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# Urban encounters between Jaguars, Pumas, and humans reported through Citizen Science in Brazil

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## Abstract

A expansão urbana e as mudanças no uso da terra têm reduzido os habitats naturais, forçando espécies silvestres, como a *Panthera onca* e a *Puma concolor* a se aproximarem das áreas urbanas em busca de recursos. Esses grandes predadores, essenciais para o equilíbrio ecológico, acabam entrando em conflito com humanos, especialmente ao predar animais domésticos. Este estudo investigou os conflitos entre onças e humanos em áreas urbanas do Brasil, com base em registros de ciência cidadã entre janeiro de 2016 e maio de 2025. Os dados foram coletados em veículos de imprensa e organizados por espécie, localização, tipo de área urbana e instituição responsável pela captura. Dos mais de 12.000 registros iniciais, apenas 2,87% ocorreram em áreas urbanas, sendo 83% envolvendo onça-parda e 17% onça-pintada. A região Sudeste concentrou a maior parte dos casos (52,9%), seguida pelo Centro-Oeste (20,1%). A onça-parda foi registrada em todas as regiões, predominando no Sudeste (61,8%), enquanto a onça-pintada teve maior ocorrência no Centro-Oeste (50,8%) e Norte (39%), sem registros no Sul e Nordeste. Áreas residenciais foram os locais mais frequentes de ocorrência, e a Polícia Militar Ambiental e o Corpo de Bombeiros foram as instituições mais acionadas. Os resultados destacam a necessidade de estratégias de manejo e políticas públicas que considerem a sobreposição entre territórios urbanos e habitats de grandes felinos, visando reduzir riscos à população e promover a conservação dessas espécies.


## Introduction

The urbanization process took on new contours starting in the 18th century, when large rural landowners, who had previously lived exclusively in the countryside, began to establish residences in cities. This shift reflected a profound change in territorial dynamics and in the model of spatial occupation (Santos, 1993). Currently, approximately 84% of the Brazilian population lives in urban areas, while only 16% remain in rural zones (Fazal, 2000; Kasa et al., 2011, IBGE, 2017).

This process is characterized by the continuous concentration of population groups and is associated with physical, environmental, social, economic and political factors. It influences the growth of the human population through urbanization, leading to ecosystems modifications and changes in land use, which have significantly contributed to population declines and biodiversity loss (Glaeser and Kahn, 2010; Hollis, 2013; Angel et al., 2021; Engdaw and Kebede, 2021).

As environments are degraded, species are pressured to seek shelter and resources along urban edges. This scenario can intensify encounters between humans and wild fauna individuals, especially in areas where urban expansion encroaches upon territories occupied by these animals, leading to conflicts (MMA, 2017). Such conflicts occur when interactions between humans and wildlife result in negative impacts on either side, potentially involving both damage caused by fauna to humans and harm inflicted by human activities on wildlife (Conover, 2001; Redpath et al., 2013).

Other predator species also fulfill this ecological role, such as the puma (*Puma concolor)*, which has a wide geographic distribution (Terborgh, 2000; Scognamillo et al., 2003), and the Jaguar (*Panthera onca*), considered the largest feline in the Americas and the third largest in the world (Sunquist and Sunquist, 2002). Both species play a fundamental role in maintaining ecological balance, particularly by regulating prey populations.

For the monitoring and management of Brazilian felines in urban contexts, citizen science, as described by Kruger and Shannon (2000), involves the participation of the general population in academic activities and stands out as a valuable tool for fauna conservation. This collaborative, low-cost, and participatory approach has proven effective in generating data and building knowledge, thereby strengthening the relationship between society and scientific research (Pattengill-Semmens and Semmens, 2003; Silvertown, 2009; Riesch and Potter, 2014; Sullivan et al., 2009). In addition to broadening the understanding of large felines' presence in anthropized environments, this approach contributes to the development of more effective management and conservation strategies (Joly, 2025).

Given this context, the present study aims to identify and analyze records of encounters between felines and humans in urban areas of Brazil, in order to evaluate whether the type of urban area influences the frequency of occurrence of the

species pumas and jaguars.

## Materials and methods

# Data collection

Data collection was conducted through news reports published in the press, including online information portals, digital newspapers, specialized blogs, and local media outlets. All occurrences were automatically flagged using the Google Alerts monitoring tool. The keywords used in the searches included: "*Panthera onca* in the city," "*Puma concolor* in the city," "felines in the city," "urban feline," "jaguar in urban area," "puma in urban area," "jaguar in the city," and "feline capture." The survey covered events that occurred between January 2016 and May 2025. To avoid duplication, a manual screening of the dataset was carried out, and only records referring to felines in Brazilian urban centers were considered.

# Data analysis

The collected data were organized according to the following variables: species, location (state and municipality), geographical region, year, source of information (media outlet, such as website, newspaper, or portal), and type of urban area.

