FULL ARTICLE

ISSN Online 1678-4456

Dogs and cats run over in an urban area: analysis of the costs generated, risk areas, and other aspects

Cães e gatos atropelados em área urbana: análise dos custos gerados, zonas de risco e outros aspectos

Yasmin da Silva Gonçalves da Rocha[1]; Luana Ribeiro Gomes[1]; Michele Brugnerotto[1]; Rita de Cassia Maria Garcia[1]

[1] Universidade Federal do Paraná, Departamento de Medicina Veterinária, Curitiba – PR, Brazil

ABSTRACT

Dogs and cats released on public roads can be owned, community-owned, or abandoned. The lack of efficient public policies for canine and feline population management (CFPM) facilitates the presence of animals on the streets, which can cause accidents and be run over. No studies identify the areas most at risk of being run over, nor are the costs involved in removing and properly disposing of carcasses known. The rate of animal running over in the municipalities can serve as an indicator for monitoring responsible animal guardianship actions and the CFPM program strategies. The objective of this study was to analyze the running over of dogs and cats and the costs involved in the Municipality of Pinhais, Paraná, Brazil, compared to other dog and cat population management costs. The City Hall provided data from January 2016 to December 2017 on collecting animal carcasses from public roads, including costs, the number of animals run over by species, and addresses from the running over to map occurrences. During this period, 199 dogs and 32 cats killed by being run over were collected. The service of collecting, transporting, and disposing of animal carcasses had an average monthly cost of R$ 20,325.19 (US$ 3,792), and the amount spent per kilogram of the animal's weight was R$ 14.83/kg (US$ 2.76). Runovers occurred more frequently in regions with lower socioeconomic status (>90%) and non-fast roads (62.3%), considered, therefore, regions with a greater propensity to aggravations.

Keywords: Run-overs. Carcass. Mapping. Stray dogs.

RESUMO

Cães e gatos soltos em vias públicas podem ter tutores, pertencer à comunidade ou estar abandonados. A ausência de políticas públicas eficazes para o manejo populacional de cães e gatos (MPCG) contribui para a presença de animais nas vias, aumentando o risco de acidentes e atropelamentos. Não há estudos disponíveis que identifiquem as áreas de maior risco para atropelamentos, nem se conhecem os custos envolvidos na remoção e no destino adequado dos cadáveres. O índice de atropelamentos de animais nos municípios pode ser utilizado como um indicador para monitorar a implementação de medidas de guarda responsável e avaliar a efetividade das estratégias adotadas no programa de manejo populacional de cães e gatos (MPCG). O objetivo deste estudo foi analisar os atropelamentos de cães e gatos e os custos envolvidos no Município de Pinhais, Paraná, Brasil, em comparação com outros custos de manejo populacional de cães e gatos. A Prefeitura forneceu dados referentes ao período de janeiro de 2016 a dezembro de 2017 sobre o recolhimento de cadáveres de animais das vias públicas, que incluíram: custos envolvidos; número de animais atropelados por espécie; e endereço dos atropelamentos para mapear as ocorrências. Durante este período foram recolhidos 199 cães e 32 gatos mortos por atropelamento. O serviço de coleta, transporte e destinação de cadáveres de animais teve um custo médio mensal de R$ 20.325,19 (US$ 3,792) e o valor gasto por quilo de peso do animal foi de R$14,83/kg (US$ 2.76). Os atropelamentos ocorreram com maior frequência em regiões com menor nível socioeconômico (>90%) e estradas não rápidas (62,3%), consideradas, portanto, regiões com maior propensão a agravos.

Palavras-chave: Atropelamentos. Carcaça. Mapeamento. Cães errantes.

Correspondence to:
Rita de Cassia Maria Garcia
Universidade Federal do Paraná, Departamento de Medicina Veterinária
Rua dos Funcionários, 1540
CEP: 80035-050, Curitiba – PR, Brazil
e-mail: ritamaria@ufpr.br

Received: October 31, 2023
Approved: August 20, 2024

How to cite: Rocha YSG, Gomes LR, Brugnerotto M, Garcia RCM. Dogs and cats run over in an urban area: analysis of the costs generated, risk areas, and other aspects. Braz J Vet Res Anim Sci. 2024;61(special issue):e218076. https://doi.org/10.11606/issn.1678-4456.bjvras.2024.218076.

