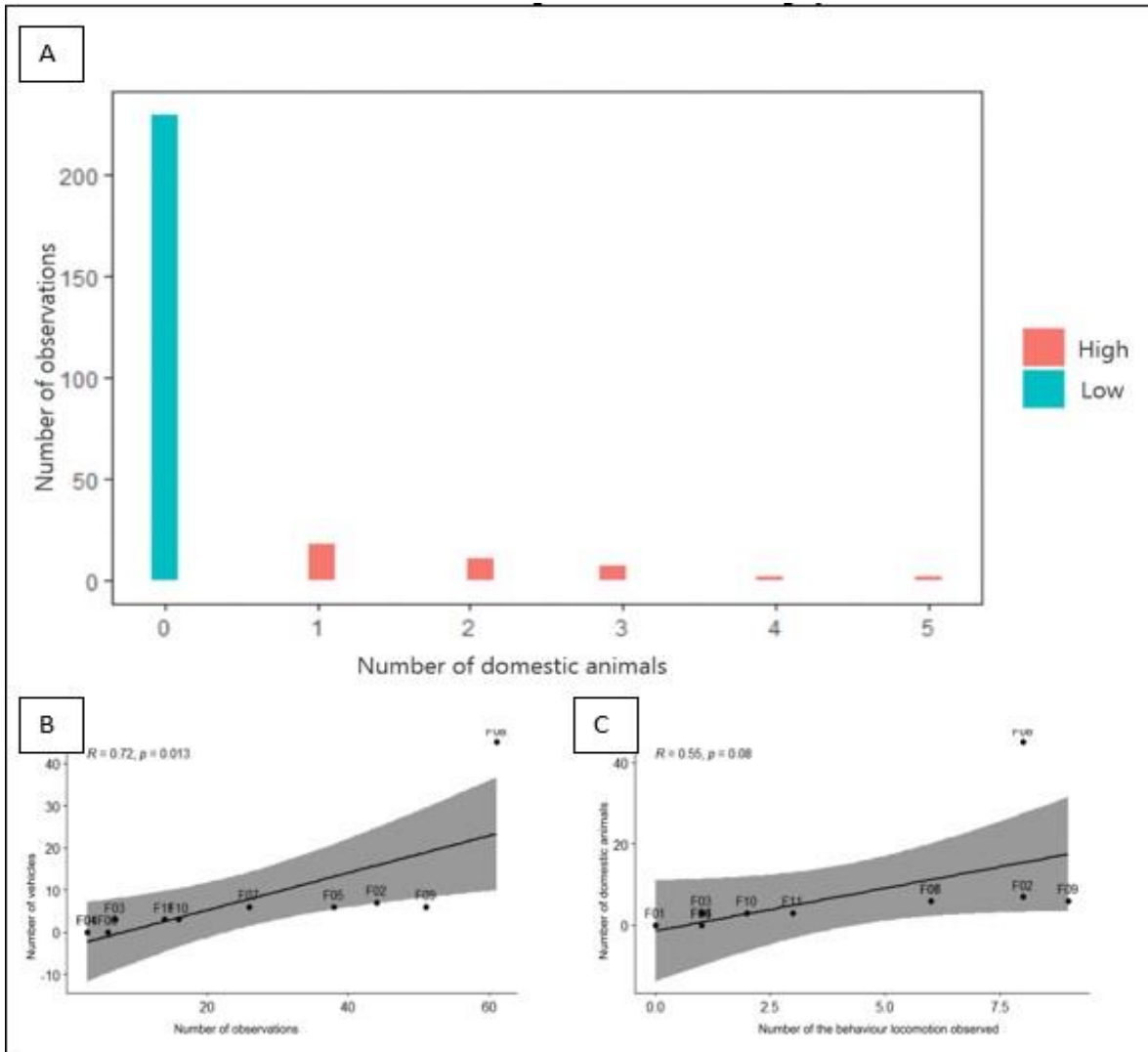


Figure 5: A) Frequency of risks regarding the number of domestic animals on the routes; B) Linear regression of the number of domestic animals found in relation to the number of sloths recorded per forest fragment; C) Linear regression of the number of domestic animals found in relation to the locomotion records. The black dots indicate the 11 forest fragments studied and the gray band the confidence interval.

The efforts made by team of the Environmental Management Commission for reforestation and densification with native plant species are essential for the forest matrix to be expanded and maintained on the Central Campus, increasing the habitat for sloths, which have potential for flag species in the local context, in promoting the conservation of forest fragments and species that occur in the forest fragments of the university, where a biodiversity composed of 456 species was recorded, 89 of which were listed on the IUCN Red List (Santos, 2014).

