Miistakis Institute

Calgary Captured Year One Analysis: Technical Report

May 2017 – May 2018

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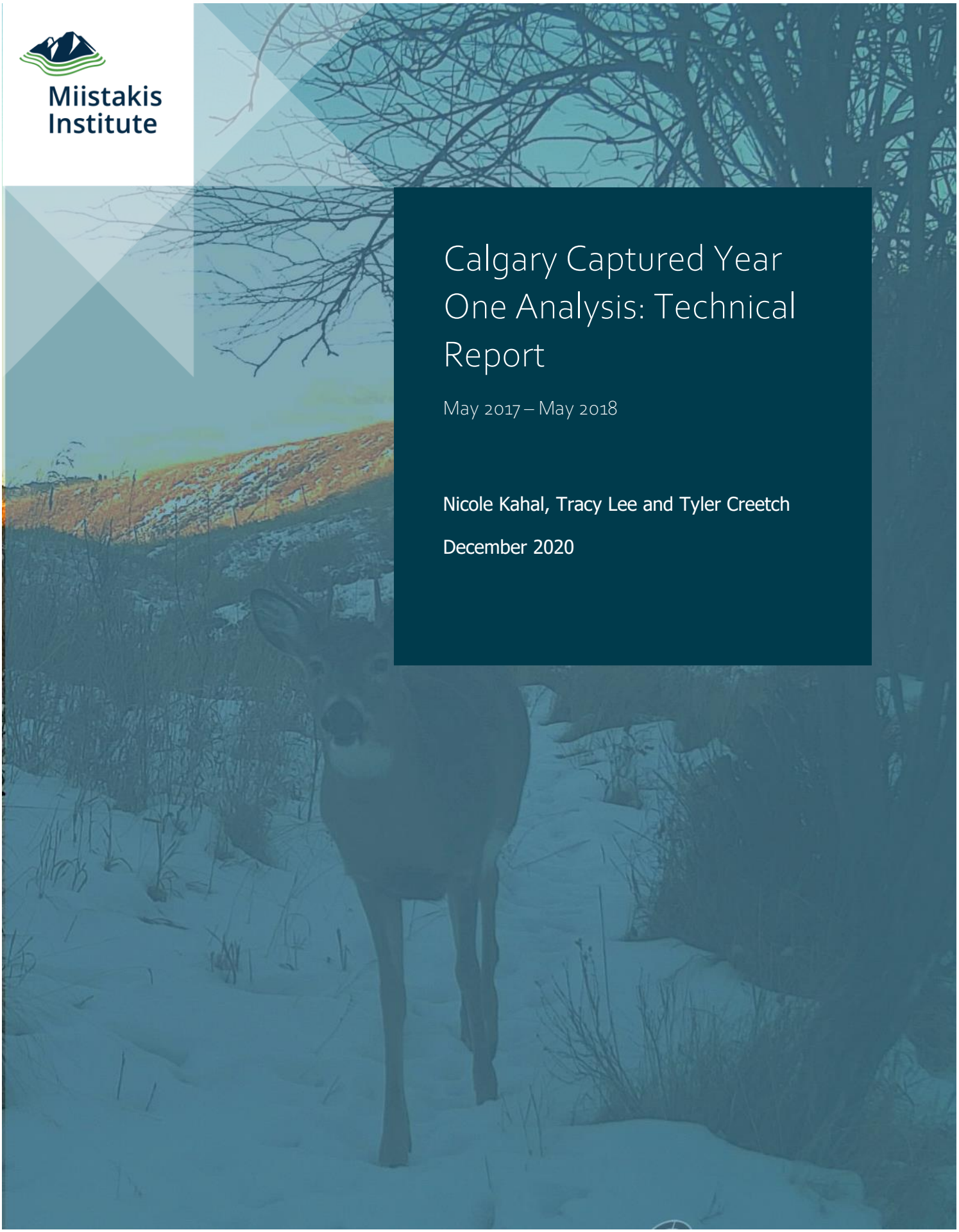
December 2020



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Thank you to our funders the Calgary Foundation, TD Friends of the Environment Foundation and Alberta Ecotrust for their generous support of Calgary Captured. We also thank our program partners at the City of Calgary, Alberta Environment and Parks, Friends of Fish Creek Provincial Park Society and Weaselhead/Glenmore Park Preservation Society for their support and enthusiasm for this program.

Executive Summary

Calgary Captured is a multi-year urban wildlife monitoring program that was launched in 2017 focused on medium to large mammals. Through citizen science, the program involved Calgarians in biodiversity monitoring through the classification of camera-trap images to species. The objectives of the program are to build a dataset of species presence in Calgary, engage Calgarians in urban wildlife awareness, and to improve our understanding of how wildlife responds to the urban environment.

We set up 72 camera traps across 16 study areas (natural area parks) between May 5 and June 1, 2017. This report highlights preliminary findings from initial deployment through May 31, 2018. As additional years are added to the dataset, we expect a more accurate representation of species presence and trends. Preliminary findings from analysis of the one year Calgary Captured dataset include:

- 27,215 wildlife and human events were recorded during the study period (false triggers, birds, insects, squirrels and mice events removed). Of these events, approximately:
    - 61% were humans, with and without dogs
    - 32% were wildlife
    - 6% were domestic animals
- Of the wildlife events, approximately:
    - 78% were deer
    - 14% were coyotes
    - 5% were hares and feral bunnies
    - 1% were all other species
- Medium and large mammals documented on camera included white-tailed deer, mule deer, moose, coyote, red fox, bobcat, cougar, black bear, raccoon and porcupine.
- Taxonomic composition was highly variable among sites, although the same few families were most common at nearly all sites in varying proportions: Cervidae (deer/moose) and Canidae (coyote/fox).
- Pooled across cameras and study areas, human use of parks exhibited a clear spring-summer peak.
- Pooled across cameras and study areas, seasonal activity rate was more consistent throughout the year for wildlife, with highest rates observed in June and November
    - Seasonal activity patterns within each study area varied considerably
- Wildlife was present in all study areas. Species distribution across natural areas varied between species, with deer and coyote activity found at the majority of sites. Moose activity was restricted to natural areas close the city boundary.
- Fish Creek and Nose Hill wildlife appear to exhibit stronger avoidance of humans (i.e., peak wildlife activity during hours when human use is lowest) than wildlife at Weaselhead/Glenmore.
- A nearly identical proportion of dogs were leashed in designated off-leash versus on-leash parks, suggesting that dog owners behave similarly with respect to dog leashing regardless of park leash rules.

Introduction

As Calgary continues to develop without much consideration for wildlife, its clear more information on urban wildlife is urgently needed. The Calgary Captured program aims to fill this gap by monitoring wildlife across multiple years through motion-activated camera traps placed in key natural environment parks and natural movement corridors. The resulting images provide insight into which animals live in Calgary, how they move around the built environment and their responses to development. Managed by the Miistakis Institute and City of Calgary, the program's partnership also included Alberta Environment and Parks, Friends of Fish Creek Provincial Park Society, and Weaselhead/Glenmore Park Preservation Society. Calgary Captured aims to utilize the information gathered to facilitate better development and management decisions that protect and enhance Calgary's ecological integrity and resiliency. This report summarizes our findings from the first year (Mary 2017 to May 2018) of data collection.

Background

The City of Calgary is well known for its park system, the entire system makes up over 70 km^2 of land. Additionally, the network is enhanced by Fish Creek Provincial Park, a large (13 km^2) park extending east from the city limits to the confluence of Fish Creek and the Bow River. The resulting riparian habitat corridors provide opportunities for wildlife movement; however, fragmentation of these areas due to urban growth is an ever-increasing threat to maintaining healthy wildlife populations.

Limited information regarding the species that inhabit our city and urban parks reduces our ability to maintain healthy wildlife populations. Calgary Captured aims to determine wildlife presence within City of Calgary Natural Areas, to help inform our understanding and management of urban wildlife. The results of the analysis will help to inform strategic planning in relation to implementation of the Calgary BiodiverCity Strategy, Natural Areas Park Management Plan, as well as individual park management plans. In addition, citizen scientists classify camera trap images to spread awareness and engage Calgarians in wildlife monitoring.

The program has developed the following objectives:

- Determine which species of large and medium sized mammals occur in Calgary's park system;
- Engage Calgarians in wildlife monitoring through the design and implementation of a citizen science program monitoring wildlife; and
- Improve the understanding of how wildlife respond to development and use of wildlife corridors in City of Calgary

Methodology

Camera trap methods

To detect and record wildlife, we employed camera traps (SpyPoint Solar Trail Camera) with a motion sensor and infrared flash to detect animal movement. Camera traps use an infrared flash that was not visible to people or most wildlife, to passively capture medium and large sized mammals.

72 camera traps located at 58 sites (grid cells) across 16 study areas (parks) were used in this study. Camera traps were installed primarily on game trails or human foot paths. Busy human trails and paved pathways were avoided to reduce the burden of processing human images. The majority of camera traps were installed between May 5 and June 1, 2017. A camera was placed in an additional natural area HID241 on July 29, 2017 due to the City's interest in observing coyotes in the area. Images collected from Southern Alberta Institute of Technology's (SAIT) 10 student camera traps (Moultrie Trail Camera) were used from May 11 to August 18, 2017. We installed Calgary Captured cameras in Weaselhead on August 17, 2017. The camera traps were checked approximately every four to six weeks, to switch out SD cards and check battery level.

We utilized a 1km grid system to systemically place cameras in each study area (Figure 1). We attempted to place the camera at the centre of each grid cell; however, there is some variability due to the smaller size of several parks, and preference for choosing a location most likely to capture wildlife movement. The sites in each study area were roughly proportional to the size of the study area. Exceptions include Weaselhead Park as well as a few smaller study areas that have more than one camera in a grid cell. We placed the camera on a tree ~1 m from the ground and 1-3 m from the monitoring area (trail, open space). Camera traps recorded time and date for each image, each detection instantly triggering the camera to take three images. Due to internal camera timing that cannot be controlled, the Spypoint cameras can take up to 10 seconds between each photo following the trigger. Monitoring was continuous since cameras were set up. Occasionally, cameras were damaged or stolen. In these instances, a replacement camera was installed on a different trail within the same grid cell. If cameras were stolen twice from one grid cell, that grid cell was retired.

Table 1: Total number of cameras per study at a given time area and study area size

NATURAL AREA	# CAMERAS	AREA (HECTARES)
FISH CREEK PP	18	1,358.5
NOSE HILL	6	1,123.7
GLENMORE/WEASELHEAD	12	224.4
BOWMONT	4	174.9
HASKAYNE	2	134.4
GRIFFITH WOODS	3	132.6
EDWORTHY	4	130.2
EDGEMONT RAVINE	2	127.2
RALPH KLEIN	2	97.1
CONFLUENCE	2	63.1