For this study, the types of urban areas were classified into four categories: residential area, industrial area, public space, and institutional area. The detailed distribution of these categories is presented in Table 1, providing a clear and systematic overview of feline records across different types of urban environments.

Table 1
Organization of urban areas into categories for record analysis.

| Type of area | Description | Examples/ Notes |
|---|---|---|
| Residential area | Houses, garages, backyards, bathrooms, pipes, condominiums. | Record of a jaguar found in a residential backyard. |
| Industrial area | Locations associated with industrial or private activities. | Power plants, private companies, metal workshops. |
| Public space | Areas intended for collective use or public circulation. | Streets, avenues, squares, parks, aerodromes (ex: Tefé – TFF/SBTF; Brigadeiro Camarão Vilhena – BVH/SBVH) |
| Institutional area | Institutional, military, or educational locations. | Hospitais, military units, schools and universities (USP, ESALQ/USP, UFMS, UFJF) |

Descriptive statistics and frequency analysis were applied (Nowak & Walker, 1999; Wilson & Mittermeier, 2009; Luza et al., 2019). A chi-square test ($\chi^2$) was performed to analyze the relationship between the type of urban area and the presence of felines. This categorization allowed for a better classification of interaction types, enabling a more accurate analysis of occurrence patterns. The model was run in R software, version 4.5.1 (R Core Team, 2025).

## Results

A total of approximately 12,000 news reports related to jaguar and puma occurrences in Brazil were recorded. Among these, encounters between the two species — the puma (*Puma concolor*) and the jaguar (*Panthera onca*) — and humans accounted for 2.87% (n = 344) of all analyzed records. Within this sample, 83% of the records referred to pumas, whereas only 17% involved jaguars, highlighting the lower frequency of jaguar occurrences in urban environments.

Regarding the geographic distribution of both species, the Southeast region accounted for the highest proportion of occurrences, with 52.9% of the records, followed by the Central-West (20.1%) and the South (15.1%). The North (9.0%) and Northeast (2.9%) regions showed the lowest numbers of records for both species, as illustrated in Fig. 1.

Regarding urban records of pumas by region, most occurrences were reported in the Southeast (61.8%), followed by the South (18.2%) and Central-West (13.7%). In contrast, the Northeast and North regions presented significantly lower numbers, with 3.5% and 2.8%, respectively, indicating a low incidence of the species in urban environments of these areas, as shown in Fig. 2a.

For jaguars (Fig. 2b), records were concentrated mainly in the Central-West (50.8%) and North (39%) regions. Occurrences in the Southeast were reduced (10.2%), and no records were reported in the South or Northeast regions, which possibly reflects the more restricted natural distribution of the species compared to the puma.

To verify whether there was an association between the recorded species (Panthera onca and Puma concolor) and the type of urban area, Pearson's Chi-squared test ($\chi^2$) was applied. The result indicated a significant association between the variables ($\chi^2 = 14.833$; $df = 3$; $p = 0.002$), demonstrating that the distribution of species in urban environments does not occur randomly but varies according to the type of area. It was observed that pumas showed higher frequencies across all categories, particularly in residential and public areas, whereas jaguars were less frequent, being mostly concentrated in residential areas.

Regarding the predominance of encounters between felines and humans across different types of urban areas, it was observed that 65.26% of puma records occurred in residential areas, while for jaguars, this percentage was 49.15%. Encounters in public spaces were also considerable, representing 29.82% for pumas and 32.20% for jaguars, with occurrences reported in streets, squares, avenues, inns, urban parks, and even airports. Industrial areas, in turn, accounted for the lowest number of records — 2.81% for pumas and 10.17% for jaguars. Finally, occurrences in institutional areas were less frequent, totaling 2.11% for pumas and 8.47% for jaguars.

## Discussão

The results obtained from citizen science records confirm the occurrence of large felids in urban environments and highlight their broad distribution across Brazil, with pumas occurring in all regions and jaguars recorded in three of them. The high number of puma records can be explained by their strong ability to adapt to different types of environments, including anthropogenic landscapes (Culver, 2010), a pattern also observed in this study. Moreover, the species has the widest geographic distribution among terrestrial mammals in the Western Hemisphere, reinforcing its remarkable ecological plasticity (Sunquist and Sunquist, 2002). According to Alves and Hannibal (2025), pumas represent about 49% of all mammal records in urban environments in Brazil, which corroborates the findings of the present study, especially their predominance in southeastern Brazil.

