Uncontrolled dog activity and problem areas in urban parks

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Abstract Domestic dogs are a significant, but poorly recognised, threat to native wildlife inhabiting natural environments within urban areas. Human presence is the main driver of dog abundance and habitat use. The objective of this study is to i) determine the level of uncontrolled dog activity (off-leash, without human accompaniment) in on-leash designated areas within the City of Calgary, ii) identify off-leash problem areas, and iii) provide recommendations to parks management on how to reduce the impacts of domestic dogs on wildlife in city parks. There was a lot of documented off-leash dog activity in all of the natural areas with camera traps, and the majority of this activity occurred in on-leash areas. A large portion of uncontrolled dog activity occurred within 250 m of off-leash designated areas (the majority occurring within 50 m), suggesting that a lack of public awareness of where off-leash areas end and on-leash areas begin may be contributing to the high off-leash rates. The results also suggest that dog owners behave similarly with respect to dog leashing, regardless of leash rules. In order to decrease the number of off-leash dogs in on-leash designated areas and the subsequent effects that dogs have on wildlife in Calgary, an increased vigilance by the city and increased public awareness of the effects that domestic dogs have on wildlife, e.g., signage in problem areas, is recommended.

INTRODUCTION

Wildlife is greatly impacted by human activities, including recreation and urbanization. One threat in particular that humans have on wildlife is with their loyal companions, domestic dogs (*Canis familiaris*). Domestic dogs are a significant, but poorly recognised, threat to native wildlife inhabiting natural environments, particularly within urban areas. Dogs are prominent agents of wildlife disturbance (Weston et al., 2014; Weston & Stankowich, 2014). The impacts of such disturbance include harassment, injury, or death; temporal and spatial displacement; and modification of behavior (Sime, 1999). Temporal and spatial displacement has been observed in various studies for many wildlife species, including small mammals, coyotes, bobcats, and deer, all of which reduced activity in urban parks during peak human visitation hours and avoided areas where dogs were present (George & Crooks, 2006; Lenth et al., 2008; Miller et al., 2001; Twardeck et al., 2017). Domestic dogs can cause direct or indirect mortality of wildlife through means such as predation, pursuit, and transmission of disease (Dorresteijn et al., 2015; Sime, 1999; Twardek et al., 2017; Weston et al., 2014). Even when on-leash, dogs can disturb wildlife sufficiently enough to reduce species diversity and abundance (George & Crooks, 2006; Lacerda et al., 2009; Sime, 1999). This disturbance not only negatively affects wildlife in the short-term, but in the long-term as well; this includes, for example, reproductive success and immune system suppression (Twardek et al., 2017).

The environmental impact of domestic dogs largely depends on the extent to which they are allowed outdoors (Twardek et al., 2017). Two key factors that influence the impact levels of dogs are i) if dogs are allowed to roam free (influenced by their owners), and ii) area covered when roaming (influenced by individual dogs) (Weston et al., 2014). Human presence is the main driver of dog abundance and the most important predictor variable in shaping dog habitat use (Lacerda et al., 2009; Lenth et al., 2008; Paschoal et al., 2018). As dogs increasingly roam into natural areas, the likelier they will encounter native carnivores and interact with them as predators, prey, and/or competitors (Vanak & Gompper, 2009). The presence of domestic dogs may be considered a human-derived edge effect in urban parks, protected areas, and along trails (Paschoal et al., 2018; Soto & Palomares, 2015). This indicates that in areas which allow off-leash dogs, there is a certain percentage of habitat that is unsuitable for certain species, even if it may be perfectly suitable otherwise. While the susceptibility that wildlife has to disturbances caused by domestic dogs is species-specific and influenced by

Published online
September 300, 2022

Citation
Squires, K., (2022). Uncontrolled dog activity and problem areas in urban parks, *CJUR*, 7(2), 6-11.

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individual habitat use (Forrest & St. Clair, 2006), the edge effect can still considerably diminish a habitat's ability to support wildlife populations.

The objective of this study is to i) determine the level of off-leash dog activity in on-leash designated areas within the City of Calgary, ii) to identify off-leash problem areas, and iii) to provide recommendations to parks management on how to reduce the impacts of domestic dogs on wildlife in city parks.