HD241	1	44.3
PASKAPOO SLOPES	2	40.9
INGLEWOOD BIRD SANCTUARY	2	36.3
TOM CAMPBELL	1	27.5

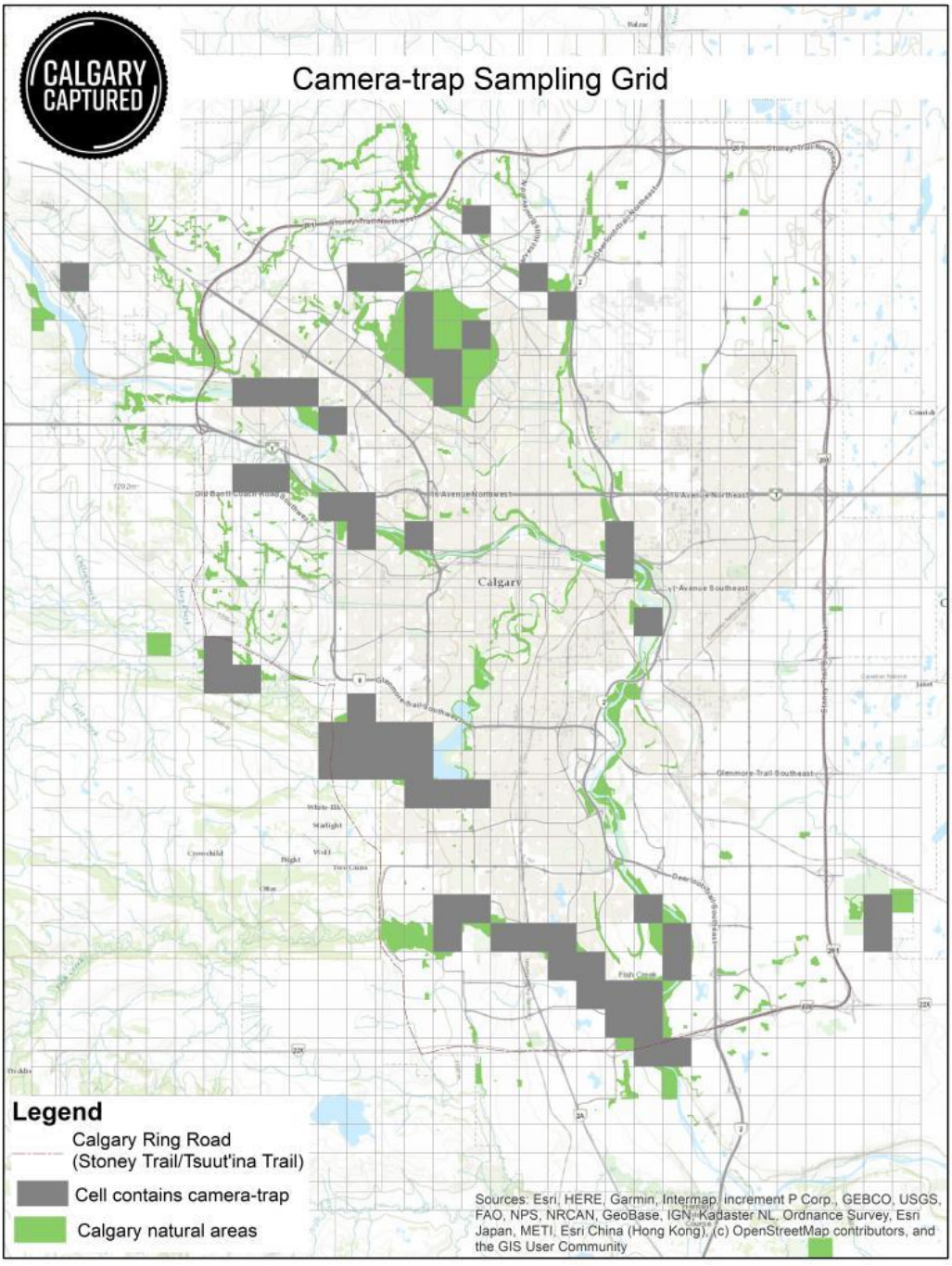


Figure 1: A 1km^2 sampling grid was used to establish camera locations in Calgary natural areas.

The total sampling effort, measured in camera-days (i.e., one camera operating for one day), was highly variable among study areas, ranging from 304 days for Tom Campbell to 6,200 days for Fish Creek Provincial Park. We accounted for this variation where necessary when analyzing data. The wide variation in sampling effort among study areas partly reflects the fact that the study areas also vary widely in size, with larger study areas generally having more camera sites. When controlling for study area size (i.e., camera-days per unit area), sampling effort at the largest study areas such as Nose Hill Park and Fish Creek Provincial Park appears more in line with other study areas (Figure 2).

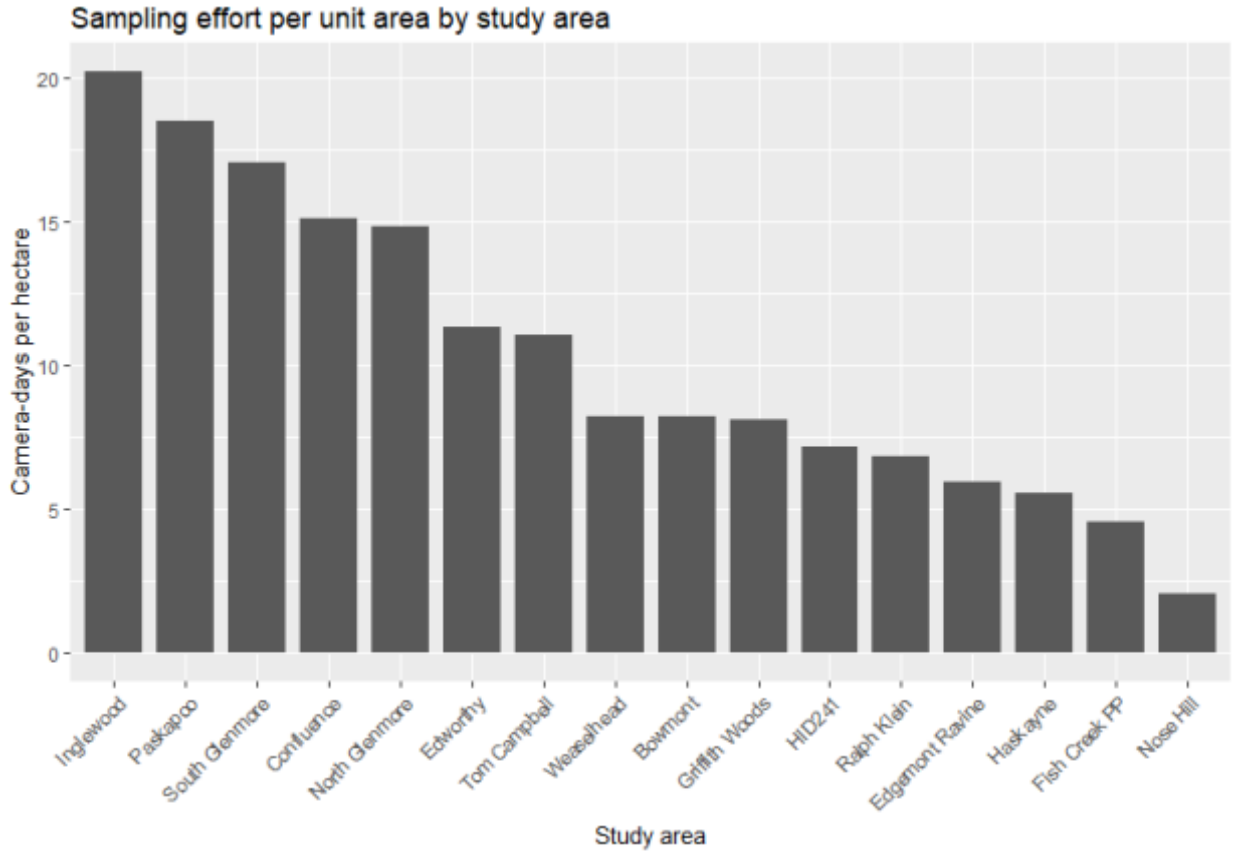


Figure 2: Sampling effort per unit area for study areas. Sampling effort was measured in camera-days and divided by study area size in hectares. Most study areas had multiple cameras operating simultaneously at different locations within the study area.

Camera trap survey limitations

- Camera traps were not installed on paved trails heavily used by humans to avoid capturing an extremely high volume of human images that would drain resources to manage. We are not documenting wildlife that utilizes human recreational paved trails.
- Failure to detect a species is not proof of its absence, as an animal may travel out of a camera trap's detection range.
- Camera traps will unavoidably capture images of a species that are unidentifiable. For example 0.8% of events were classified as "unknown."
- Although camera traps were located within their own 1 km^2 grid, spatial autocorrelation (units closer together capturing the same individuals), is difficult to fully avoid

(Ancrenaz et al. 2012). This does impact generating a list of species presence at specific natural areas.

- We used SAIT student camera trap images between June and August in the Weaselhead natural area. The SAIT cameras often ran out of battery and therefore had inconsistent total days of operation. In addition, our database was unable to process many of the SAIT camera's images, resulting in classifying all such images manually. The SAIT images were not uploaded to Zooniverse, instead being manually entered into the database and were included in this analysis.
- Issues such as malfunctioning and stolen cameras resulted in loss of data due to an inability to collect images while cameras were down (prior to our knowledge of the issue). Cameras were replaced as soon as an issue was identified, however, this resulted in ahighly variable sample effort among study areas.

Species identification

The wildlife images collected were classified to a species by citizen scientists through the online Zooniverse platform. Each wildlife image was classified by five to eight individuals and images with fewer than 75% agreement on species in image were flagged for review. Rare species for Calgary (bears, fox, ect.) were also reviewed. Human events were flagged for expert review. Further, images the resulted in Zooniverse classifications of rare or unusual species were reviewed. All human images recorded were processed by Miistakis Institute staff and volunteers in-house on a custom program, Image Loader. To protect privacy, all human images were deleted after classification and were not uploaded to the public Zooniverse site.

Events

Human and wildlife events are considered independent if the time between consecutive images of the same species was more than 30 minutes apart, duration selected through consultation with Dr. Tony Clevenger and is similar to other projects (Parks Canada uses 20 minutes). For each human event, the number of individuals was classified. If a dog was detected in an image containing a human, we recorded if it was off-leash. All images containing humans were classified on the ImageLoader database. ImageLoader, operated through Microsoft Access, allows automatic extraction of information embedded in images such as date and time, and performs file manipulation, moving images to "processed" and "human" folders, allowing for quick classification and management of camera trap data. Images containing humans are moved to the human folders, and are deleted; all other images are moved to processed folders for upload to the Zooniverse portal to allow crowd-sourced classifications.

Summary Statistics: May 2017 – May 2018

Cameras recorded a total of 52,706 events during the study period. Approximately 45 percent of these events were false triggers (i.e., no animals or humans recorded in images), and 1 percent were events for which the species could not be determined. We removed these false trigger and unknown species events from the dataset prior to further analysis. We also removed 1,946 events involving small animals (birds, insects, squirrels, and mice) because the study was intended to focus on medium-to-large mammals, and the camera height and distance between cameras was not set up to reliably capture small animals.

Of the remaining 27,215 events, approximately 61 percent involved humans (with or without dogs), approximately 32 percent involved wildlife, and approximately 6 percent involved domestic animals unaccompanied by humans. Approximately 4 percent of these remaining events were recorded during periods when cameras were known or suspected to be malfunctioning (e.g., recording incorrect dates and times); such events were included in some analyses for which timing was irrelevant (e.g., species composition), but were excluded from other time-dependent analyses (e.g., seasonal variation in activity rates).

Taxonomic Composition and Species Diversity

Wildlife events were dominated by deer (approximately 78 percent of events), followed by coyotes (approximately 14 percent), and hares and feral bunnies (approximately 5 percent; Table 1). All other wildlife species comprised less than 1% each of wildlife events (Figure 3). Because many animals captured in images were not identified to species, we assigned each event to a family (i.e., a taxonomic grouping two levels above species) to allow more valid estimation of species composition and diversity patterns within and across study areas. For instance, weasels, mink, and marten were all assigned to family Mustelidae.

Table 2: Counts of camera trapping events by wildlife species, pooled across all cameras and study areas. Note that some events were not classified to the species level.

SPECIES	NUMBER OF RECORDED EVENTS
WHITETAIL DEER	3568
MULE DEER	1466
COYOTE	1013
DEER (UNKNOWN SPECIES)	840
HARE OR FERAL BUNNY	408
RACCOON	50
PORCUPINE	49
BOBCAT	37
MOOSE	15
RED FOX	9
COUGAR	8
SKUNK	8
BEAVER	4
BLACK BEAR	3
WEASEL	3

MARTEN	2
MINK	1

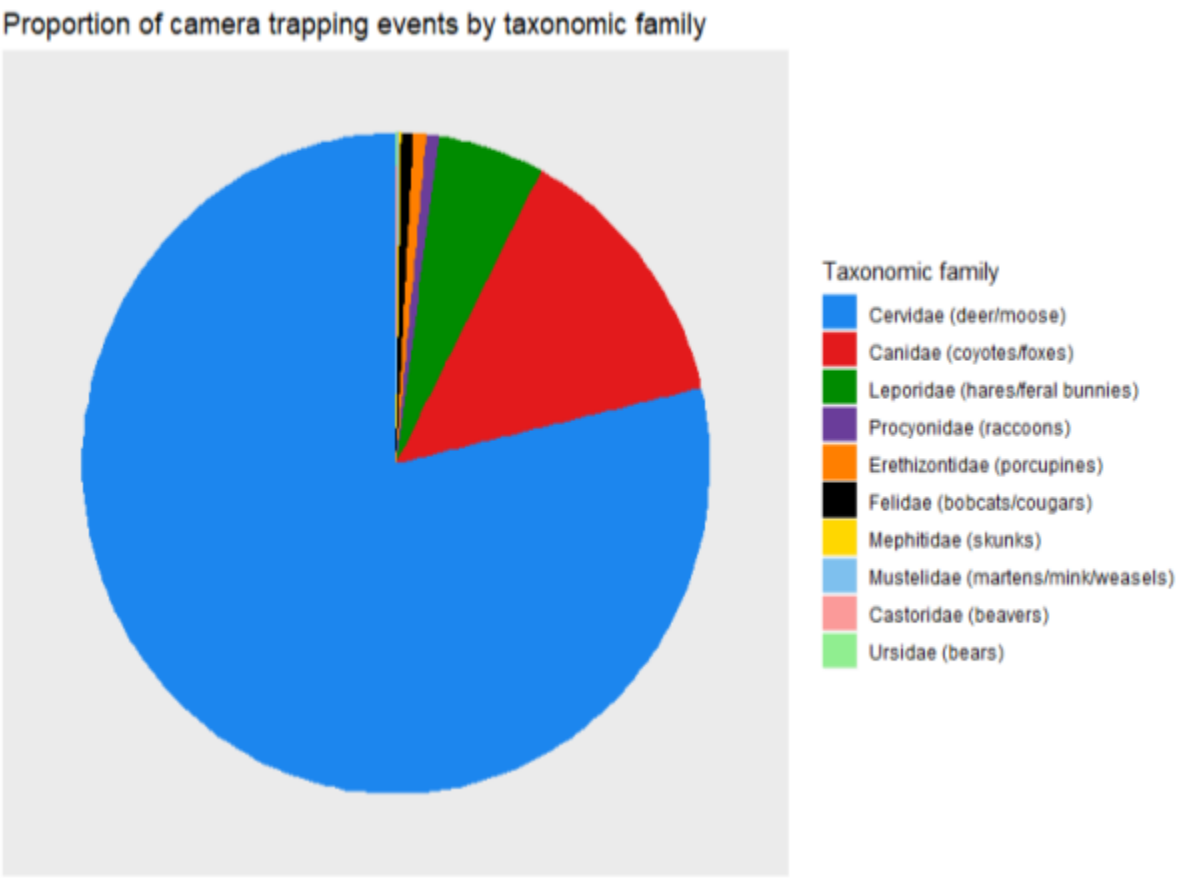


Figure 3: Overall taxonomic composition of wildlife events recorded by cameras. Events were pooled across all cameras and study areas.