Despite efforts to expand the vegetation cover and connect the fragments within Central Campus, urbanization in the João Pessoa city has grown intensely, changing the forest landscape (De Andrade et al., 2020). Recently, work has been carried out to install two access roads for the passage of vehicles cutting the largest forest fragment belonging to the Central Campus, which houses part of the Timbó River basin (Rosa; Rosa, 2013). This remnant has been gradually suppressed for the installation of residential and business buildings in the Bancários neighborhood and now had its forest landscape modified into three smaller fragments.

During observations of sloths in the surroundings of the forest fragments there was no use of the suspended fauna passages, the same was observed by Silva et al. (2017a), Martin (2015) and De Andrade et al. (2020). However, on March 15, 2022, a young sloth was recorded using one of the wildlife passages, located in fragment F03 towards the larger fragment of the Central Campus (Figure 6), the same passage was used in 2018. These sporadic recordings reinforce the importance of camera trap monitoring.



Figure 6: Sloth using the suspended fauna passage that connects the F03 fragment on the Central Campus on march 15, 2022.

4 Conclusions

The brown-throated sloths (*B. variegatus*) are important to the ecosystem, contributing to forest maintenance from the cycling of soil nutrients. In all forest fragments studied, sloths were recorded, regardless of their size variety, the individuals of the population showed active reproduction, with young and juveniles individuals registered in all the fragments, with the exception of fragment F01.

The population of the brown-throated sloth of the Central Campus were surrounded by the urban matrix with the presence of human activity, although the research was initiated during the period of social isolation of the COVID-19 pandemic, with the low intensity of the presence of people, vehicles and domestic animals, those anthropogenic disturbances impact negatively that population.

Efforts to mitigate the disturbances caused to these animals must be done, such as forest densification on the Central Campus of Federal University of Paraíba, the accumulation of litter in areas between fragments to avoid falls into the impervious surface and forest connection through rope bridge arboreal overpasses in hotspot areas with a higher density of sloths.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

All the authors contribute with the conceptualization, data curation, formal analysis, methodology, project administration, writing, proofreading and validation.

DECLARATION OF INTEREST

The authors disclose that they have no known competing financial interests or personal relationships that could have appeared to influence the study reported in this manuscript.

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REFERENCES

- ALLEMAND, M. M.; FERREGUETTI, A.; PEREIRA-RIBEIRO, J.; ROCHA, C.; BERGALLO, H. Invasion by *Canis lupus familiaris* (Carnivora) in a protected area in the Atlantic Forest biome, Brazil: Spatial distribution and abundance. *Mastozoología Neotropical*, v. 26, n. 2, p. 233-240, 2020.
- ALTMANN, J. Observational study of behavior: Sampling methods. *Behaviour*, v. 49, n. 3/4, p. 227-266, 1974.
- BARBOSA, M. R. V. *Estudo florístico e fitossociológico da Mata do Buraquinho, remanescente de Mata Atlântica em João Pessoa, PB*. 1996. 135 f. Tese (Doutorado em Botânica) - Universidade Estadual de Campinas, Campinas, 1996.
- BRASIL. Decreto Estadual nº 7264, de 01 de junho de 2010. Reconhece e atualiza Lista de Espécies de Mamíferos pertencentes à Fauna Silvestre Ameaçadas de Extinção no Estado do Paraná e dá outras providências, atendendo o Decreto nº 3.148, de 2004. *Diário Oficial do Executivo*, Paraná, p. 83, 2010.
- BRASIL. Resolução CONAMA nº 391, de 25 de janeiro de 2007. Define vegetação primária e secundária nos estágios inicial, médio e avançado de regeneração da Mata Atlântica no estado da Paraíba. *Diário Oficial da União*, seção 1, Brasília, p. 41, 2007.