METHODS

Study area

This study took place in Calgary, Alberta (51.0447° N, 114.0719° W). The City of Calgary has 71 parks, in total covering over 10,000 hectares of natural area (City of Calgary, n.d.-b). Most parks are open to visitors from 5:00 a.m. – 11:00 p.m. and allow a variety of recreational activities, including walking, running, and cycling, to take place within their boundaries (City of Calgary, n.d.-b).

Many parks in the city allow domestic dogs to accompany their humans. There are only a few areas that prohibit dogs completely for both human and wildlife safety. These include playgrounds; wading or swimming areas; rivers, lakes, or ponds; and the Inglewood Bird Sanctuary, Inglewood Wildlands, and Weaselhead Natural Environment Park trails for the protection of sensitive wildlife habitats (City of Calgary, n.d.-b). In accordance with Calgary's Responsible Pet Ownership Bylaw 23M2006 and Parks and Pathways Bylaw 11M2019, dogs are required to be on-leash at all times, unless in a designated off-leash area (City of Calgary, n.d.-b). There are 150 public off-leash areas in Calgary, which make-up approximately 17% of all the natural areas in the city (City of Calgary, n.d.-a) (Figure 1). Furthermore, the by-laws require owners to ensure their pet is not running at large, entering areas in which they are prohibited, and is restrained by a leash within 2 meters of an off-leash area (City of Calgary, 2018).

Camera trapping

97 wildlife cameras (Spypoint and Reconyx) were placed at 106 locations across 19 parks and natural areas in the city between May 9, 2017, and May 31, 2020, as part of the Calgary Captured Urban Wildlife Monitoring Program (Figure 2). The selected locations were primarily on game trails or human foot paths. Camera placement occurred in a 1 x 1 km grid system throughout the parks and were approximately 1 m from the ground (Dorresteijn et al., 2015; Schlacher et al., 2015). Study areas contained different numbers of sites, which were roughly proportional to their physical area, and not all cameras were operational for the full duration of the study period. The camera traps recorded time and date for each detection and took 3 images when triggered.

Analysis and classification

The wildlife images collected were classified to a species through the online WildTrax platform, by Miistakis Institute staff and in-house volunteers. An event was defined as any image that contained a living being (human or wildlife). Human and wildlife events were considered independent if consecutive images of the same species were taken more than 30 minutes apart. If a dog was detected in an image, a staff member would record whether it was on-leash, off-leash, or if the leashing was unknown. To protect privacy, all human images recorded were processed manually, and were deleted after classification.

The data set was cleaned, which involved filtering out records from unreliable cameras or those with very short sampling period, false trigger events, and records for very small animals not designed to be captured by cameras (birds, insects, etc.). Records of humans with dogs occurring after June 1, 2018 were unavailable due to a camera software change (on-leash events were not recorded properly after this date). The resulting data for humans with dogs ranged from May 9, 2017 to May 31, 2018 (379 total camera trap days) and included 16 parks within Calgary; while the data of domestic dogs alone ranged from May 9, 2017 to May 31, 2020 (1,119 total camera trap days) and included 19 parks within the city. Because human with dog events were not being recorded properly, the leashing status of those dogs was unknown; thus, for this analysis, dogs were classified as either controlled or uncontrolled. The assumption of uncontrolled was made if the dog was captured in the camera traps without a human nearby and was off-leash, while controlled was assumed if the dog was captured in an image accompanied by a human nearby, regardless if on- or off-leash (Cortés et al., 2021).

Dog activity rates were determined through the calculation of the number of dog events per camera trap day in each grid cell. Dog control rates were calculated as a proportion of total dog events per 100 camera trap days and by camera location. The frequency of uncontrolled dogs from off-leash designated areas was calculated as uncontrolled dog activity per 100 camera trap nights for each camera versus the distance from such areas using ArcMap GIS. Problem areas were identified using ArcMap GIS by assessing the rates of off-leash dogs in on-leash designated areas and their distance from designated off-leash area boundaries..