Introduction

Traffic accidents involving running over animals can harm animals and people (Cherry et al., 2019). The lack of animal identification makes it difficult for guardians to be held responsible for the accident's cause and adopt preventive measures (Jardim et al., 2017), in addition to material damage being at the expense of the state and citizens involved in the accident (Huijser et al., 2009). The presence of animals on Brazilian highways is considered the eighth major cause of traffic accidents. However, the record of the occurrence of these cases is still scarce in Brazil, making it difficult to assess the actual situation (Jardim et al., 2017).

Canine and feline population management programs (CFPM) are fundamental in controlling and preventing human-animal interaction problems. They require several indicators for their evaluation and monitoring (Garcia et al., 2012). The analysis of pets run over in urban areas can serve as an indicator to monitor responsible animal guardianship actions and as an auxiliary parameter in CFPM programs. This aims to reduce the incidence of these accidents and contribute to the institution's awareness of responsible guardianship and the harmonious coexistence between humans and animals.

Therefore, this study aimed to evaluate the running over of dogs and cats and to analyze the costs involved for the municipality of Pinhais, Paraná, Brazil, comparing the costs of strategies for reproductive control in the population management of dogs and cats.

Material and Methods

The study was conducted in the city of Pinhais, Paraná, Brazil, where the City Hall outsources the collection of animal carcasses. We used the database provided by the Department of the Environment, which is responsible for receiving applications for collecting animal carcasses. The data collected covered the period from January 2016 to December 2017, including the costs involved in collecting the carcasses of dogs and cats run over on public roads; the cost of the monthly outsourced service for collecting, transporting, and incinerating the carcasses; the number of animals run over during this period; the species of animal run over; the address where the animal was run over, and the costs involved in neutering dogs and cats.

The amount spent per kilogram of animal weight was also assessed. Thus, the average cost range generated in each run-over was measured, considering the dog size as small (up to 10 kg), medium (10,001 to 20 kg), and large (over 20,001 kg), and the average weight for cats (4 kg).

The collected data were used to create a city map to identify regions with a higher incidence of accidents. This was done using a Geographic Information System (GIS), ArcGIS Online, which allows the creation of maps for data analysis. The data were computed and analyzed statistically using the Chi-square test of adherence.

The map was divided into five housing sectors (Table 1) based on the Pinhais/PR Housing and Land Regularization Plan (Pinhais, 2010), which divides the municipality into five regions based on the different socioeconomic structures of the population (Figure 1) and compared to the municipality's average monthly income map (Figure 2).

Results

The Department of the Environment registered 1,699 requests for the collection of animal carcasses during the years 2016 and 2017. Of these, 86.40% (1468/1699) are canine carcasses, 12.83% (218/1699) are feline carcasses, and 0.77% (13/1699) are of other species.

Runovers totaled 13.71% (233/1699) of carcass collection. From these, 85.4% (199/233) of canines were involved, 13.73% (32/233) of cats, and 0.85% (2/233) of other species. The other requests refer to deaths due to illness, natural causes, unknown causes, or other reasons (Figure 3).

Among the run-over animals, the frequency of collected dogs was much higher than that of cats. The statistical

Table 1 – Division of Housing Sectors

Sector	Neighborhoods
1	Atuba, Emiliano Perneta e Estância Pinhais
2	Jardim Cláudia, Alto Tarumã, Pineville e Centro
3	Weissópolis, Vargem Grande e Maria Antonieta
4	Jardim Amélia e Jardim Karla
5	Alphaville Graciosa, Parque das Nascentes e Parque das Águas

Source: Pinhais (2010).

