



DEATHS OF SOUTHERN MANED THREE-TOED SLOTH (*Bradypus crinitus*, GRAY 1850) IN AN URBAN ENVIRONMENT

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Abstract: The expansion of urban areas has created hostile environments for forest species, negatively impacting biodiversity. Animals that explore anthropized areas can suffer various injuries, such as electrocution and attacks by domestic dogs. Here, we report two fatal incidents involving the threatened Southeastern maned three-toed sloth (*Bradypus crinitus*, Gray 1850) that occurred in the municipality of Santa Teresa, mountainous region of Espírito Santo, Brazil. One sloth was attacked by a domestic dog, while the other was electrocuted in an urban environment. Both events underscore the need for immediate action to create a less hostile urban environment for the conservation of this species. Properly insulate the electrical wiring, installing wildlife crossings, and running campaigns to encourage residents to keep their dogs on a leash are effective ways to prevent or mitigate these accidents.

Keywords: Atlantic Forest; electrocution; domestic dog; Pilosa; urban impacts.

Undoubtedly, the expansion of urban areas exert a variety of impacts on the natural environment (Elmqvist *et al.* 2021), by creating hostile environments for numerous plant and animal species (Simkin *et al.* 2022).

Arboreal animals possess remarkable adaptations for life in trees (Mureb *et al.* 2023), making them highly susceptible to the negative effects of human-made landscapes (Santos *et al.* 2019). Thus, fragmented forest areas immersed in non-habitat matrices might expose arboreal

animals to a series of negative interactions such as dog attacks (Díaz *et al.* 2023), roadkill (Abra *et al.* 2021) and electrocution (Almeida *et al.* 2022), many of which are lethal (Brown *et al.* 2023). Such a scenario is quite common in the region of the Atlantic Forest, which lost 77% of its original forest cover (Vancine *et al.* 2024), and is home to more than 145 million Brazilians (Carlucci *et al.* 2021). In fact, this biome accounts for more than 53% of the urbanized areas within Brazilian territory (MapBiomias 2022).

As urban and economic development progresses, power lines are becoming increasingly common. Brazil reached 183,082 km of power lines in 2022 (TAESA 2023), and the Atlantic Forest harbors the densest concentration of medium-voltage power lines (1–44 kV) among all Brazilian biomes (Biasotto *et al.* 2022) and have direct impacts on arboreal species (Printes *et al.* 2010). Free-roaming and domestic dogs (*Canis lupus familiaris*, Carnivora: Canidae), which are also closely associated with human presence, are spreading rapidly across different biomes and showing remarkable adaptability (Paschoal *et al.* 2018, 2012). In addition, domestic dogs can pose several threats to the native fauna, including spatio-temporal competition (Marshall *et al.* 2023), hybridization (Tyagi *et al.* 2023), disease transmission (Da Silva *et al.* 2022), and predation (Doherty *et al.* 2017).

The recently described southern maned three-toed sloth (*Bradypus crinitus* Gray, 1850) is endemic from the Atlantic Forest of southeastern Brazil (Miranda *et al.* 2023). When considered as single species, the maned sloth (*Bradypus torquatus*) was listed by IUCN Red List as Vulnerable, due to deforestation and related impacts (Chiarello *et al.* 2022). Because sloths are essentially arboreal, they are highly susceptible to negative interactions in urban environments. In the absence of tree canopy connections or artificial wildlife bridges, they may use power lines to move around, and may become victims of electrocution (Santos *et al.* 2022). In some cases, they may also descend to the ground, to defecate (Pauli *et al.* 2014) or during dispersal movements in fragmented and less forested landscapes, where trees have few or no canopy connections (Cassano 2006). This behavior makes them vulnerable to attack by domestic and feral dogs (Brown *et al.* 2023).

This short communication reports two deaths related to these factors observed in the threatened southern maned sloth deaths. One case involves an attack by several domestic dogs, while the other involves electrocution, all occurring in Santa Teresa (19°55'55.33"S, 40°35'59.68"W), a municipality located in the mountainous region of the state of Espírito Santo, southeastern Brazil (Figure 1).