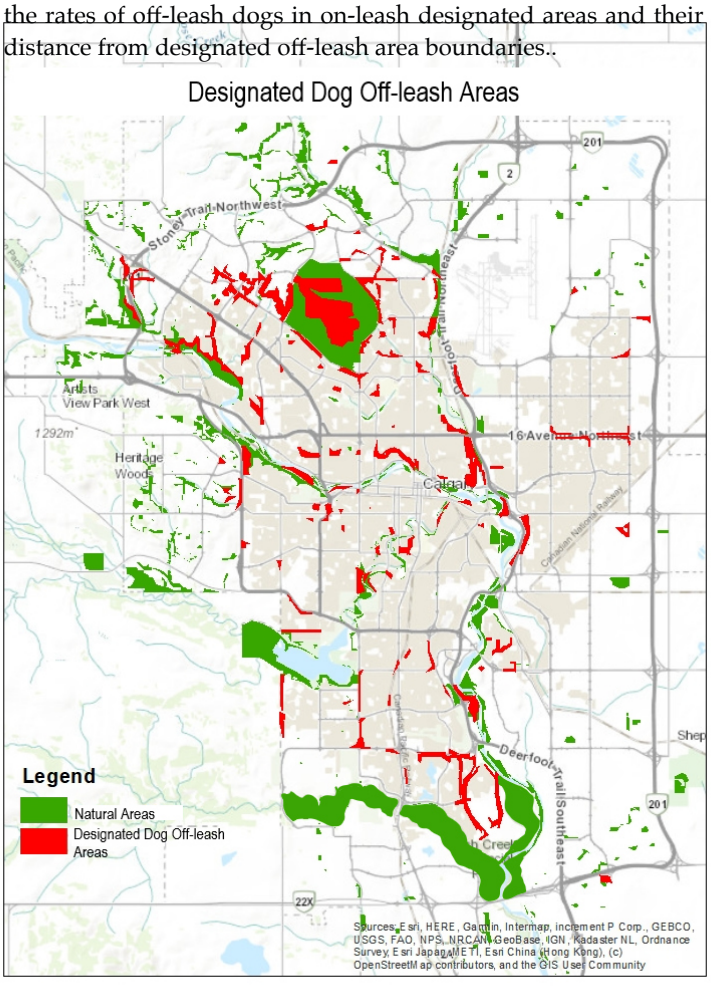

Figure 1 Designated off-leash areas in Calgary.

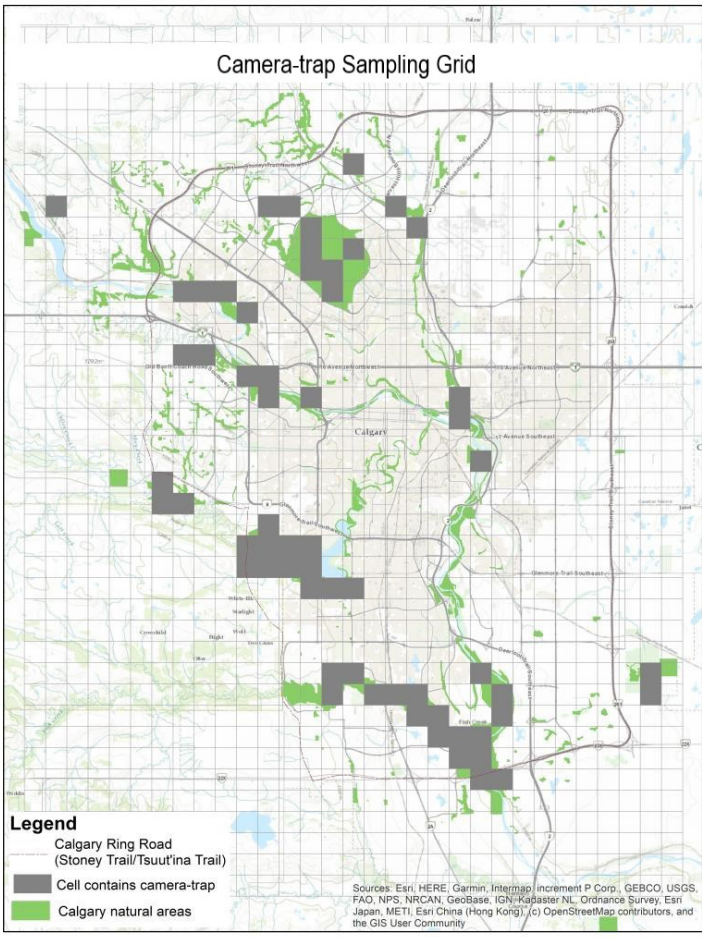

Figure 2 Camera-trap sampling grid (1 km^2) used to establish camera locations in Calgary natural areas.