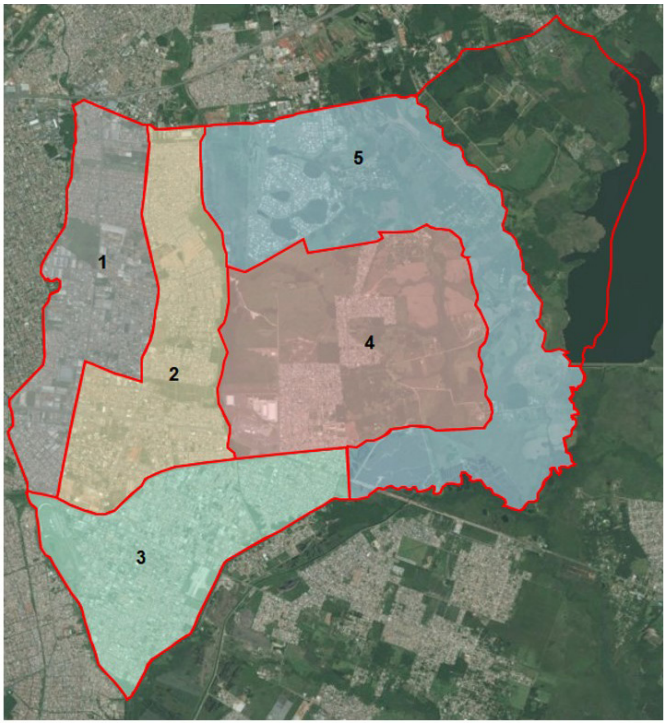

Figure 1 – Delimitation of Pinhais Housing Sectors.
Source: Pinhais' Housing and Land Regularization Plan (Pinhais, 2010).

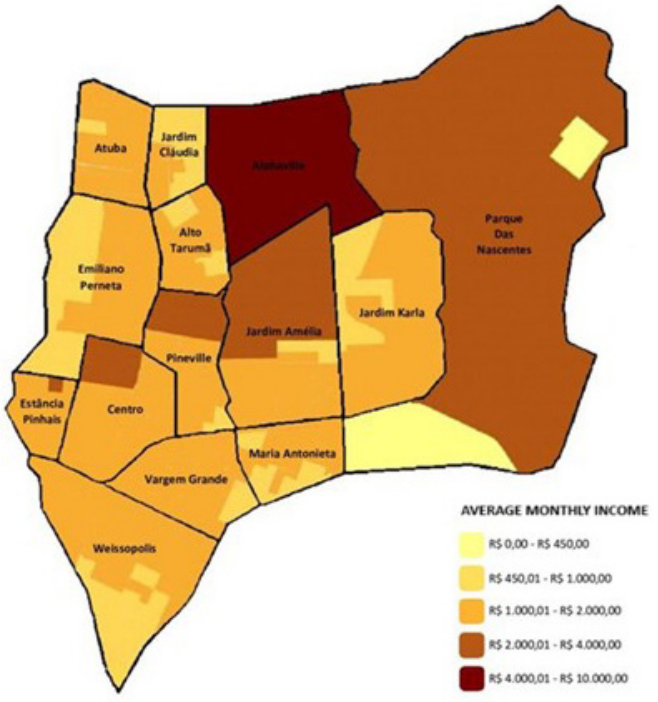

Figure 2 – Pinhais' average monthly income map.
Source: Pinhais (2010).

analysis of the collected species shows a significant difference between the species ($p < 0.0001$), with a frequency of 86.1% (199/231) for dogs and 13.9% for cats (32/231).

Figure 4 shows the monthly distribution of run-over accidents in 2016 and 2017. Compared to 2016, the highest

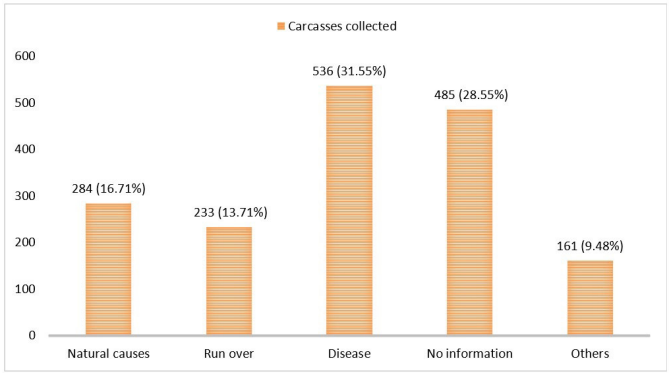

Figure 3 – The number of carcasses collected in 2016 and 2017 in the municipality of Pinhais/PR.

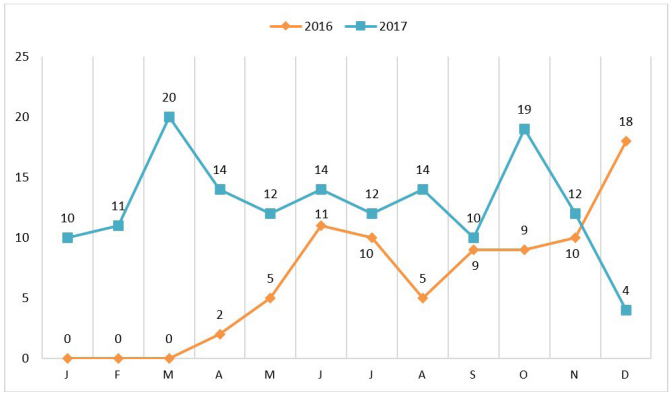

Figure 4 – Monthly distribution of animal runovers between 2016 and 2017 in Pinhais/PR.

number of dogs and cats were run over in 2017 in all months except December.