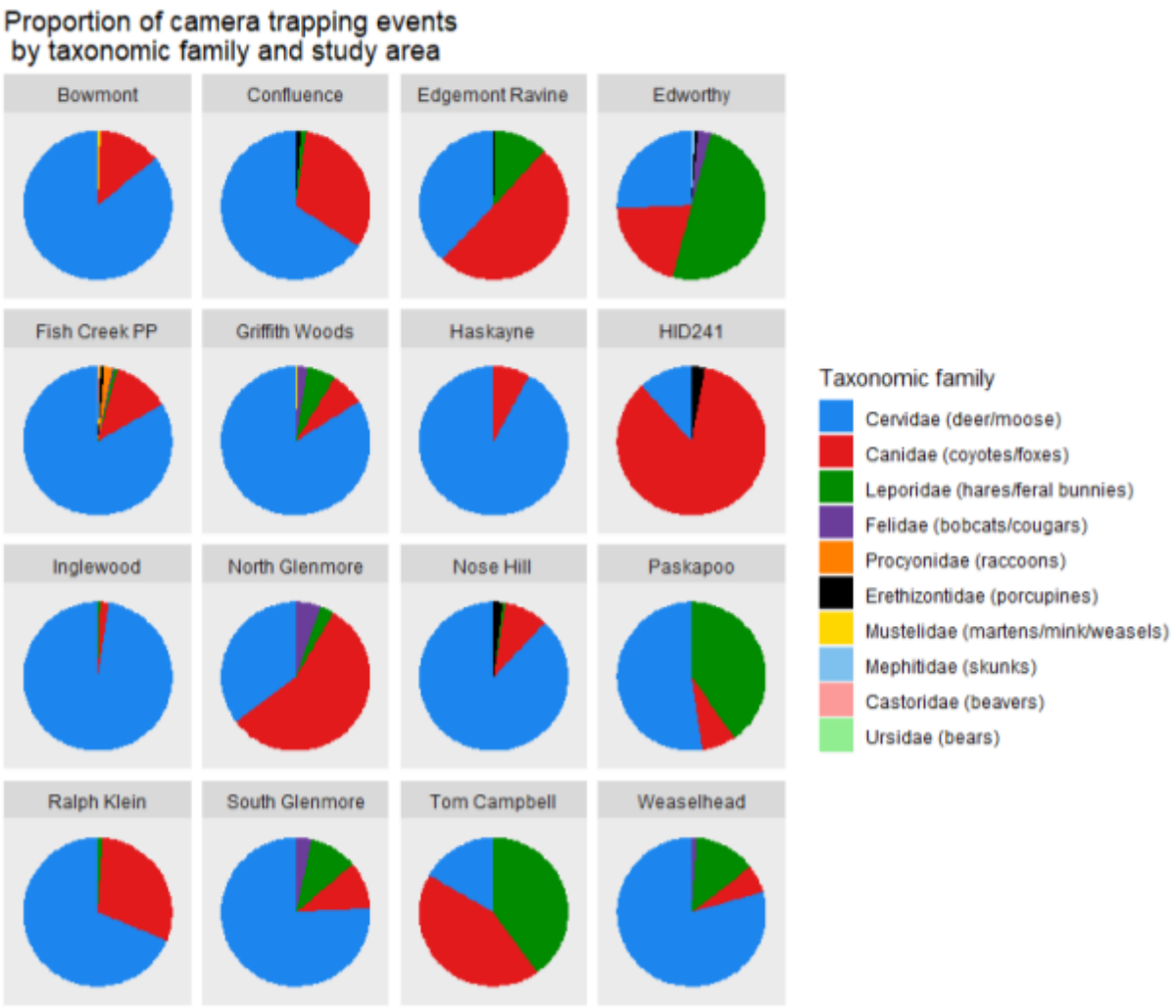


Figure 4: Taxonomic composition of wildlife events by study area. Events were pooled across cameras within each study area.

We compared study areas with respect to two commonly measured components of taxonomic diversity: richness and evenness. Richness refers to the number of unique taxonomic groups (i.e., species, genera, families, etc.) present within a study area, while evenness refers to how similar the abundance of these taxonomic groups is within the study area. Overall diversity is highest in study areas that contain many taxonomic groups with similar numbers of individuals from each group. Typically, richness and evenness are measured at the species level, but we measured them at the family level for this analysis. Richness was calculated simply as a count of families observed at each study area. Evenness was calculated using Pielou's index, which ranges for 0 (lowest evenness) to 1 (highest evenness). We also calculated a composite measure of taxonomic diversity, Simpson's index, that incorporates both richness and evenness for each study area. Simpson's index also ranges from 0 (lowest diversity) to 1 (highest diversity).

Taxonomic composition was highly variable among sites, although the same few families were most common at nearly all sites in varying proportions (Figure 4). The number of recorded families (i.e., richness) varied from 2 to 10 within study areas (Figure 5). However, it should be noted that richness estimates are likely influenced by variation in sampling effort among study

areas, with richness estimates inflated for heavily sampled study areas relative to lightly sampled study areas. Estimates of overall diversity (Simpson's index) ranged from 0.64 for Edworthy, which contained significant fractions of cervid, canid, leporid, and felid observations, to 0.04 for Inglewood, which were almost entirely cervid observations (Figure 6).

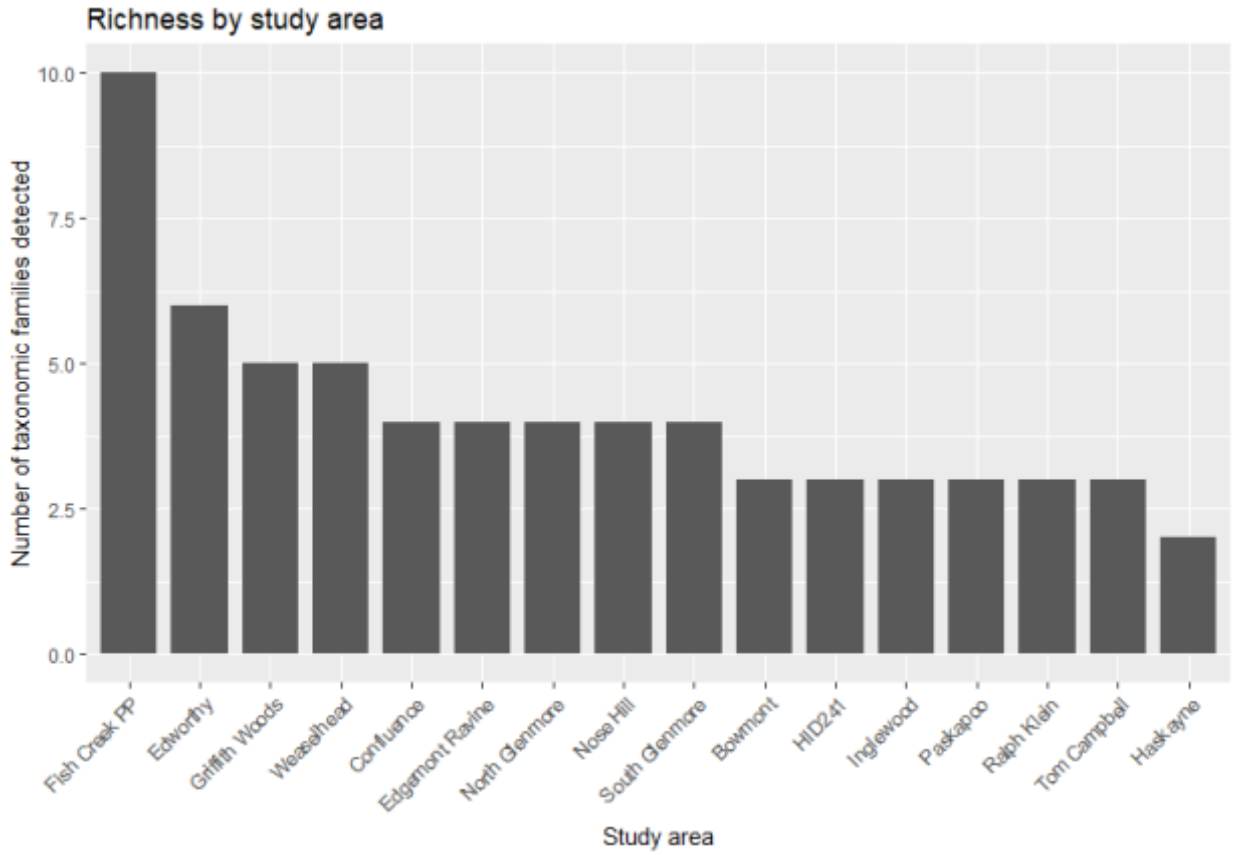


Figure 5: Taxonomic richness by study area. Richness was calculated as the number of families recorded by the cameras within a study area during the study period. Richness was not corrected for variation in sampling effort, so it may be inflated for study areas.

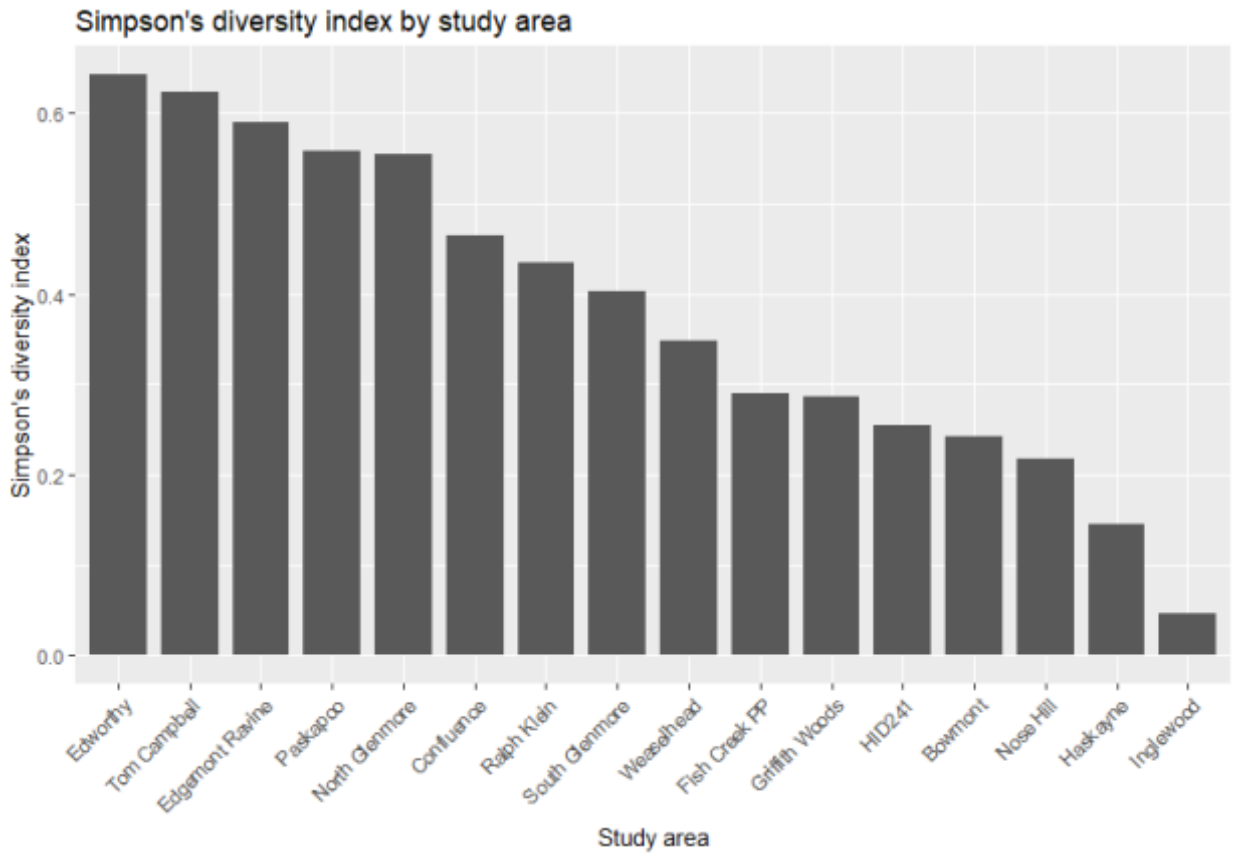


Figure 6: Taxonomic diversity by study area. Diversity was calculated as Simpson's index, which incorporates both richness and eveness. Simpson's index ranges from 0 (lowest possible diversity) to 1 (highest possible diversity).