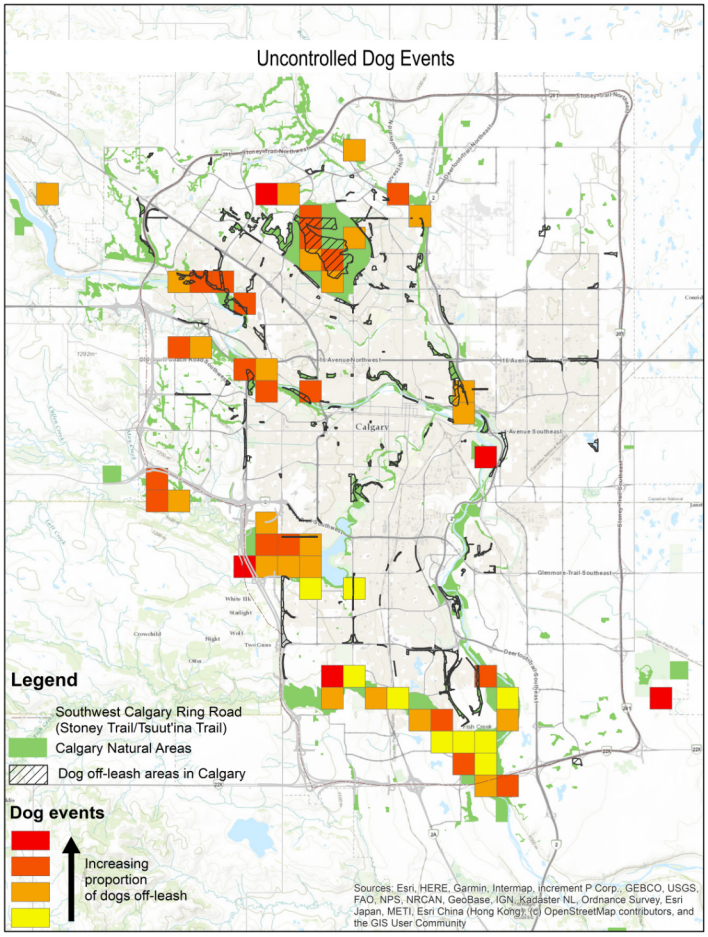

Figure 3 Designated off-leash areas in Calgary.

Park	Total dog events	Uncontrolled events	%	Controlled events	%
Bowmont	61.36	48.44	78.93%	12.93	21.07%
Confluence	54.71	28.33	51.78%	26.39	48.22%
Edgemont	3.93	3.66	93.28%	0.26	6.72%
Edworthy	494.88	298.84	60.39%	196.04	39.61%
Fish Creek PP	835.68	376.32	45.03%	459.37	54.97%
Griffith Woods	12.02	9.38	78.05%	2.64	21.95%
Haskayne	2.58	1.79	69.31%	0.79	30.69%
HID241	27.82	7.24	26.02%	20.58	73.98%
Inglewood	0.18	0.18	100.00%	0.00	0.00%
North Glenmore	176.20	96.51	54.78%	79.68	45.22%
Nose Hill	471.74	281.77	59.73%	189.97	40.27%
Paskapoo	11.77	4.38	37.21%	7.39	62.79%
Ralph Klein	0.09	0.09	100.00%	0.00	0.00%
SE Corridor	89.90	89.90	100.00%	0.00	0.00%
South Glenmore	243.76	120.02	49.24%	123.75	50.76%
Tom Campbell	184.06	48.97	26.61%	135.09	73.39%
Twelve Mile Coulee	6.17	6.17	100.00%	0.00	0.00%
Weaselhead	157.01	73.64	46.90%	83.38	53.10%
Winston Heights	6.08	6.08	100.00%	0.00	0.00%
Total	**2,670.70**	**1,415.82**		**1,254.88**	

Table 1 Total rate of dog events for both controlled and uncontrolled dogs, calculated as the number of dog events per 100 camera trap nights in each park.

RESULTS

There were 21,876 total events involving dogs, of which 16,804 were uncontrolled (without human, off-leash; 76.81%). Uncontrolled dogs were recorded on 91 of the 97 camera traps (Figure 3). Uncontrolled dogs were recorded in on-leash areas in all of the parks (89.03% of the total uncontrolled events), with the exception of Tom Campbell and Winston Heights, as well as 2 camera-traps in Nose Hill, as in these parks the camera-traps were set in areas which permitted dogs to be off-leash (Tables 1 and 2).