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- CARDER, G., PLESE, T., MACHADO, F. C., PATERSON, S., MATTHEWS, N., MCANEA, L., & D'CRUZE, N. The impact of 'selfie' tourism on the behaviour and welfare of brown-throated three-toed sloths. *Animals*, v. 8, n. 11, p. 216, 2018. Available from: <https://doi.org/10.3390/ani8110216>.
- CASTRO-VÁSQUEZ, L.; MEZA, M.; PLESE, T.; MORENO-MORA, S. Activity patterns, preference and use of floristic resources by *Bradypus variegatus* in a tropical dry forest fragment, Santa Catalina, Bolívar, Colombia. *Edentata*, v. 11, n. 1, p. 62-69, 2010. Available from: <https://doi.org/10.1896/020.011.0111>.
- CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). Appendice II. Available from: <https://cites.org/eng/app/appendices.php>. Accessed on: 9 dec. 2020.
- CULLEN, L.; BODMER, R. E.; VALLADARES-PÁDUA, C. Ecological consequences of hunting in Atlantic forest patches, São Paulo, Brazil. *Oryx*, v. 35, n. 2, p. 137-144, 2001. Available from: <https://doi.org/10.1046/j.1365-3008.2001.00163.x>.
- DE ANDRADE, A. C.; MEDEIROS, S.; CHIARELLO, A. G. City sloths and marmosets in Atlantic forest fragments with contrasting levels of anthropogenic disturbance. *Mammal Research*, v. 65, n. 3, p. 481-491, 2020. Available from: <https://doi.org/10.1007/s13364-020-00492-0>.
- DICKMAN, C. R. Sloths. In: MACDONALD, D. W. (Ed.). *The encyclopaedia of mammals*. Andromeda Oxford, p. 776-779, New York, 1995.
- DINIZ, L. S. M.; OLIVEIRA, P. M. A. Clinical problems of Sloths (*Bradypus* sp. and *Choloepus* sp.) in Captivity. *Journal of Zoo and Wildlife Medicine*, v. 30, n. 1, p. 76-80, 1999.
- DOHERTY, T. S.; DICKMAN, C. R.; GLEN, A. S.; NEWSOME, T. M.; NIMMO, D. G.; RITCHIE, E. G.; VANAK, A. T.; WIRSING, A. J. The global impacts of domestic dogs on threatened vertebrates. *Biological conservation*, v. 210, p. 56-59, 2017. Available from: <https://doi.org/10.1016/j.biocon.2017.04.007>.
- GAUDIN, T. J.; CROFT, D. A. Paleogene Xenarthra and the evolution of South American mammals. *Journal of Mammalogy*, v. 96, n. 4, p. 622-634, 2015. Available from: <https://doi.org/10.1093/jmammal/gyv073>.
- MAGALHÃES, A. R. Pequenos Mamíferos em Remanescentes Florestais da Grande João Pessoa: Como comunidades e populações respondem a urbanização? 2015. 120 f. Dissertação (Mestrado em Ciências Biológicas) - Universidade Federal da Paraíba, João Pessoa, 2015.
- MARQUES SILVA, S.; DÁVILA, J. A.; VOIRIN, B.; LOPES, S.; FERRAND, N.; MORAES-BARROS, N. The curious case of *Bradypus variegatus* sloths: populations in threatened habitats are biodiversity components needing protection. *Biodiversity and Conservation*, v. 27, p. 1291-1308, 2018. Available from: <https://doi.org/10.1007/s10531-017-1493-7>
- MARTIN, A. Behavior of *Bradypus variegatus* in an urban area (UFPB Campus, João Pessoa, Brazil). 2015. 20 f. Thèse (Master en Éthologie) - Université Paris 13 - UFR Lettres, Sciences de L'Homme et des Sociétés, Paris, 2015.
- MARTINS BEZERRA, B.; SILVA SOUTO, A.; HALSEY, L. G.; SCHIEL, N. Observation of brown-throated three-toed sloths: Mating behaviour and the simultaneous nurturing of two young. *Journal of Ethology*, v. 26, n. 1, p. 175-178, 2008. Available from: <https://doi.org/10.1007/s10164-007-0038-z>.
- MEDEIROS, S. T. A. Proposta para implantação de estruturas para a conexão ecológica entre os fragmentos florestais do Campus I da UFPB e do seu entorno. 2010. 69 f. Monografia (Graduação em Ciências Biológicas) - Universidade Federal da Paraíba, João Pessoa, 2010.
- MICKISH, S. B.; BERNILS, R. S.; PIZZI, P. A. *Livro Vermelho da Fauna Ameaçada no Estado do Paraná*. Instituto Ambiental do Paraná, Curitiba, 2004.
- MORAES-BARROS, N.; CHIARELLO, A.; PLESE, T. *Bradypus variegatus*. The IUCN Red List of Threatened Species, e.T3038A47437046, 2014. Available from: <https://doi.org/10.2305/IUCN.UK.2014-1.RLTS.T3038A47437046.en>. Accessed on: 9 dec. 2020.
- PARÁIBA. Atlas eólico: Paraíba. Camargo Schubert Engenheiros Associados; Associação Técnico Científica Ernesto Luiz de Oliveira Junior - ATECEL; Universidade Federal de Campina Grande, Campina Grande, 2014.
- PEDROSA, E. P. Análise da Viabilidade Populacional da Preguiça-Comum (*Bradypus variegatus* Schinz, 1825) em Fragmento de Mata Atlântica e as Principais Ameaças dos Ambientes Urbanos na Paraíba. 2016. 94 f. Dissertação (Mestrado em Ecologia) - Universidade Federal da Paraíba, Rio Tinto, 2016.