Average time between detections

Time between detections can help to understand which species are scarce in urban natural areas and contribute to our understanding of wildlife trends over time. Figure 7 shows the average days between detections (events) of wildlife species, as well as the maximum days between detections (events). Deer and human had the lowest average and maximum days between events, which is not surprising is an urban area. Additional years of data may give a more accurate measure of species scarcity.

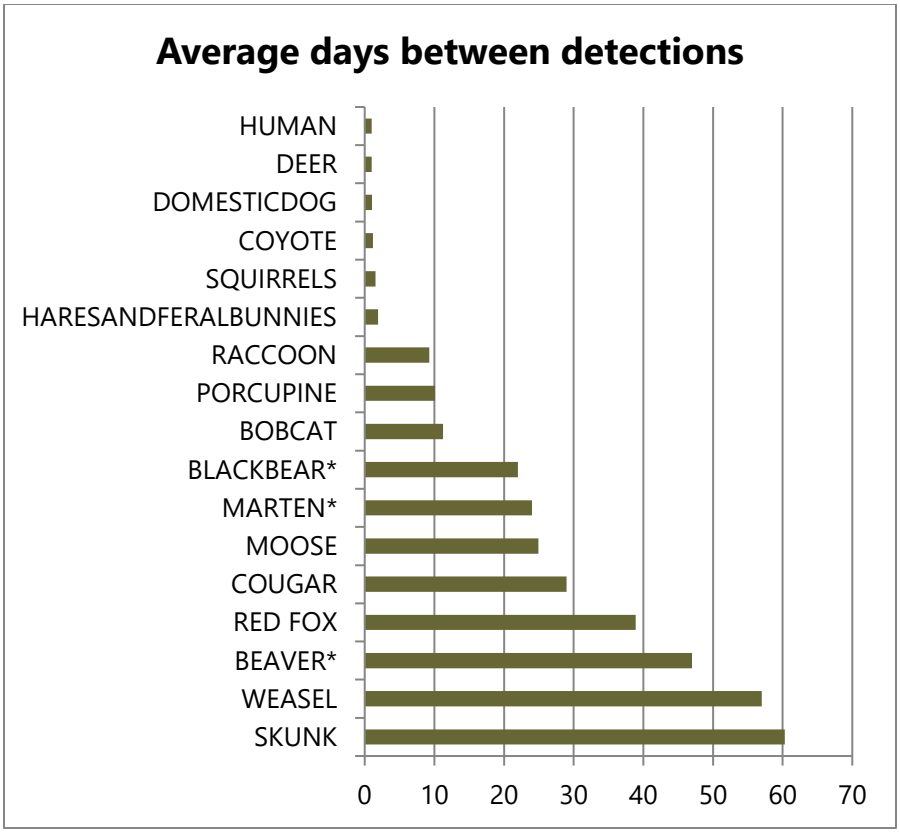


Figure 7: Average days between detections. *Four or less events were recorded of black bear, marten and beaver.

Activity rates

The total number of events recorded during the study period varied widely among study areas (Figure 8), and most study areas had more non-wildlife events (i.e., those involving humans and/or domestic animals) than wildlife events. In particular, far more wildlife and non-wildlife events were recorded within Fish Creek Provincial Park than within any other study area. However, these totals do not account for differences in sampling effort among study areas. After accounting for this variation, the rate of events (i.e., number of events per camera day) was more even among study areas (Figure 9), especially for wildlife events. Because the rate at which animals are recorded by cameras is influenced by species abundance, movement patterns, camera set-up, habitat, and a variety of other potential confounding factors, it is most appropriate to interpret photographic rate as an index of animal activity at camera sites.

To examine spatial patterns, wildlife activity rates were calculated as the number of wildlife events per camera day for each cell within the 1km^2 sampling grid used to establish camera locations. Figure 10 shows the wildlife activity rate across all study areas. See Appendix II for maps of activity rates for six different species (white-tailed deer, mule deer, bobcat, moose, coyote, fox) and for maps that focus on wildlife activity rate for Fish Creek Provincial Park, Nose Hill Park and Weaselhead/Glenmore Park. These maps highlight the distribution within sampled natural areas of different species. White-tailed deer and coyote were recorded at all study areas; mule-deer was recorded at all but one study area; bobcats were recorded at six study areas; moose were recorded at six study areas; and foxes were recorded at five study areas.

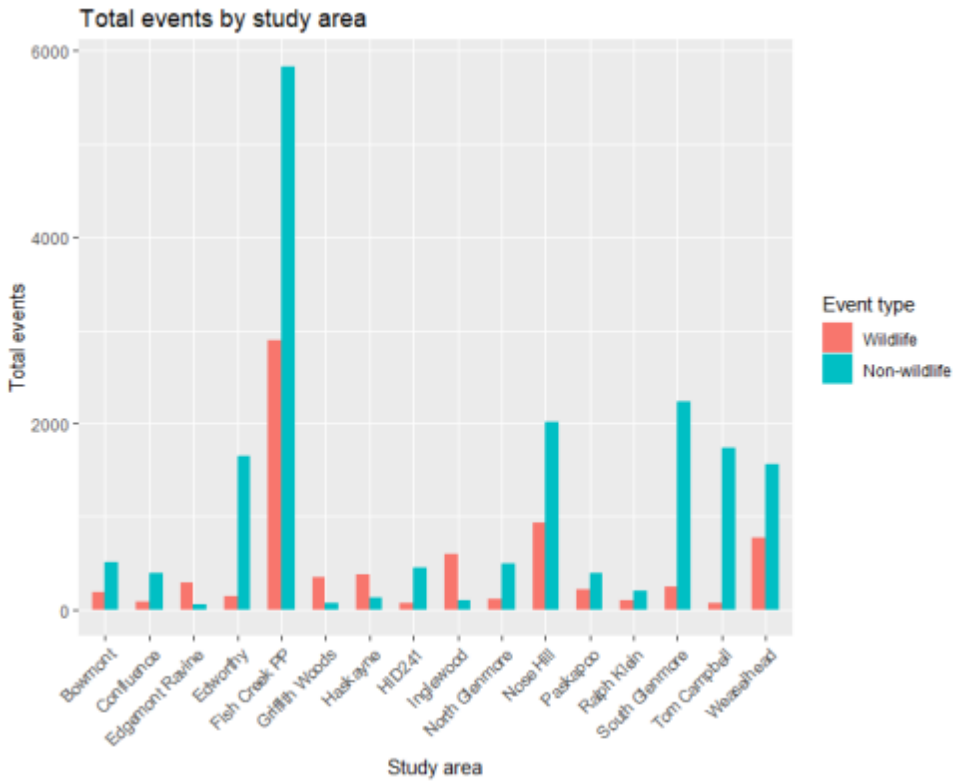


Figure 8: Total number of events recorded within each study area, broken down by event type (wildlife or non-wildlife).

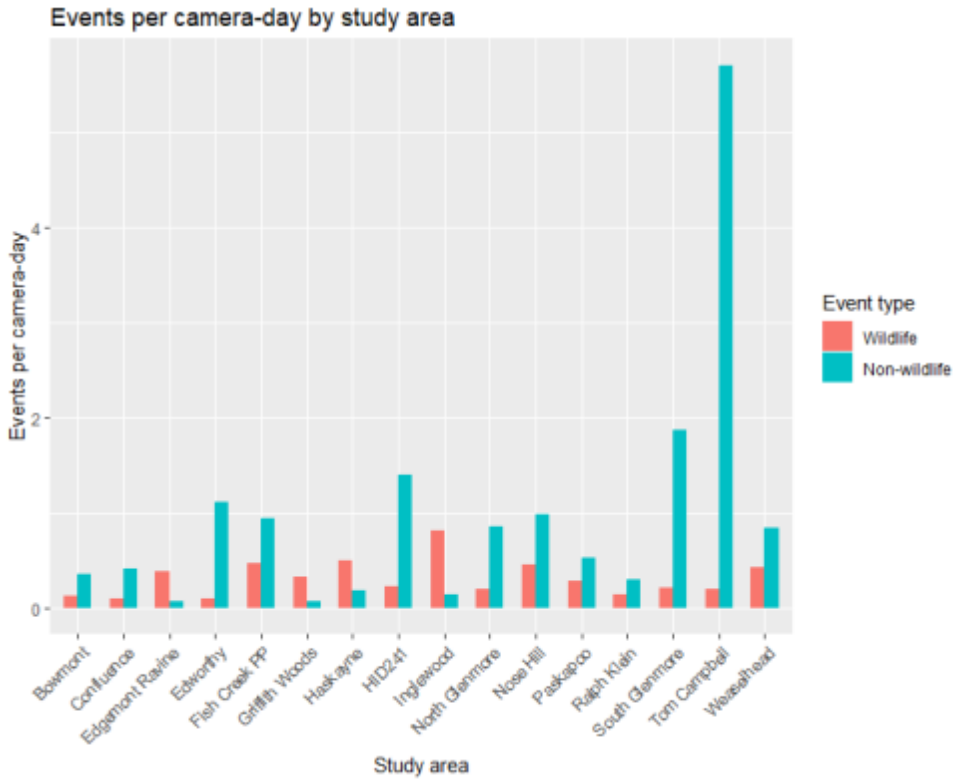


Figure 9: Rate of events recorded within each study, broken down by event type (wildlife or non-wildlife), controlling for sampling effort.

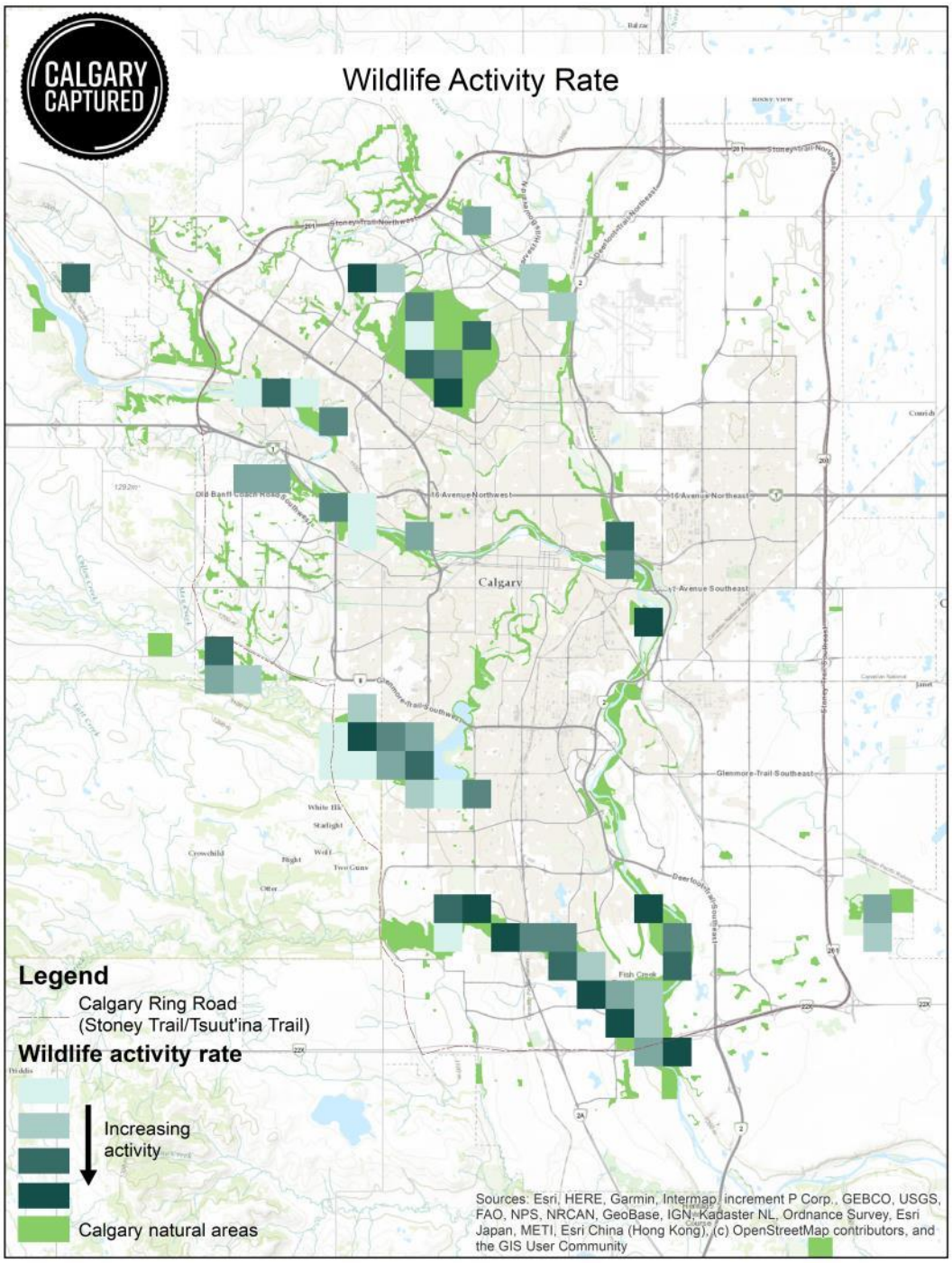


Figure 10: Map of wildlife activity rate across camera-trap study areas. Activity rates were calculated as the number of wildlife events per camera day for each grid cell. Note that some grid cells included multiple cameras. Activity rates depicted in quantile classification.