Among other factors that may explain the presence of carnivores in urban areas in Brazil are anthropogenic variables such as population density and the degree of urbanization, as demonstrated by Pereira et al. (2024). In general, carnivores are among the groups most affected by increasing human pressure on natural habitats (Crooks et al., 2011; Ripple et al., 2014), particularly because their dispersal capacity is not fully understood in Brazil (Pettigrew et al., 2012; Furtado, 2010; Furtado et al., 2017). This scenario tends to worsen with the intensification of deforestation, habitat conversion, and reductions in species' home ranges, all of which directly compromise biodiversity (Rabinowitz and Zeller, 2010; Hanski, 2011; Haddad et al., 2015; Morato et al., 2020).

Landscape changes reduce the availability of resources and shelter (Vieira et al., 2008; Regolin et al., 2017). Both species have generalist diets and are increasingly pressured to occupy territories near urbanized areas, competing for space and food, which heightens their vulnerability to persecution and mortality (Gurung et al., 2008; Franco et al., 2018; Versillo, 2021). Apex predators have low dependence on food sources provided by humans and therefore require large areas of natural habitat to maintain viable populations. This pattern is also confirmed for the species analyzed in this study (De Angelo et al., 2011; Regolin et al., 2017).

In Asia, studies have shown that leopards (Panthera pardus) exhibit a high capacity to adapt to heavily modified environments. In India, the configuration of forest landscapes and their proximity to densely populated areas facilitate the occupation of these territories by large felids, allowing them to persist in anthropogenic landscapes and maintain frequent interactions with local communities (Athreya et al., 2013).

Similarly, in North America, black bears (Ursus americanus) have been increasingly attracted to urban areas due to the high availability of food, particularly human-generated waste (Beckmann and Lackey, 2008), indicating that resource availability may favor the presence of carnivores in cities (Gehrt et al., 2010; Bateman and Fleming, 2012; Gehrt, 2012; Larson et al., 2020). The predation of domestic animals has also been identified as an attractant for large predators (Ripple et al., 2014; Darimont, 2015).

In the present study, interactions between domestic dogs and pumas were reported in several cases, such as in Jataí (GO), where an individual was seen walking near a health facility and fled after a dog barked; in Araucária (PR), where a puma was cornered by dogs inside a company yard; and in Caldas Novas (GO), where a puma was captured after being chased away by dogs.

Other reports indicate that jaguars occasionally attack domestic species in several Central and South American countries (Soto-Shoender and Giuliano, 2011; Amador-Alcalá et al., 2013; Butler et al., 2014; Fiorello et al., 2017; Jędrzejewski et al., 2017; Hoogesteijn et al., 2020). In Belize, Foster et al. (2010) found remains of dogs in jaguar scats, whereas in India, leopard diets in urbanized areas may include between 39% and 64% domestic dogs (Edgaonkar and Chellam, 2002; Athreya et al., 2014).

This relationship with domestic animals may be an important factor influencing the presence of felids in urban environments, especially in residential areas, where several individuals were recorded in close proximity to households (Fig. 6).

A jaguar was also documented in several urban situations. In one record, an individual remained hidden beneath a fuel-supply truck in Vilhena (RO). In another case, a jaguar entered a residence in the Jardim Tropical neighborhood in the city of Sorriso (MT). Additionally, the simultaneous entry of two jaguars into a house was reported in Miranda (MS), with the record documented by local residents (Fig. 7). All records were obtained by the property owners.

Brazil plays a decisive role in the conservation of the two largest felid species in the Americas, as the country hosts the largest populations of Panthera onca in the world (Sanderson et al., 2002). The puma, in turn, has a well-established distribution; however, its population is estimated at approximately 4,000 individuals, with a projected decline exceeding 10% over the next three generations (Azevedo et al., 2013; Mazzolli, 2010). In this context, the results of the present study reinforce the importance of understanding the dynamics of human–felid encounters (Pettigrew et al., 2012; Soulsbury and White, 2015; Nyhus, 2016).

## Conclusion

In this context, citizen science proved to be an important tool for generating a useful, comprehensive, and up-to-date database for both species—the puma and the jaguar.

The findings indicate that pumas accounted for the highest number of records, with a strong concentration in the Southeast region, whereas jaguars were most frequently recorded in the Central-West. The substantial number of records occurring in residential areas and public spaces highlights potential risks and underscores the need for urgent, integrated public policies and monitoring actions. Such measures are essential to ensure effective responses to the challenges posed by human–felid coexistence in increasingly urbanized landscapes in Brazil.

## Declarations

# CRediT authorship contribution statement

**Herlina Paula**: Investigation, Data Curation, Writing – Original Draft. **Maria Beatriz**: Conceptualization, Formal Analysis, Data Curation. **Jéssica Lobato**: Writing – Review and Editing. **Igor Araújo**: Writing – Review and Editing. **Rogério Fonseca**: Conceptualization, Validation, Project Administration.

# Declaration of Competing Interest

The authors declare that there are no conflicts of interest regarding the submitted article entitled “Urban encounters between Jaguars, Pumas, and humans reported through Citizen Science in Brazil”.