On March 13th, 2023, locals brought an injured maned sloth from a rural area to the National Institute of Atlantic Forest. Its left upper limb was unresponsive, indicating a potential shoulder

ligament dislocation or fracture. Found on the ground, the sloth fought off about five pursuing domestic dogs. It was quickly rescued and given veterinary care, but its fragile condition led to its death shortly after arrival. On April 4th, 2023, at National Institute of Atlantic Forest, the necropsy revealed that this animal was an adult female – determined by its head-body length of 70 cm (including tail), body weight (Lara-Ruiz & Chiarello 2005) and the presence of a clitoris (Lara-Ruiz & Chiarello 2005, Dünner & Pastor 2017). During the necropsy it was evidenced that the sloth had about five lesions provoked by domestic dog in the dorsal region. We found three perforations in the thoracic region and two more in the sacral region, as well as some abrasions on the animal's back and arms. The left arm was dislocated from the shoulder. Ectoparasites, worms and organ fragments were collected for future study.

About a month later, on April 16th, 2023, another event was recorded. This time, a sloth was electrocuted in an urban area of Santa Teresa. The incident occurred on a street light pole with a power transformer, less than 10 meters from the headquarters of the Nacional Institute of Atlantic Forest. Following the electrocution, the individual fell and was subsequently rescued. During first aid, the individual suffered open fractures to both the upper and lower left limbs, and tragically died shortly thereafter. On April 27th, 2023, the necropsy revealed that the animal was a young adult male, based on its collar size and the presence of a visible penis, with a body weight of 5 kg, and a head-body length of 50 cm (Lara-Ruiz & Chiarello 2005, Dünner & Pastor 2017). The entire left limb was necrotic, as were parts of both lower limbs. We also noticed that the death of this individual was mainly due to respiratory problems, as its lungs showed a pink to red color, signs of an unhealthy state, probably due to injuries caused by electrocution.

Due to the absence of the animal's clinical history, we were unable to confirm the circumstances that led to the death of the first individual. However, based on the facts reported by the residents (animal found on the ground), it is reasonable to infer that the animal either crossed the ground by moving from one fragment to another due to a lack of arboreal connection. Alternatively, the individual may have fallen to the ground due to a broken branch or a fallen tree, as the necropsy indicated that the

left arm was dislocated from the shoulder. While lying on the ground, the individual was attacked by domestic dogs, causing punctures in the skin and dislocation of the arm. Weakened by these injuries, the individual proved unable to resist and eventually succumbed. The most diagnostic feature of canine injuries is usually the slashing and biting of prey over a large part of the body (Green & Gipson 1994); these were the findings found in the sloth necropsy (Figure 2).

The second individual, a young male, was electrocuted near (approximately 8 meters from the nearest fragment) forest fragments of varying sizes. Among these forest fragments, one of 70 hectares served as a functional and structural link to other forest fragments, including the Municipal Natural Park of São Lourenço, where the maned sloth lived (Moreira *et al.* in press). Considering the circumstances and the fact that it was a young adult animal, it is likely that the animal was trying to reach another forest fragment when it was electrocuted.

This movement may be related to natal dispersal, when a young individual moves from its birthplace to its first breeding area (Garcés-Restrepo *et al.* 2018). The necropsy and the presence of external electrical lesions suggest electrical injury as the cause of death. The animal showed lesions mainly in the skin, hair, muscles, and lungs, which are common lesions of electrocution, as well as venous congestion in shock organs, petechiae, and ecchymoses in the trachea, heart, and lungs (Schulze *et al.* 2016).

Although the urban areas represent less than 1% of the occupied area in our study area, this land cover has increased by 349% in the last 36 years (MapBiomas 2022). This impressive expansion is mainly due to the strong growth of real estate speculation, mainly through illegal land subdivisions (MPES 2022), driven by the strengthening of tourism in the area. As a result, elements associated with urbanization, such as power lines and domestic animals, are increasingly present, and can lead to harmful interactions with