Seasonal & diel activity patterns

We observed seasonal variation in event rates for wildlife and non-wildlife (i.e. humans and domestic animals) when events were pooled across cameras and study areas (Figure 11). Most notably, non-wildlife use of parks exhibited a clear spring-summer peak. Seasonal activity rate was more consistent throughout the year for wildlife, with highest rates observed in June and November. We also examined seasonal activity patterns within each study area and found that these patterns could vary considerably among study areas. Figure 12 shows seasonal activity patterns for three individual study areas: Fish Creek Provincial Park, Nose Hill Park, and Weaselhead/Glenmore Park. This wide variation may partially reflect statistical noise associated with small sample sizes for some study areas, and further years of data should help clarify whether differences among study areas are meaningful.

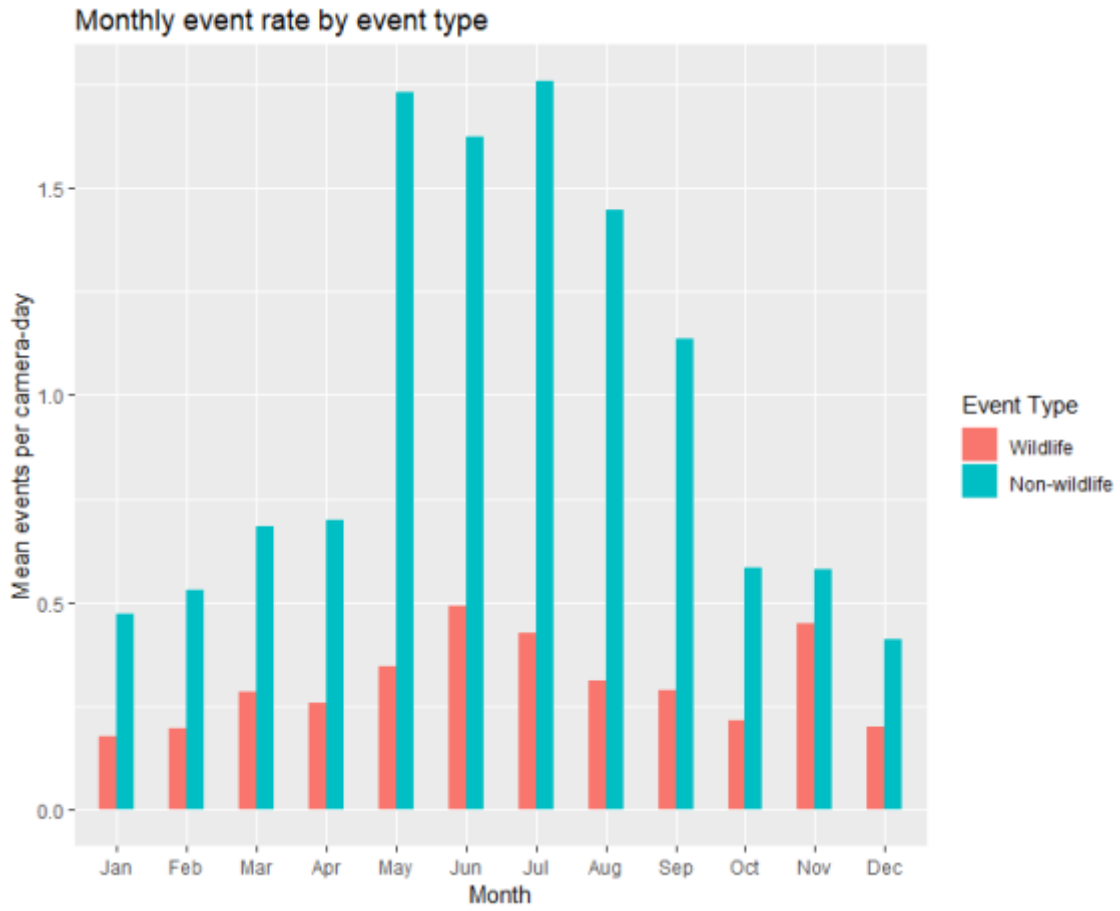


Figure 11: Monthly event rate for non-wildlife and wildlife events. Events were pooled across all cameras and study areas.

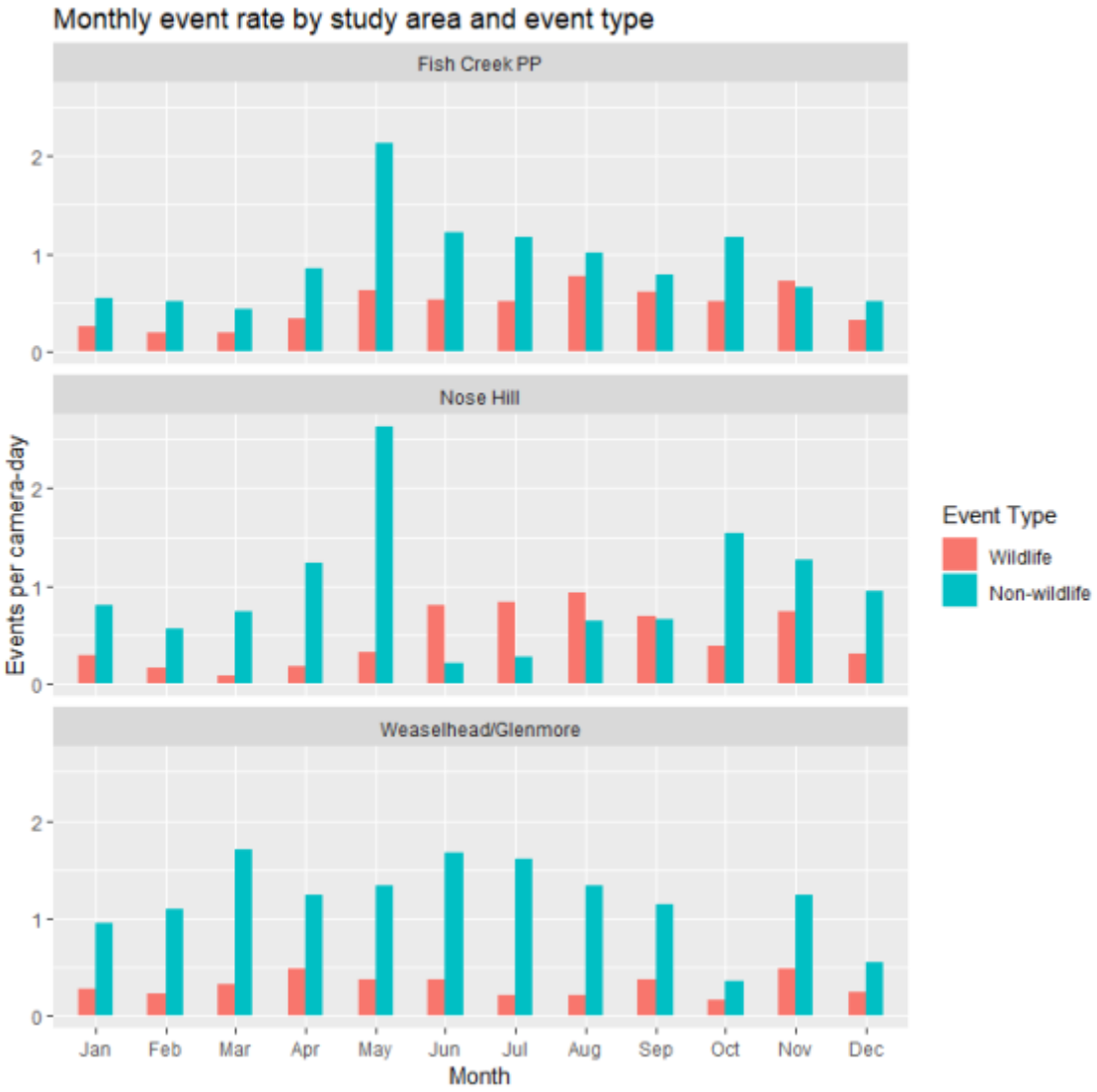


Figure 12: Monthly variation in rates of non-wildlife and wildlife events for select study areas. North Glenmore, South Glenmore, and Weaselhead study areas have been combined into a single unit.

We observed diel variation in event rates for non-wildlife and wildlife when events were pooled across cameras and study areas Figure 13. Diel activity patterns also appeared to vary among seasons. Non-wildlife events were concentrated during daylight hours in all seasons. For wildlife, diel patterns were more complex: activity was highest at midday during winter, at dawn and dusk during summer, and spread out more evenly across daylight hours during spring and fall.

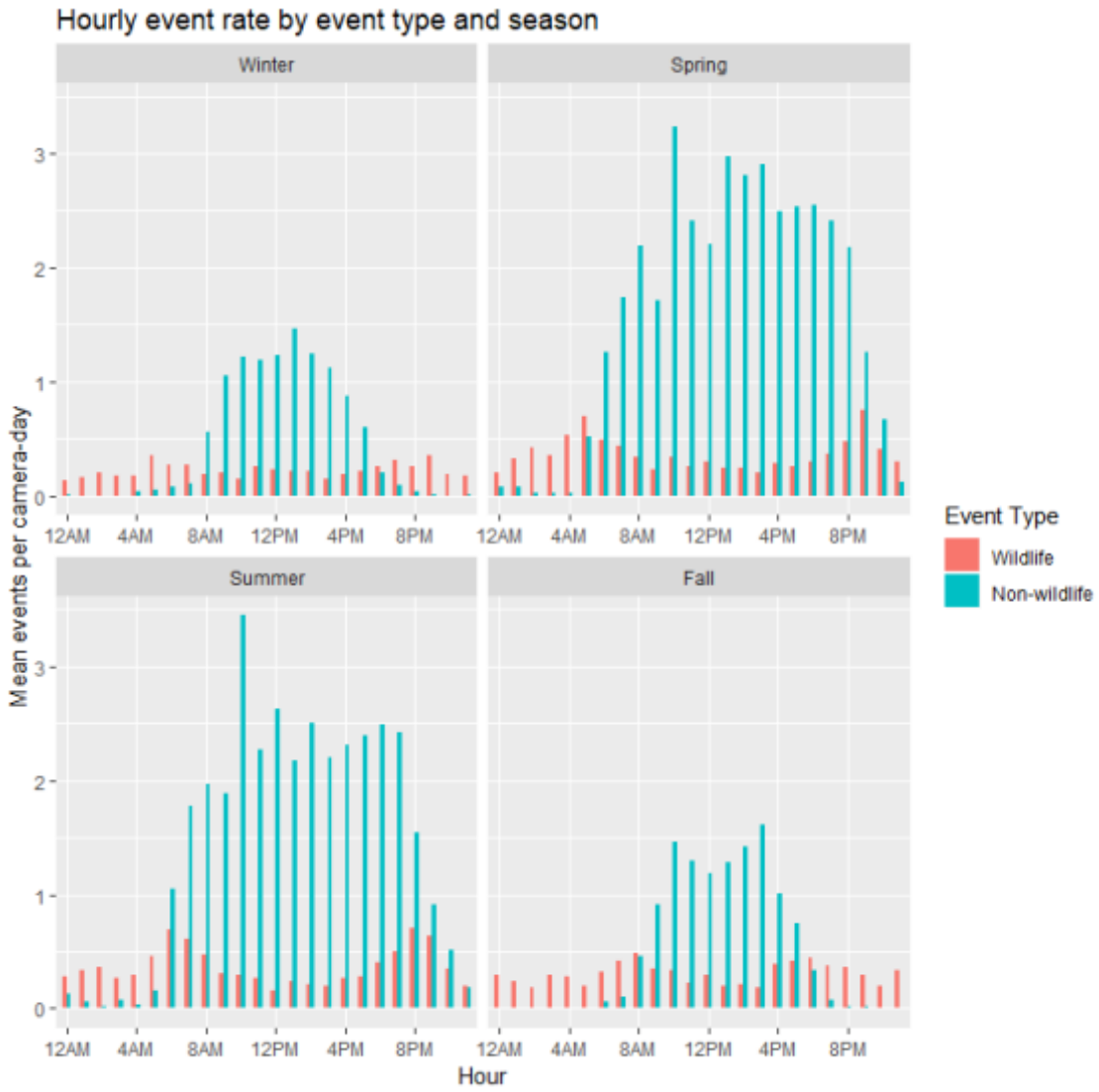


Figure 13: Diel variation in rates of non-wildlife and wildlife events, broken down by season. Value on y-axis is the mean number of events per camera day, across all cameras within all study areas, during a particular hour of the day. Winter=Jan-Mar; Spring=Apr-June; Summer=Jul-Sep; Fall=Oct-Dec

We also examined diel patterns for three individual study areas: Fish Creek Provincial Park (Figure 14), Nose Hill Park (Figure 15), and Weaselhead/Glenmore Park (Figure 16). There are some interesting differences among study areas. For instance, wildlife at Fish Creek and Nose Hill appear to exhibit stronger avoidance of humans (i.e., peak activity during hours when human use is lowest) than wildlife at Weaselhead/Glenmore.