ANTHROPOGENIC DISTURBANCES IN A POPULATION OF BROWN-THROATED SLOTHS OF THE SPECIES *BRADYPUS VARIEGATUS* SCHINZ, 1825 IN URBAN ATLANTIC FOREST FRAGMENTS IN PANDEMIC PERIOD

PEDROSA, E. P.; CASTRO, C. S. S.; ROCHA, F. L. Threats to the brown-throated three-toed sloth *Bradypus variegatus* Schinz, 1825 (Pilosa: Bradypodidae) in an urban environment in State of Paraíba, Brazil. *Revista Brasileira de Gestão Ambiental e Sustentabilidade*, v. 8, n. 19, p. 1169-1181, 2021. Available from: [https://doi.org/10.21438/rbgas\(2021\)081936](https://doi.org/10.21438/rbgas(2021)081936).

PINHEIRO, S. D. Comportamento alimentar da preguiça comum *Bradypus variegatus* Schinz, 1825 (Xenarthra, Bradypodidae) no Parque Centenário de Barra Mansa-RJ. 2008. 122 f. Dissertação (Mestrado em Ciências Biológicas) - Universidade Federal de Juiz de Fora, Juiz de Fora, 2008.

QGIS Development Team. QGIS Geographic Information System. **Open Source Geospatial Foundation Project**, 2021. Available from: <http://qgis.osgeo.org/>. Accessed on: 25 oct. 2021.

R Core Team. R: A language and environment for statistical computing. **R Foundation for Statistical Computing**, Vienna, 2021. Available from: <https://www.R-project.org/>. Accessed on: 25 oct. 2021.

ROSA, P.; ROSA, C. **Atlas Geográfico da UFPB: Planos de Informação do Campus I**. Editora da UFPB, João Pessoa, 2013.

SANTOS, T. O. **Riqueza e status de conservação de espécies no Campus I da UFPB, João Pessoa, Paraíba, Brasil**. 2014. 54 f. Monografia (Graduação em Ciências Biológicas) - Universidade Federal da Paraíba, João Pessoa, 2014.

SILVA, S. M.; CLOZATO, C. L.; MORAES-BARROS, N.; MORGANTE, J. S. Towards a standard framework to describe behaviors in the common-sloth (*Bradypus variegatus* Schinz, 1825): Novel interactions data observed in distinct fragments of the Atlantic Forest, Brazil. *Brazilian Journal of Biology*, v. 73, n. 3, p. 527-53, 2013. Available from: <https://doi.org/10.1590/S1519-69842013000300010>.

SILVA, G. A. O.; PAZ, M. C. P.; CORDEIRO, T. A. Monitoramento do bicho-preguiça *Bradypus variegatus* Schinz, 1825 (Xenarthra: Bradypodidae) em um remanescente de Floresta Atlântica (João Pessoa-PB, Nordeste do Brasil). *Revista Brasileira de Gestão Ambiental e Sustentabilidade*, v. 4, n. 8, p. 299-312, 2017. Available from: <https://doi.org/10.21438/rbgas.040805>.

SOS MATA ATLÂNTICA. **Atlas dos Remanescentes Florestais da Mata Atlântica Período 2021-2022**. Relatório Técnico. São Paulo, 2023.

VIVO, M.; CARMIGNOTTO, A. P.; GREGORIN, R.; HINGST-ZAHER, E.; IACK-XIMENES, G. E.; MIRETZKI, M.; PERCEQUILLO, A. R.; ROLLO JR., M. M.; ROSSI, R. V.; TADDEI, V. A. Anexo 5: Mamíferos do Estado de São Paulo. In: BRESSAN, P. M.; KIERULFF, M. C. M.; SUGIEDA, A. M. (Org.). **Fauna ameaçada de extinção no Estado de São Paulo: vertebrados**. Fundação Parque Zoológico de São Paulo/Secretaria do Meio Ambiente, São Paulo, 2009.

WETZEL, R. M. Systematics, distribution, ecology, and conservation of South American Edentate. In: MARES, M.; GENOWAYS, H. H. (Eds.). **Mammalian biology on South America**. The University of Pittsburgh, Pittsburgh, 1982.

XAVIER, A. A. J. G.; MOURÃO, G. M.; COSTA, J. F.; MORAES-BARROS, N. Avaliação do Risco de Extinção de *Bradypus variegatus* Schinz, 1825 no Brasil. In: ICMBIO (Instituto Chico Mendes de Conservação da Biodiversidade). **Avaliação do Risco de Extinção dos Xenartros Brasileiros**. Brasília, DF: ICMBio, 2015.