Furthermore, compared to 2016, 2017 showed a considerable increase in the number of animals run over, with a significant difference ($p < 0.0001$). In the first year, 79 animals (34.2%) were collected. In the second year, 152 (65.8%) of 231 dogs and cats were killed by being run over. The highest frequency found was in March 2017. However, there was no significant difference between the months, and no seasonality was observed.

Collecting, transporting, and final disposal of animal carcasses services are some items included in the Pinhais City Council's waste collection contract. The monthly average for these services in 2017 was R$ 20,325.19/month (US$ 3,792/month), while the amount spent per kilo of animal weight was R$14.83/kg (US$ 2.76/Kg).

Table 2 shows the average costs related to the collection of dog runovers based on the size of the animals. Large animals generate collection costs at least twice as high as small animals. Running over small dogs can cost up to R$ 148.30 (US$ 27.66) per animal; the medium size costs between R$ 148.30 (US$ 27.66) and R$ 296.60 (US$ 55.33), and the large size generates a cost of over R$ 296.60 (US$ 55.33)

per animal collected. The average cost of collecting cat carcasses (4 kg) is approximately R$ 59.32 (US$ 11.06).

Table 3 shows the costs of sterilization services for dogs and cats. The procedure for females (OSH) in both species is more expensive than for males (orchiectomy). The procedure cost in canines is based on the animal's size, while in cats, the cost is fixed, regardless of size.

Figure 5 maps the 231 runovers in the municipality in 2016 and 2017. A greater occurrence of runovers was found in sector 2, where 114 dogs and cats (49.4%) were collected ($p < 0.0001$). In sectors 1 and 3, 41 (17.7%) and 56 (24.2%) animals were collected, respectively, but there was no statistical difference between these two sectors. The sectors with the lowest frequency of cases were sectors 4 and 5, in which sector 4 had a frequency of 18 animals (7.8%) collected and sector 5 with only two animals (0.9%) over the two years.

There was no statistical correlation between runovers and highways on city roads. A higher frequency was found on normal roads, occurring in 62.3% (144) of the cases. According to the study, highways are no longer prone to animal runovers. They occur significantly less frequently ($p = 0.0002$) in only 37.7% (87) cases.

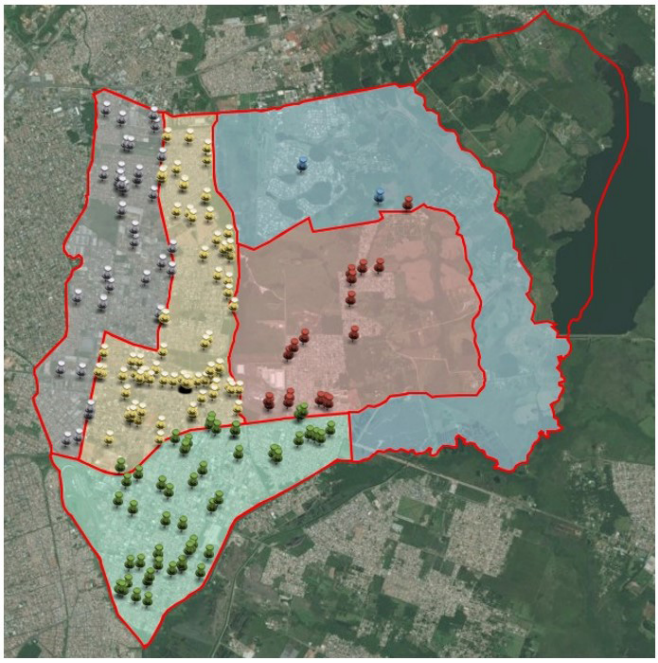

Figure 5 – Mapping of animal runovers in the municipality of Pinhais/PR in 2016 and 2017.
Source: Authors (2018) – Available in: Esri (2023).