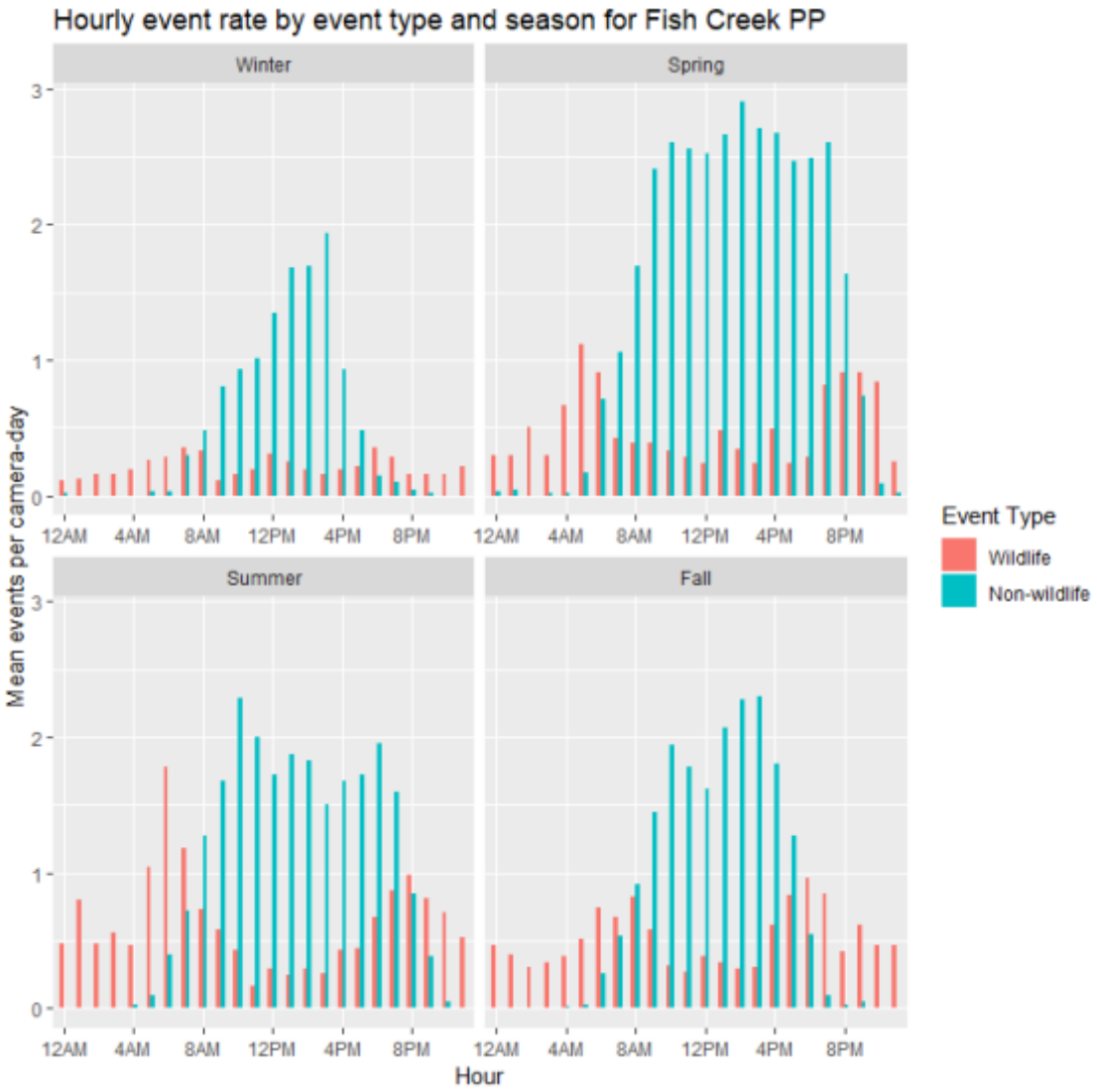


Figure 14: Diel variation in rates of non-wildlife and wildlife events, broken down by season, for Fish Creek Provincial Park. Value on y-axis is the mean number of events per camera day, across all cameras within the study area, during a particular hour of the day. Winter=Jan-Mar; Spring=Apr-June; Summer=Jul-Sep; Fall=Oct-Dec

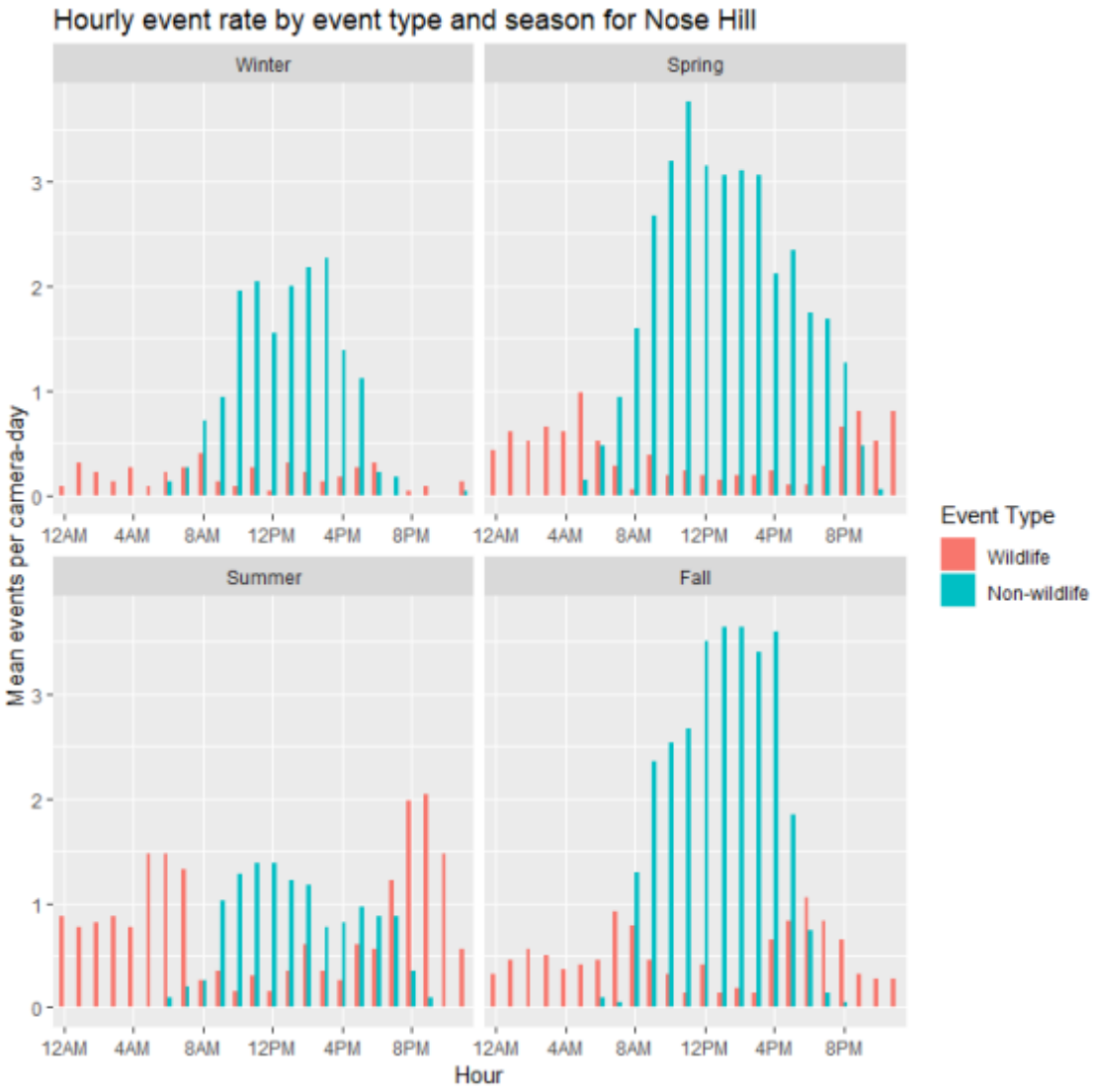


Figure 15: Diel variation in rates of non-wildlife and wildlife events, broken down by season, for Nose Hill. Value on y-axis is the mean number of events per camera day, across all cameras within the study area, during a particular hour of the day. Winter=Jan-Mar; Spring=Apr-June; Summer=Jul-Sep; Fall=Oct-Dec

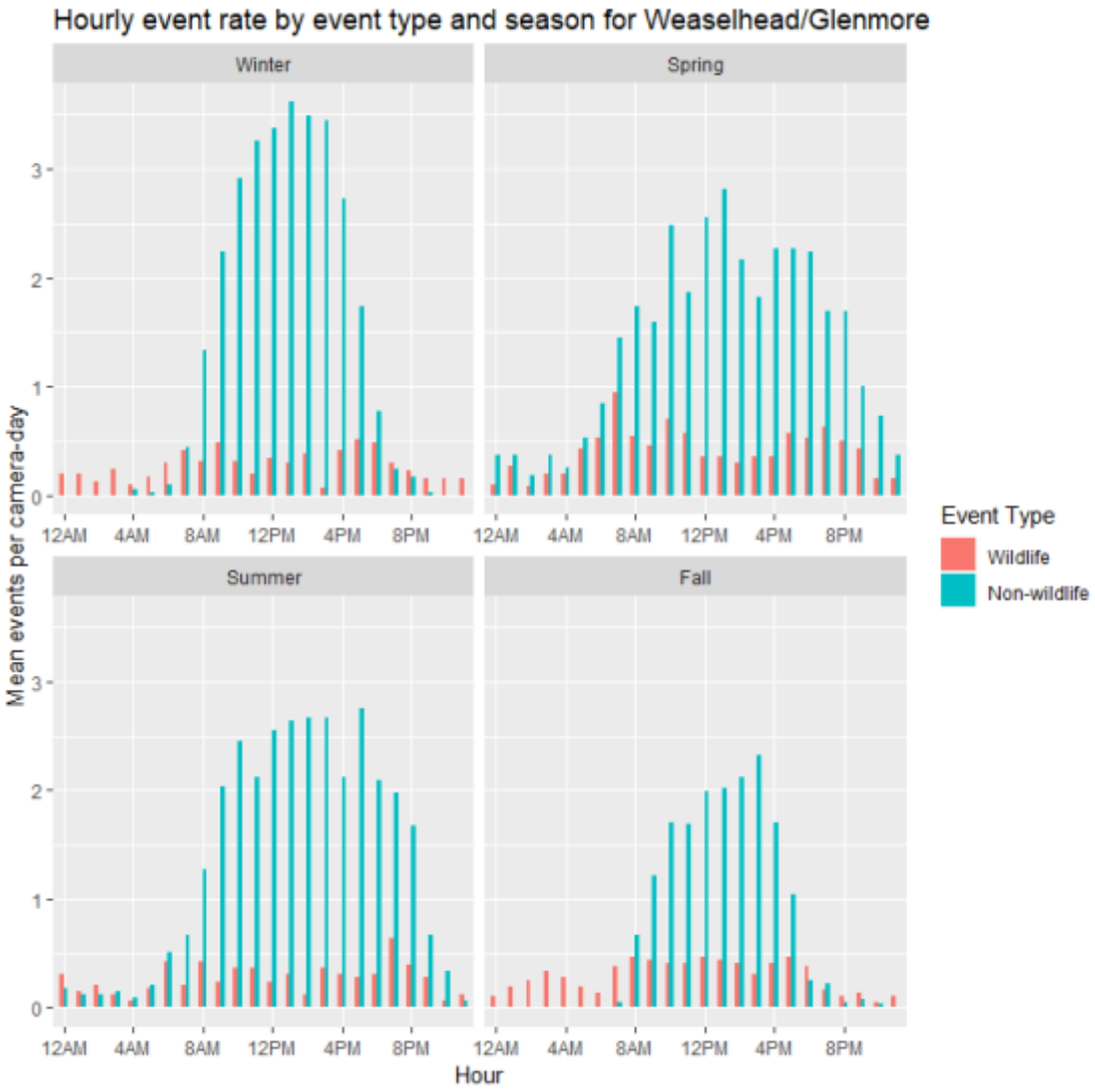


Figure 16: Diel variation in rates of non-wildlife and wildlife events, broken down by season, for Weaselhead/Glenmore. Value on y-axis is the mean number of events per camera day, across all cameras within the study area, during a particular hour of the day. Winter=Jan-Mar; Spring=Apr-June; Summer=Jul-Sep; Fall=Oct-Dec