Off-leash problem areas

There were 7,057 uncontrolled domestic dog events that took place within 250 m from the boundary of a designated off-leash area (42% of total uncontrolled dog events) (Table 3). These events were captured on 17 cameras; the other 74 cameras were not included

due to their location being i) greater than 250 m from the off-leash areas or ii) in parks without off-leash areas. The majority of uncontrolled dogs in these events occurred within 50 m from the off-leash area boundary (Figure 4).

Temporal activity

The vast majority (99.87%) of dog events took place within park open hours (5:00 am – 11:00 pm). Only 28 events occurred outside of park hours, most of which were uncontrolled dogs (67.86%); the rest of those events were controlled dogs. Of the events that took place during operating hours, the majority took place in the afternoon (11:00 am – 4:59 pm) (see Figure 5). Seasonally, the majority of domestic dog events took place in the spring (36.45%), with winter being the second-most common occurrence (26.59%) (see Figure 6).

Park	Uncontrolled		Controlled	
	On-leash area	Off-leash area	On-leash area	Off-leash area
Bowmont	48.44	0.00	12.93	0.00
Confluence	28.33	0.00	26.39	0.00
Edgemont	3.66	0.00	0.26	0.00
Edworthy	298.84	0.00	196.04	0.00
Fish Creek PP	376.32	0.00	459.37	0.00
Griffith Woods	9.38	0.00	2.64	0.00
Haskayne	1.79	0.00	0.79	0.00
HID241	7.24	0.00	20.58	0.00
Inglewood	0.18	0.00	0.00	0.00
North Glenmore	96.51	0.00	79.68	0.00
Nose Hill	169.97	111.80	189.97	62.80
Paskapoo	4.38	0.00	7.39	0.00
Ralph Klein	0.09	0.00	0.00	0.00
SE Corridor	89.90	0.00	0.00	0.00
South Glenmore	120.02	0.00	123.75	0.00
Tom Campbell	0.00	48.97	135.09	135.09
Twelve Mile Coulee	6.17	0.00	0.00	0.00
Weaselhead	73.64	0.00	83.38	0.00
Winston Heights	0.00	6.08	0.00	0.00
Total	**1,334.85**	**166.85**	**1,338.26**	**197.89**

Table 2 Uncontrolled and controlled dog rates for on- and off-leash areas, calculated as the number of dog events per 100 camera trap nights in each park.

Distance from off-leash park (m)	Park	Number of uncontrolled dog events
0	Nose Hill-49	71.13
	Nose Hill-50	40.66
	Tom Campbell-24	48.97
	Winston Heights-77	6.08
50	Bowmont-16	9.12
	Bowmont-87	5.00
	Edworthy-56	280.25
	Nose Hill-54	15.73
	Nose Hill-57	14.83
100	Bowmont-19	5.63
	Bowmont-58	26.09
	Fish Creek PP-45	7.77
150	Bowmont-17	0.27
	Edworthy-13	3.75
200	North Glenmore-1	0.36
	North Glenmore-66	94.91
250	Twelve Mile Coulee-88	0.09

Table 3 Rate of uncontrolled dog activity versus the distance from off-leash areas (within 250 m), calculated as the number of dog events per 100 camera trap nights in each park. Note: some camera traps were excluded due to a distance of greater than 250 m from the off-leash area or location in parks without off-leash areas.