Table 2 – Costs of collecting dog carcasses based on size

Size	Price range of collecting (R$)	Price range of collecting (US$)
Small (up to 10 kg)	Up to 148.3	Up to 27.66
Medium (10,001 kg to 20 kg)	148.30-296.60	27.66-55.33
Large (over 20,001 kg)	Over 296.60	Over 55.33

Discussion

The competent bodies must carry out the transport and destination of the carcasses collected from the municipal, state, or federal roads to remove from the environment and material capable of retaining and transporting contagious or infectious organisms. Dead animals in the environment can contaminate the soil and groundwater, which is essential for public health and may present a risk to humans (Figueiredo Filho & Manfredini, 2011). Thus, it is necessary to collect the animals quickly and safely, minimizing the risk of contamination of the environment since the carcasses are excellent culture media.

The municipality's incineration is a safe and effective method of disposing of the collected animals (Cardoso, 2002). Therefore, removing the carcasses from the place of the occurrence is essential, and the higher the incidence of cases, the greater the municipality's expense in collecting them. Thus, two pillars of canine and feline population management (CFPM), sterilization and guardianship, are essential to prevent and reduce these accidents due to the decrease in stray animals, contributing positively to animal and human health and administration from public bodies.

In the United States, there are about two million accidents per year involving large mammals (Huijser et al., 2009). In addition, one million vertebrates are killed by being run over on the country's roads (Forman & Alexander, 1998).

Table 3 – Costs with sterilization of dogs and cats

Procedure	Value	Value
Orchiectomy in small canines	R$ 179.99	US$ 33.58
Orchiectomy in medium-sized canines	R$ 193.33	US$ 36.06
Orchiectomy in large canines	R$ 229.70	US$ 42.85
Orchiectomy in cats	R$ 130.00	US$ 24.25
Ovariosalpingohisterectomy (OSH) in small canines	R$ 209.97	US$ 39.17
Ovariosalpingohisterectomy (OSH) in medium-sized canines	R$ 288.33	US$ 53.79
Ovariosalpingohisterectomy (OSH) in large canines	R$ 376.66	US$ 70.27
Ovariosalpingohisterectomy (OSH) in felines	R$ 211.66	US$ 39.49

In Spain, in 2011, the presence of animals on highways was responsible for more than 17 thousand traffic accidents, where 10 people died, and 84 suffered severe injuries as a result (López, 2012). In Brazil, according to the Federal Highway Police, the running over of animals is the eighth biggest cause of traffic accidents. About 30% of the people involved suffer minor or severe injuries, and 3% can die (Jardim et al., 2017).

Huijser and collaborators (2009) report that approximately two billion dollars are spent annually on traffic accidents involving animals in the United States and are related to vehicle repairs, medical assistance for the people involved, and removal of the animal's carcass from the accident site. On the other hand, Groot & Hazebroek (1996) cited that large animals hit by cars cost an average of one billion dollars in vehicle repairs in Europe. In Spain, between 2006 and 2012, an estimated annual cost of 105 million is related to animal-vehicle collisions (Sáenz-de-Santa-María & Tellería, 2015). In addition, the average cost of an animal-vehicle collision in the São Paulo state, in Brazil, was R$21,656 (US $9,629) between 2003 and 2013 (Abra et al., 2019).

In 2017, the municipality of Pinhais/PR spent R$243,902.28 (US$45,504.15) annually collecting animals. However, this amount does not include dog and cat runover since the municipality did not record this expense individually.

The cost per kilo of carcass collected in the present study was R$14.83 (US$2.76), three times higher than Curitiba/PR, which charges R$4.80 (US$0.89) (Oliveira et al., 2015) and eight times greater when compared to the municipality of Santo Ângelo/RS, which has an expense of R$ 1.83 (US$ 0.34) per kilo (Santo Ângelo, 2014). The Federal Highway Police initially spends R$397.78 (US$1,260.96) on activating a vehicle to collect animals (per animal) plus R$1.05 (US$3.33) per kilometer traveled when the displacement is greater than 60 km to collect animal carcasses on the country's highways (Brasil, 2015).

When analyzing the costs of the city hall with the collection and sterilization of dogs and cats, it was possible to observe that, although in some cases, the cost of spaying small animals may be higher than the collection of carcasses, the great importance of population management is not only based on public spending but also on the control of zoonoses transmission, animal welfare, aggressions (Lima & Luna, 2012) and injuries to humans (Huijser et al., 2009; Jardim et al., 2017). Only in medium and large animals can the cost of collecting carcasses be greater than the cost of sterilization, corroborating the importance of the procedure, which contributes to population control and reduction of stray animals.