Relationship between activity rate and habitat connectivity

The ecological condition of natural areas and their connectivity with surrounding natural areas are both believed to influence wildlife populations. We used data on centrality (a network-based indicator of habitat connectivity) to explore the relationship between connectivity and two measures of wildlife population status: event rate (a proxy for relative abundance) and species richness. We found very weak but positive relationships between habitat connectivity and both wildlife variables (Figure 17 and Figure 18). We expect that this relationship may become clearer when additional years of camera trapping data are available for analysis. This analysis is city centric meaning each natural area and its importance to the ecological network is assessed relative to each other within the city limits. It does not therefore account for connections between natural areas in the city with natural areas outside of the city which may represent important drivers for regional connectivity.

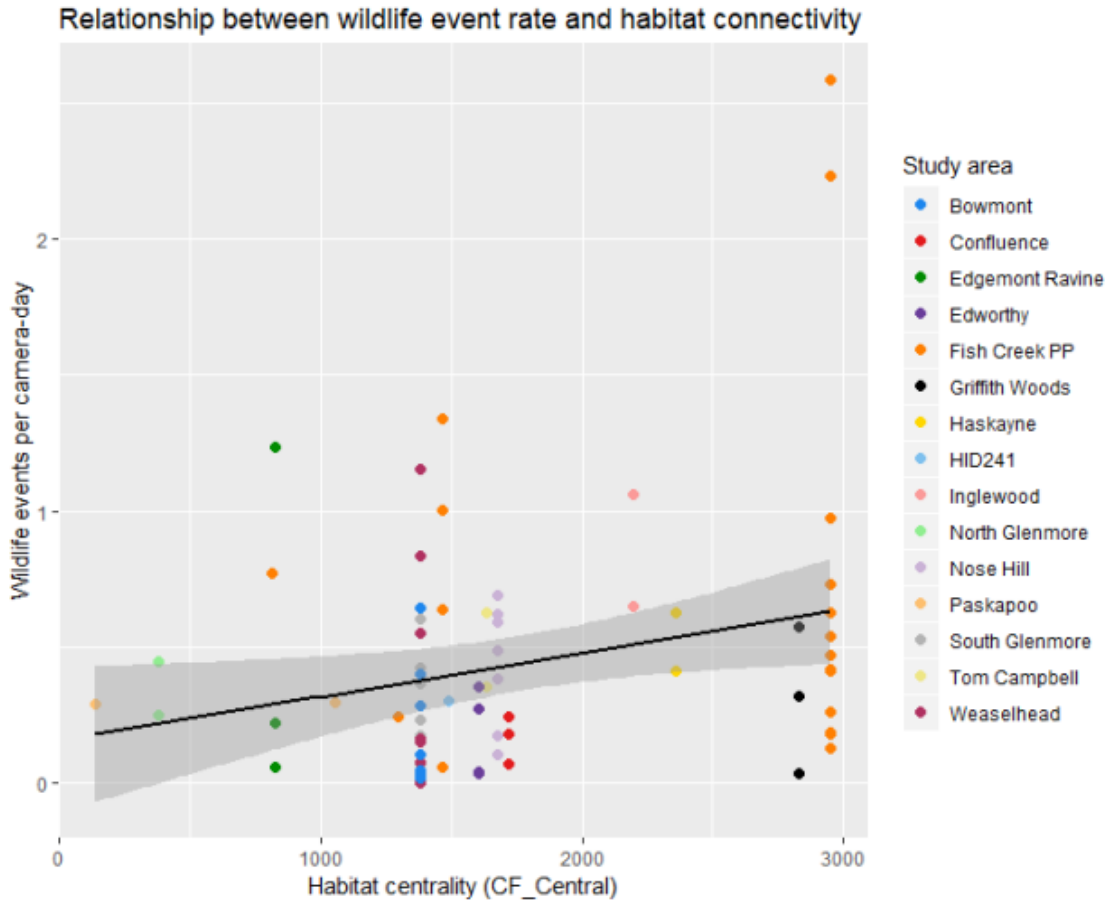


Figure 17: Relationship between habitat connectivity ("CF_Central" attribute from centrality shapefile) and wildlife event rate. Each point in the plot represents a single camera location, and points are color-coded by study area. Black line and dark grey band are best-fit line and 95% confidence interval from simple linear regression.

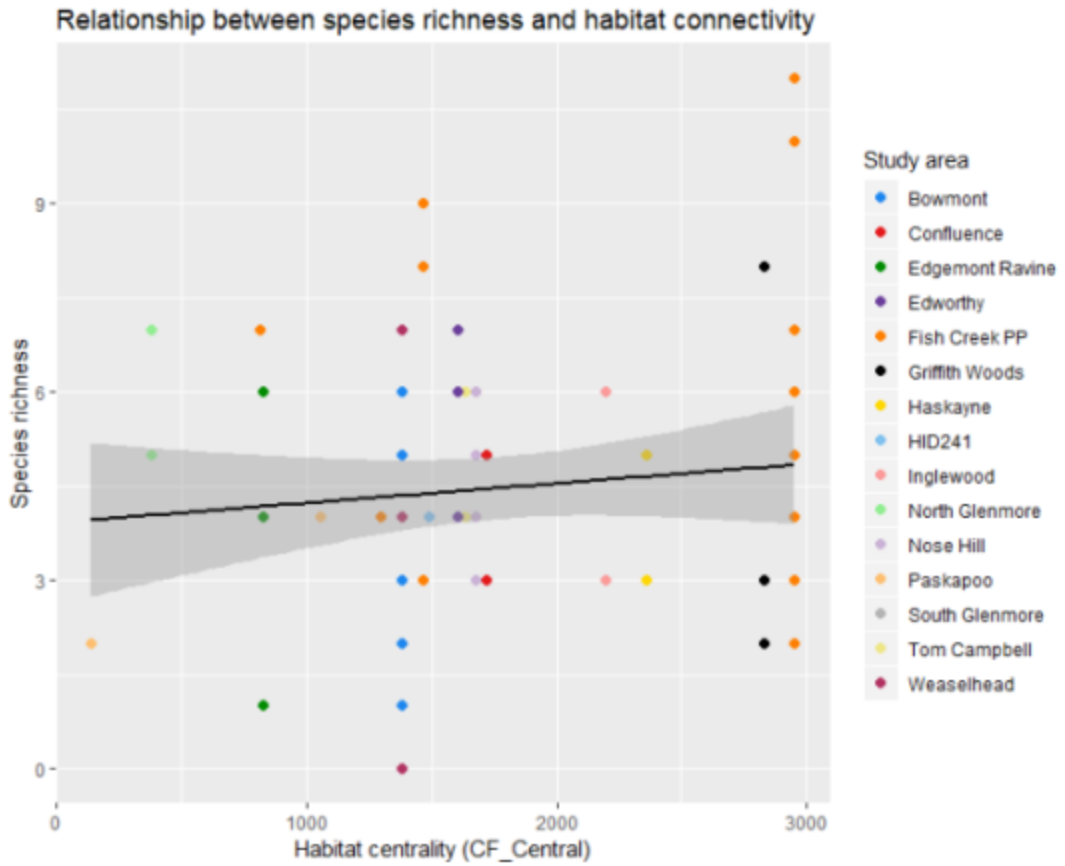


Figure 18: Relationship between habitat connectivity ("CF_Central" attribute from centrality shapefile) and wildlife species richness. Each point in the plot represents a single camera location, and points are color-coded by study area. Black line and dark grey band are best-fit line and 95% confidence interval from simple linear regression.

Off-leash dogs

Cameras recorded 4,584 events involving off-leash dogs during the study period, and 81 percent of these events were recorded by cameras located outside designated public off-leash areas. The rate at which events involving dogs were recorded was highly variable among cameras across the city, and even among cameras within the same study area (Figure 19). Figure 20 shows which areas have a high proportion of dog events off-leash. While areas with high proportions of off-leash events may indicate where leash rule enforcement is needed, the total rate of dog events must also be considered (e.g., Ralph Klein park had a low number of dog events, so a high proportion of off-leash events may not be indicative of a problem area). Considering areas with high rates of dog events (outside of designated off-leash areas), Weaselhead Park and Fish Creek Provincial Park contain areas where on-leash rules may not be consistently adhered to. Interestingly, a nearly identical proportion of dogs were leashed in designated off-leash areas versus on-leash areas (Figure 21), suggesting that dog owners behave similarly with respect to dog leashing regardless of park leash rules.

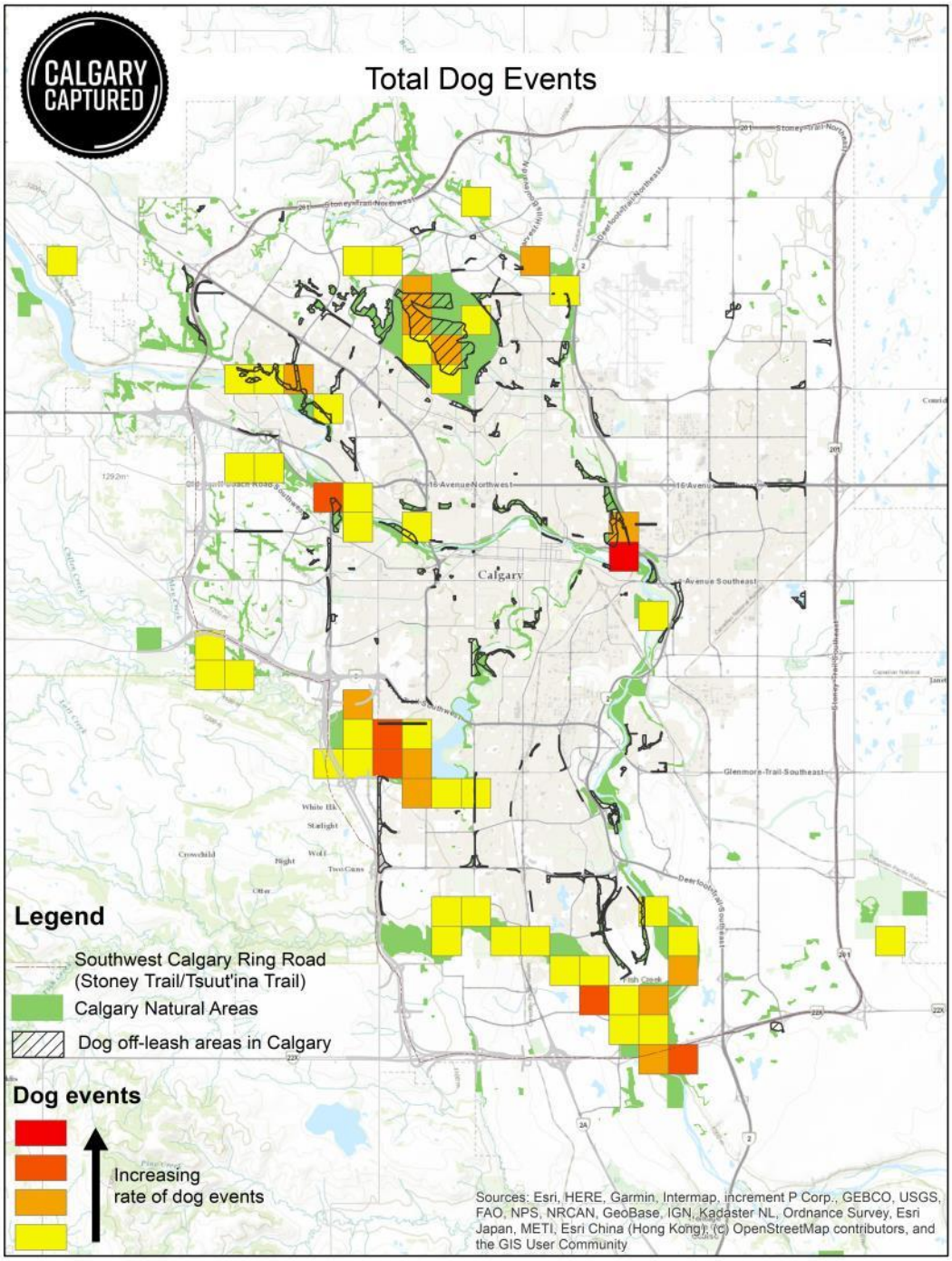


Figure 19: Total rate of dog events, both off-leash and leashed dogs, calculated as the number of dog events per camera day, averaged across all cameras within the grid cell. Red areas indicate areas that had a high rate of dog events.