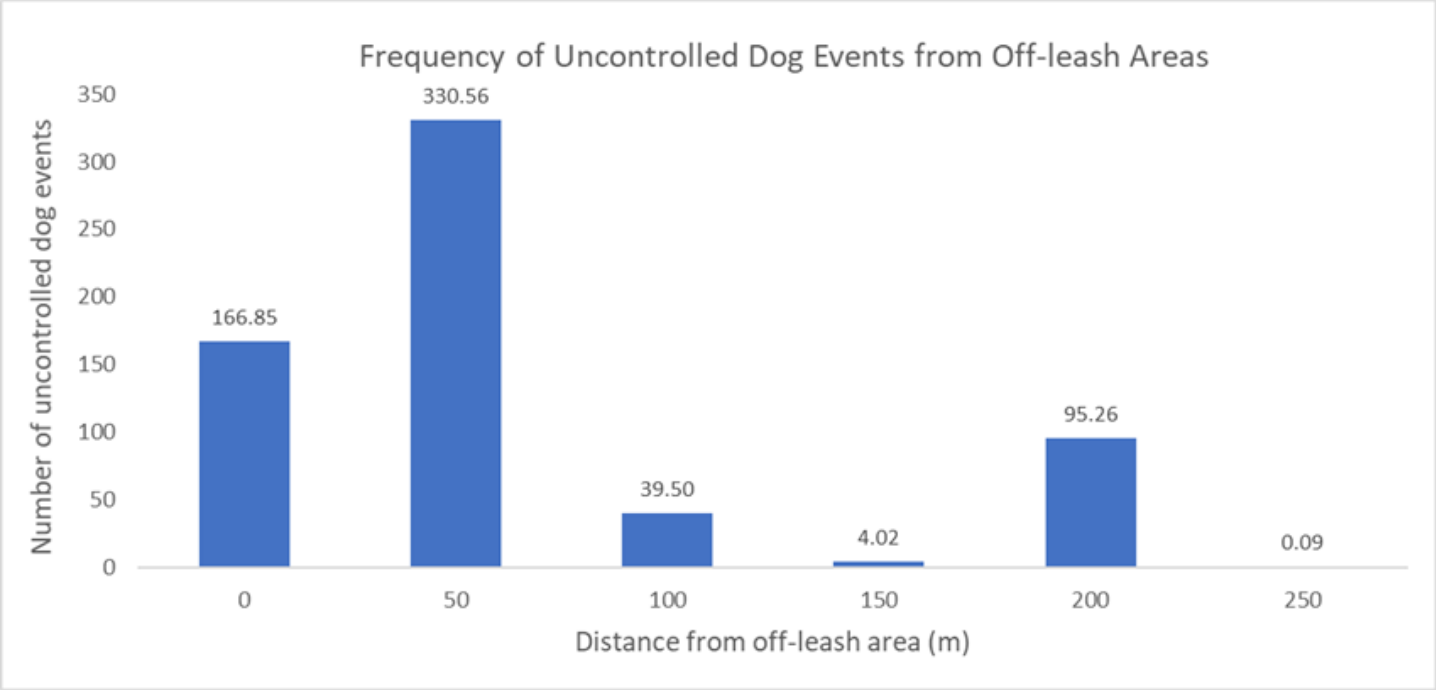

Figure 4 Uncontrolled dog (without human, off-leash) activity per 100 camera trap nights versus the distance from off-leash areas (within 250 m).

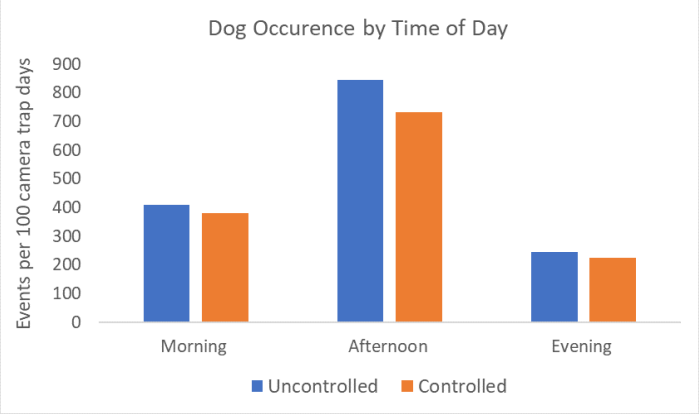

Figure 5 Occurrence of dog events, controlled (with human either on- or off-leash) and uncontrolled (without human, off-leash), by time of day, within park operating hours (5:00 am – 11:00 pm) per 100 camera trap nights. Morning = 5:00 AM – 10:59 AM; Afternoon = 11:00 AM – 4:59 PM; Evening = 5:00 PM – 11:00 PM.