The number of carcasses collected from dogs was significantly higher than those from cats, with 86.1% of canines and 13.9% of felines. Similar values were found in the study by Oliveira et al. (2015), in which the annual frequency of dog carcasses predominates and represents about 90% of the total animals collected. On Brazilian highways, small canids are also the main representatives among the species of animals run over (Vieira, 1996). In the case of Pinhais, the human/dog ratio was 2.57, while the human/cat ratio was 16.7 (Baquero et al., 2018), showing a canine population almost seven times larger than the feline, which would justify the higher number of carcasses.

Comparing 2016 and 2017, there was a significant increase in animal runover in 2017, and the opposite was expected since population management actions were implemented in the city. However, service record errors may have occurred, as in the first trimester of 2016, there was no record of runovers, in addition to a high number of animals collected without informed origin. Thus, it is estimated that this number may be higher.

The data found is associated with the income level of each sector when compared with the map of the municipality's average monthly income (Pinhais, 2010). The sectors with the highest economic conditions in the municipality, sector 4 with average incomes of up to R$ 4,000.00 (US$ 746.26), and sector 5 with average incomes of up to R$ 10,000.00 (US$1,865.67), showed low frequencies of run-overs with significant differences. As a result, an analysis shows that regions with higher socioeconomic levels are less susceptible to runovers. This can occur from different points of view, such as greater responsible pet animal guardianship, since middle and upper classes may tend to confine their animals inside their homes, as well as children, who are not only more confined to higher income regions are also more likely to be run over when they come from poorer regions (Daros, 1998) and greater access to information, also related to higher income (Salvato et al., 2010). This finding reinforces the need to set up projects that provide information on the importance of responsible guardianship, especially in the municipality's most vulnerable areas. The aim is to reduce the number of stray animals and, consequently, the number of run-overs.

Forman et al. (2003) explains that, concerning animal runovers on the roads, the most associated risk factors are vehicle speed and traffic volume. However, the result found in this study indicates that animal runover does not occur more frequently on highways within the municipality. Such data may be related to a municipality's greater existence of "not fast" roads than fast roads. When analyzing only the frequency of being run over, it was found that the non-fast road is more prone to accidents due to its greater

quantity. The Deputado João Leopoldo Jacomel Highway, the main road in the city, was the one that obtained the largest number of animals run over. However, there were many more occurrences in other places.

The choice of indicators involving public service, which includes the carcasses of dogs and cats collected in urban areas, allows for the management of MPCG programs (Garcia et al., 2012). In this way, the implementation of socio-educational measures that include the concepts of responsible guardianship, population control with sterilization measures, and the counting and identification of animals is necessary to allow an evaluation of the effectiveness of the actions already implemented (International Companion Animal Management Coalition, 2007).

Conclusion

The number of animals run over in Pinhais, Paraná, Brazil, was higher in regions with lower socioeconomic status and non-fast roads. In addition, there was an increase in occurrences in 2017 compared to 2016. Thus, the analysis of the number of animals run over can be used as an indicator to improve responsible pet guardianship. It demonstrates the importance of developing strategies to raise awareness about restricting these animals' access to the unaccompanied street and population management of dogs and cats in municipalities.

Conflict of Interest

There are no conflicts of interest.

Ethics Statement

The study did not require ethical approval.

Acknowledgements

We want to thank the Environmental Department of the municipality of Pinhais for providing the data.

References

Abra FD, Granziera BM, Huijser MP, Ferraz KMPMB, Haddad CM, Paolino RM. Pay or prevent? Human safety, costs to society and legal perspectives on animal-vehicle collisions in São Paulo state, Brazil. PLoS One. 2019;14(4):e0215152. http://doi.org/10.1371/journal.pone.0215152. PMid:30973920.

Baquero OS, Marconcin S, Rocha A, Garcia RCM. Companion animal demography and population management in Pinhais, Brazil. Prev Vet Med. 2018;158:169-77. http://doi.org/10.1016/j.prevetmed.2018.07.006. PMid:30220391.

Brasil. Ministério da Justiça. Portaria nº 1070, de 30 de julho de 2015. Tabela de Preços Públicos. Diário Oficial da União; Brasília; 2015 Aug 3.