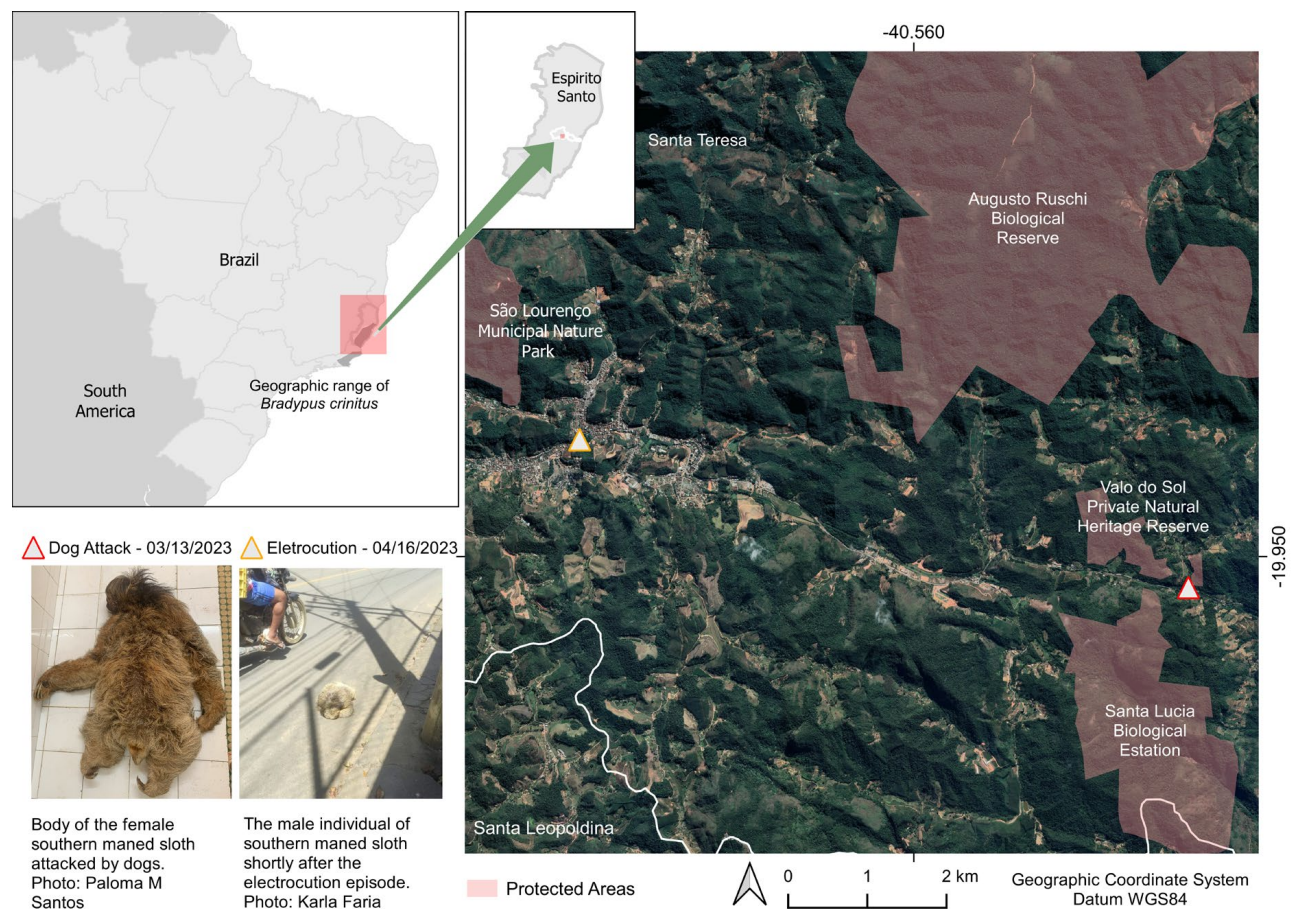
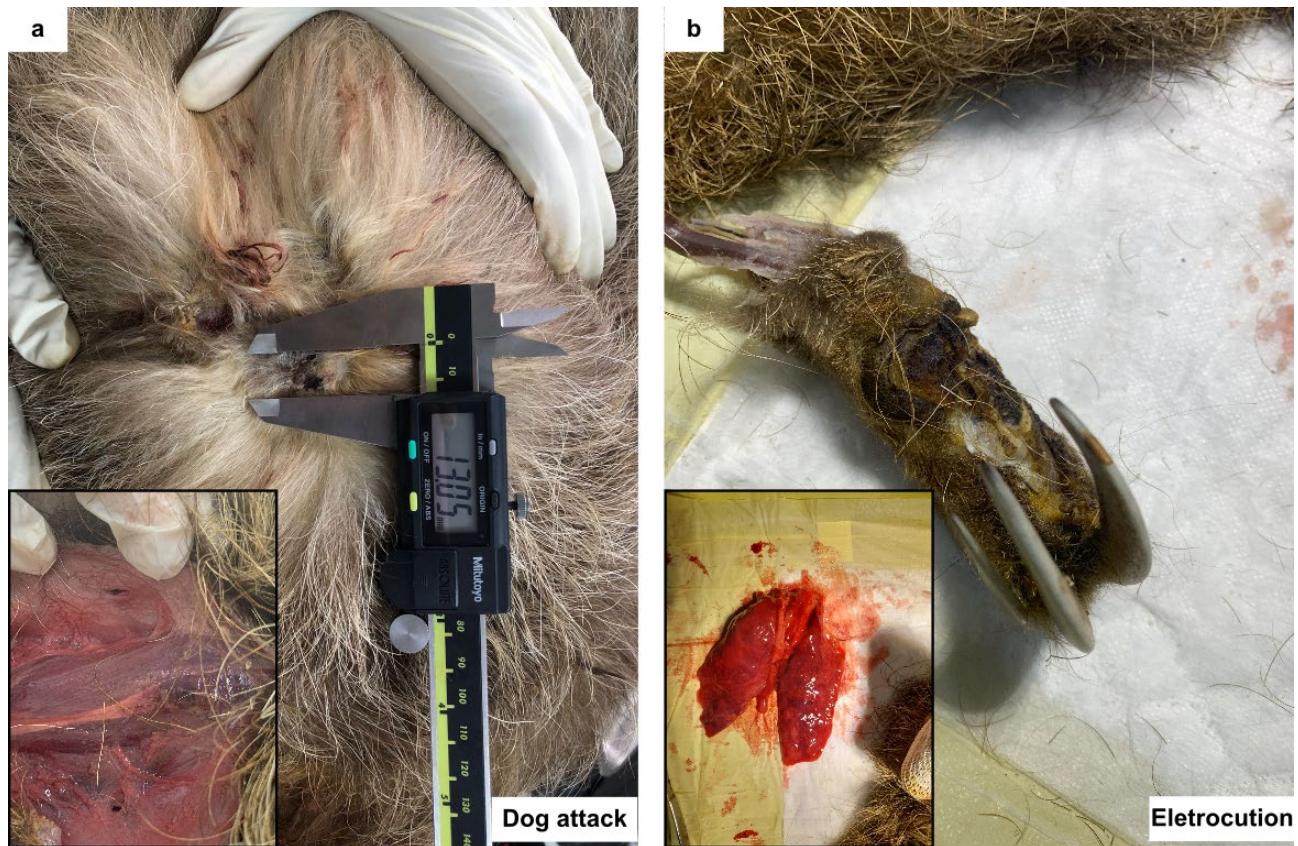