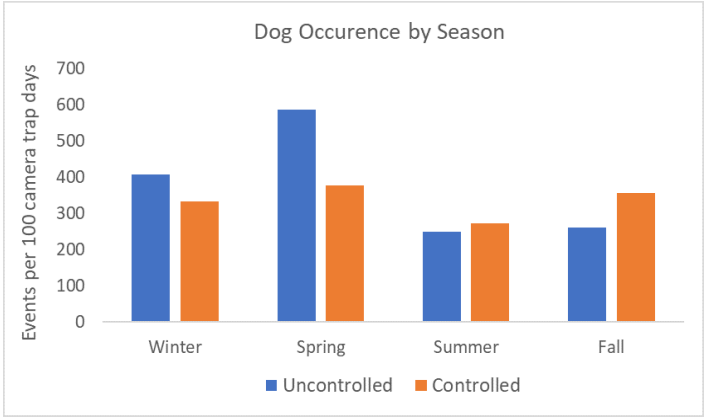

Figure 6 Occurrence of dogs, controlled (with human, either on- or off-leash) and uncontrolled (without human, off-leash), by season per 100 camera trap nights. Winter = January – March; Spring = April – June; Summer = July – September; Fall = October – December.

DISCUSSION

There was variation in the number of total dog events across the city of Calgary, Alberta and within its parks. Throughout Nose Hill Park, dog activity rates were high, while throughout both Glenmore/Weaselhead Park and Fish Creek Provincial Park activity rates vary. Furthermore, the rate of leashing varies more throughout both Glenmore/Weaselhead Park and Fish Creek Provincial Park versus Nose Hill Park. The large portion (42%) of uncontrolled dog events occurring within 250 m of the designated off-leash area, and the trend that the majority of those events are occurring within 50 m, suggests that a lack of public awareness of where off-leash areas end and on-leash areas begin may be contributing to the high rates of off-leash dogs. The results also suggest that dog owners behave similarly with respect to dog leashing regardless of leash rules and that there is a lack of owner compliance with city by-laws. This is a similar conclusion to the studies by Cortés et al. (2021), Parsons et al. (2016), Weston et al. (2014), and White (2009), all of which recorded a lack of compliance with leash regulations.

It is the responsibility of the City of Calgary Animal & Bylaw Services to enforce bylaws and educate the public on dog-related rules and issues. Consequences for not obeying the by-laws include ordering a dog to be put on-leash, ordering the removal of a dog from an area, and/or issuing fines for non-compliance (City of Calgary, 2018). An increased vigilance by the City of Calgary and increased public awareness of the effects of domestic dogs on wildlife, through means such as signage in problem areas, could help to decrease the high number of dog owners who are not complying with the leashing regulations. For example, increasing the enforcement of leash laws reduced the frequency of unleashed dogs by 21% across the eastern United States in the study by Parsons et al. (2016). This is especially beneficial in the long term, as on-leash regulations can reduce wildlife disturbances (Martinetto & Cugnasse, 2001).

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CONCLUSIONS

For many wildlife species, keeping dogs on-leash, notably during certain critical periods (e.g., winter, gestation, and lambing), can help to avoid wildlife mortality due to predation and the consequences of pursuits (Martinetto & Cugnasse, 2001). Domestic dogs amplify the negative responses of wildlife to human disturbance, as they extend the radius of human recreational influence on a landscape (Sime, 1999; Weston & Stankowich, 2014). Therefore, areas with significant wildlife populations should be designated as on-leash and require greater regulatory actions to decrease the rates of off-leash dogs.

The impacts of dogs on wildlife have significant management implications, as dog policies (e.g., prohibited or allowed, and off-leash or on-leash) are an important factor in determining the extent of such impacts. When dogs are on-leash, their range of influence is lessened and spontaneous predatory behaviors are less likely to occur. Through increasing leashing regulations in parks and protected areas, wildlife is disturbed less often, thus decreasing time spent being vigilant and increasing time conducting routine activities. Because dogs are one of the most widely distributed terrestrial carnivores, filling the knowledge gap on their effect on the composition and distribution of wildlife species, especially other carnivores, habituating in urban areas should be a key consideration for future studies to inform natural resource managers seeking to mitigate such effects (Gámez & Harris, 2021). It is recommended that the City of Calgary increases i) signage to indicate where off-leash areas end and on-leash areas begin, ii) enforcement in on-leash designated areas, and iii) public awareness of the effects dogs have on wildlife. As well, camera monitoring should be continued in order to better understand the effects of domestic dogs on wildlife in Calgary parks.

Acknowledgements

The author would like to thank Tracy Lee "for their advice, knowledge, and guidance on this project", and the Calgary Captured wildlife monitoring program "for providing the three-year data-set and trusting me to conduct the study".

Conflicts of interest

This author declares no conflicts of interest

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