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## Figures

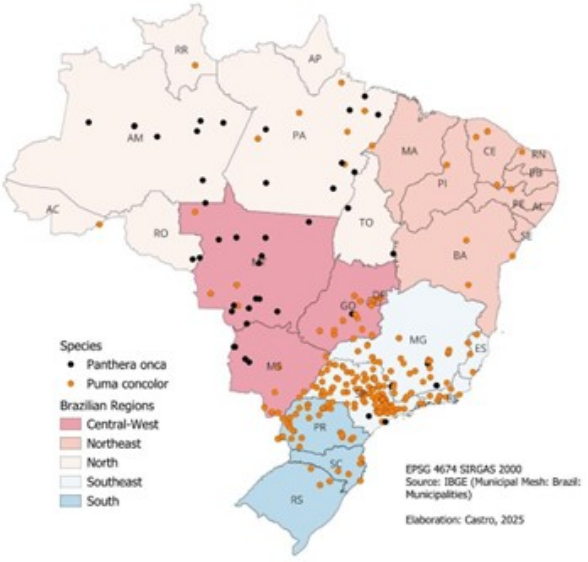



**Figure 1**

Distribution of *Panthera onca* (jaguar) and *Puma concolor* (puma) occurrences in urban areas of Brazil

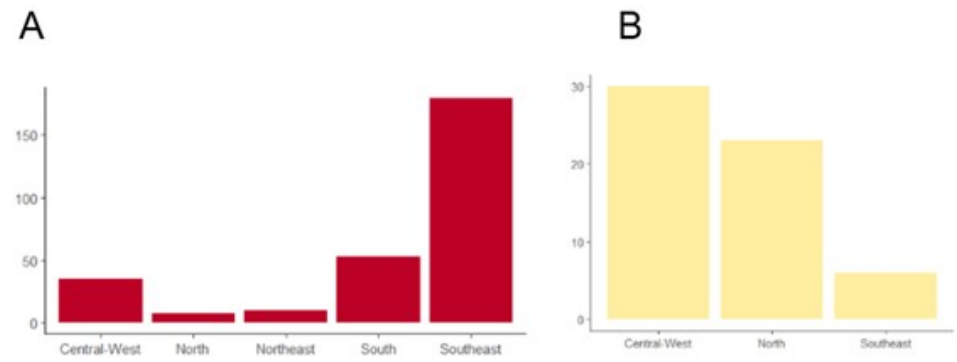



**Figure 2**

(a) Urban  records of puma by region in Brazil. (b) Urban records of jaguar by region in Brazil.

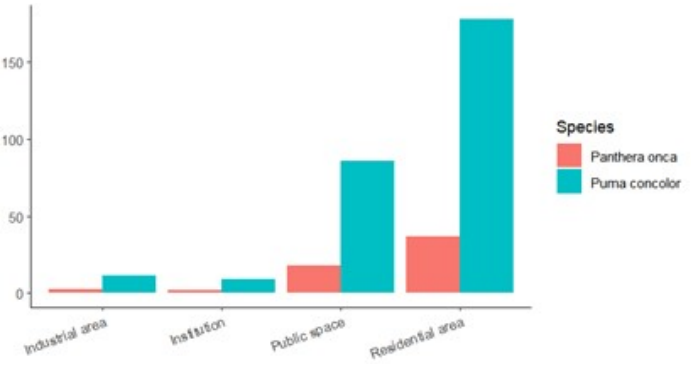



**Figure 3**

Type of urban area with the highest number of feline records.



**Figure 4**

Fig. 6. A) individual inside a garage; B) individual under a car within a garage; C) individual inside a bathroom stall; D) individual beneath a barbecue grill structure.

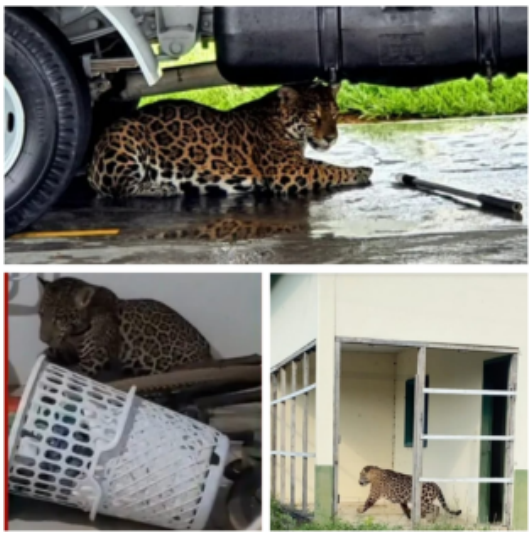


**Figure 5**

Fig. 7. Records of jaguars in urban areas