Cardoso CVP. Descarte de carcaças. In: Andrade A, Pinto SC, Oliveira RS, editors. Animais de laboratório: criação e experimentação. Rio de Janeiro: Fiocruz; 2002. p. 281-8.

Cherry CC, Dietz S, Sauber-Schatz E, Russell S, Proctor J, Buttke D. Characteristics of animal-related motor vehicle crashes in select National Park Service units-United States, 1990-2013. Traffic Inj Prev. 2019;20(1):58-63. http://doi.org/10.1080/15389588.2018.1508835. PMid:30644778.

Daros EJ. Acidentes de trânsito e comportamento humano. In: Anais do I Encontro Nacional para Prevenção de Acidentes de Trânsito e Primeiros Socorros ao Acidentado; 1998. Sociedade Nordestina de Neurocirurgia; 1998.

Esri. ArcGIS [Internet]. 2023 [cited 2023 Oct 31]. Available from: https://arcg.is/4eDvf

Figueiredo Filho YA, Manfredini S. Contaminação do solo e das águas subterrâneas por sepultamento de carcaças de animais no solo [tese]. São Paulo: Universidade de São Paulo; 2011. http://doi.org/10.11606/D.8.2011.tde-29082012-115144.

Forman R, Sperling D, Bissonette J, Clevenger A. Road ecology: science and solutions. Chicago: University of Chicago Press; 2003.

Forman RTT, Alexander LE. Roads and their major ecological effects. Annu Rev Ecol Syst. 1998;29(1):207-31. http://doi.org/10.1146/annurev.ecolsys.29.1.207.

Garcia RCM, Calderón N, Ferreira F. Consolidação de diretrizes internacionais de manejo de populações caninas em áreas urbanas e proposta de indicadores para seu gerenciamento. Rev Panam Salud Publica. 2012;32(2):140-4. http://doi.org/10.1590/S1020-49892012000800008. PMid:23099875.

Groot GWTA, Hazebroek E. Ungulate traffic collisions in Europe. Biology. 1996;10(4):1059-67.

Huijser MP, Duffield JW, Clevenger AP, Ament RJ, McGowen PT. Cost-benefit analyses of mitigation measures aimed at reducing collisions with large ungulates in the United States

and canada: a decision support tool. Ecol Soc. 2009;14(2): art15. http://doi.org/10.5751/ES-03000-140215.

International Companion Animal Management Coalition – ICAM. Guia de controle humanitário da população canina. ICAM; 2007.

Jardim JMM, Silva Júnior RA, Pascoal IC, Oliveira AADF, Pinheiro Júnior JW. Análise dos acidentes de trânsito ocasionados por animais nas rodovias federais do estado de Pernambuco, Brasil. Med Vet. 2017;11(1):76. http://doi.org/10.26605/medvet-n1-1628.

Lima AFM, Luna SPL. Algumas causas e consequências da superpopulação canina e felina: acaso ou descaso? Rev Educ Contin Med Vet Zootec CRMV-SP. 2012;10(1):32-8. http://doi.org/10.36440/recmvz.v10i1.258.

López M. "Animaladas" en el asfalto. Tráfico Segur Vial. 2012;35-7.

Oliveira HV, Morikawa VM, Biondo AW, Garcia RCM. A remoção de animais mortos nas ruas indica guarda irresponsável e sai mais caro que educação e castração gratuitas. Rev Clin Vet. 2015;116:32-6.

Pinhais. Prefeitura Municipal. Plano de habitação e regularização fundiária. Ecotécnica; 2010.

Sáenz-de-Santa-María A, Tellería JL. Wildlife-vehicle collisions in Spain. Eur J Wildl Res. 2015;61(3):399-406. http://doi.org/10.1007/s10344-015-0907-7.

Salvato MA, Ferreira PCG, Duarte AJM. O impacto da escolaridade sobre a distribuição de renda. Estud Econ. 2010;40(4):753-91. http://doi.org/10.1590/S0101-41612010000400001.

Santo Ângelo. Prefeitura Municipal. Edital nº 109/2013. Coleta, transporte, tratamento e destino final de resíduos sólidos urbanos: planilha de custos (animais mortos). Santo Ângelo: Departamento de Compras e Patrimônio; 2014.

Vieira EM. Highway mortality of mammals in central Brazil. Cienc Cult. 1996;48(4):270-2.

Financial Support: None.