Figure 1. Location of the events in the municipality of Santa Teresa, ES, Brazil. The first photo shows the first sloth who died due to the attack of a dog, and the second shows the moment when the second sloth fell after being electrocuted, still alive.



Photos: Paloma M Santos

Figure 2. Body parts of *Bradypus crinitus* individuals injured in Santa Teresa, Espírito Santo, Brazil: (a) Perforating skin injury extending to the musculature; (b) External current mark and singed hair of a hand. An electrocution-damaged lung is indicated by the smaller box on the left.

wildlife. Overall, electrocution and dog attacks are the two main urban-related threats suffered, with a high mortality rate for arboreal mammals (Chaves *et al.* 2022, Oliveira *et al.* 2008). Sloths are prone to injuries related to their hind and lower limbs as they move around power lines, mainly burns, skin sloughing, and exposed fractures, as illustrated in our descriptions. Such injuries can often lead to limb amputation, which is often difficult to rehabilitate and does not guarantee the survival of the individual (Lima *et al.* 2012, Santos *et al.* 2022).

This is not the first report of wildlife being fatally attacked by dogs. In 2014, an individual maned sloth was killed in 2014 by approximately five domestic dogs in the southern region of Santa Maria do Jetibá, state of Espírito Santo (P. M. Santos, personal communication). In addition, a previous study reported that dogs prey on native fauna in Santa Teresa (Srbek-Araujo & Chiarello 2008). Overall, most of these predation events are recreational in nature and do not involve the consumption of the

killed prey (Marks & Duncan 2009), which may be related to instinctive predator-prey play rather than hunting for food (Lacerda *et al.* 2009). It is plausible that a similar scenario occurred with the recently killed sloth, which had numerous small puncture wounds throughout its body.

To reduce or even avoid these types of negative interactions, some strategies should be adopted, such as isolating power lines, installing of wildlife crossings, and adopting natural living fences to facilitate the flow of individuals (Pereira *et al.* 2020). In addition, campaigns to encourage residents to keep their dogs confined are essential and fundamental to preventing dog attacks and the transmission of diseases from domestic dogs to wildlife. Educating the community about domestic and feral dogs and their risks, and developing culturally appropriate pet ownership practices are other strategies to reduce the risks associated with free-roaming dogs (Schurer *et al.* 2015).

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