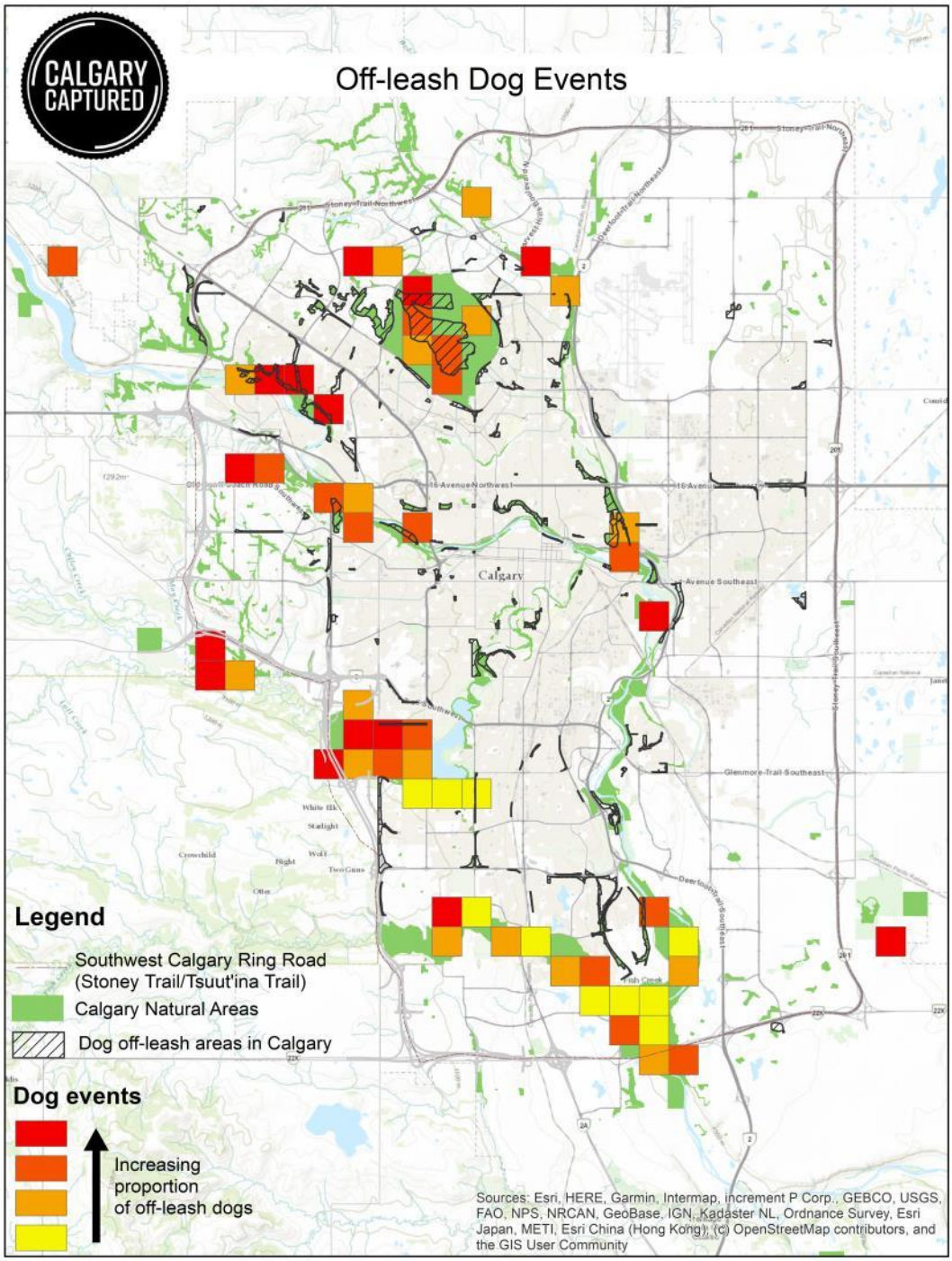


Figure 20: Proportion of total dog events that were off-leash. Red areas indicate highest rate of off-leash dogs.

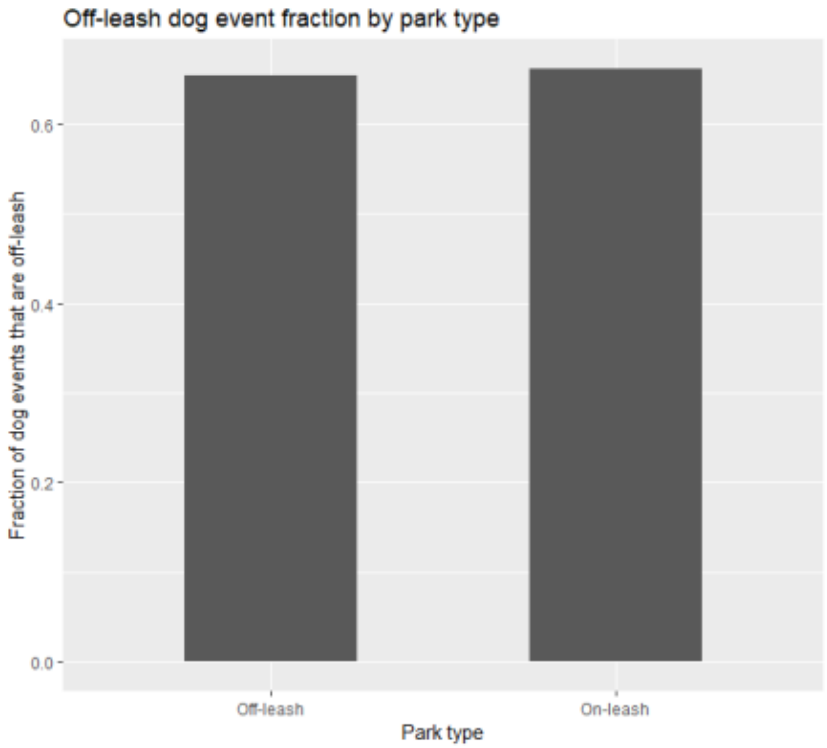


Figure 21: Fraction of dog events that involved off-leash dogs within designed off-leash areas versus outside these areas. This suggests dog owners behave similarly regardless of leashing rules.

Next Steps

The results in this report are preliminary, as additional years of camera-trap data will show a clearer picture of wildlife occurrence and trends in Calgary's park system. The next report will analyze findings through Spring 2020, of which recommendations will be based. As well, additional cameras were placed in two wildlife corridors in 2019/2020 to validate wildlife use of modeled corridors, and inform our knowledge of how urban wildlife respond to the built environment.

The program continues to engage Calgarians through citizen science on the Zooniverse platform, as well as the Wildtrax platform. The program partners continue to utilize the program findings to communicate about urban biodiversity in Calgary.

This one-year dataset is open source. Please contact nicole@rockies.ca for more information.

Appendix

Appendix I: Species recorded in each study area between May 2017 and May 2018

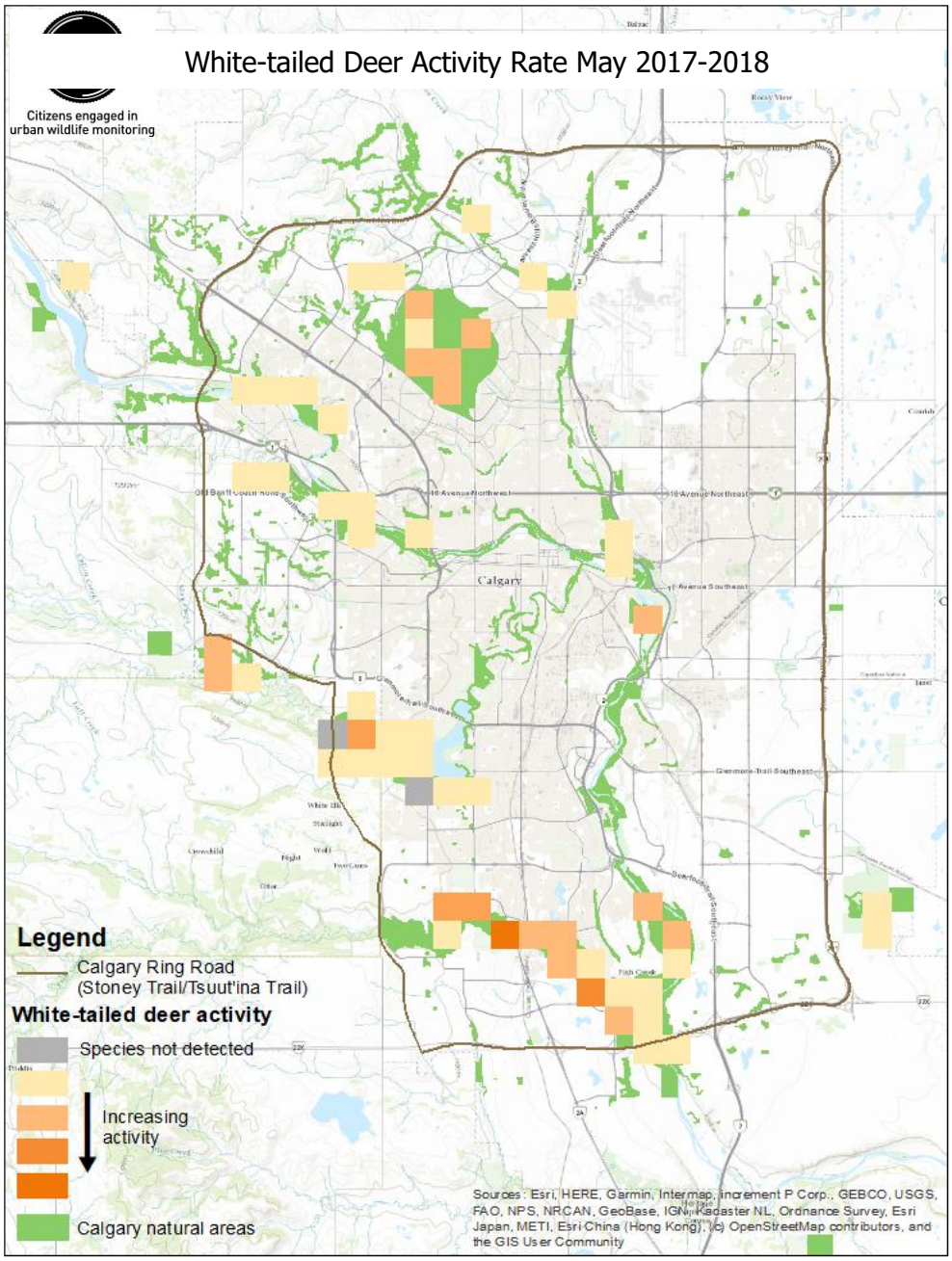
	Bowmont	Confluence	Edgemont	Edworthy	Fish Creek PP	Griffith Woods	Haskayne	HID241	Inglewood	North Glenmore	Nose Hill	Paskapoo	Ralph Klein	South Glenmore	Tom Campbell	Weaselhead
Beaver					■											
Black bear					■											
Bobcat				■	■	■				■				■		■
Cattle							■									
Cougar					■											■
Coyote	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Mule deer	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■
White-tailed deer	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Domestic dog	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Domestic cat																■
Domestic goat		■														
Hares and feral bunnies		■	■	■		■			■	■	■	■	■	■	■	■
Human	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Raccoon					■											
Porcupine		■	■	■	■			■			■					
Marten						■										
Mink					■											
Moose						■	■						■	■		■
Red fox	■					■							■		■	■
Skunk				■	■											
Squirrels	■		■	■	■				■	■	■	■		■	■	■
Weasel	■				■											

Appendix II: Spatial patterns of species activity rates

Activity rates were calculated as the number of wildlife events per camera day for each cell within the sampling grid. Some grid cells included multiple camera locations. Activity rates were depicted on the maps in the same even intervals to allow for comparison.

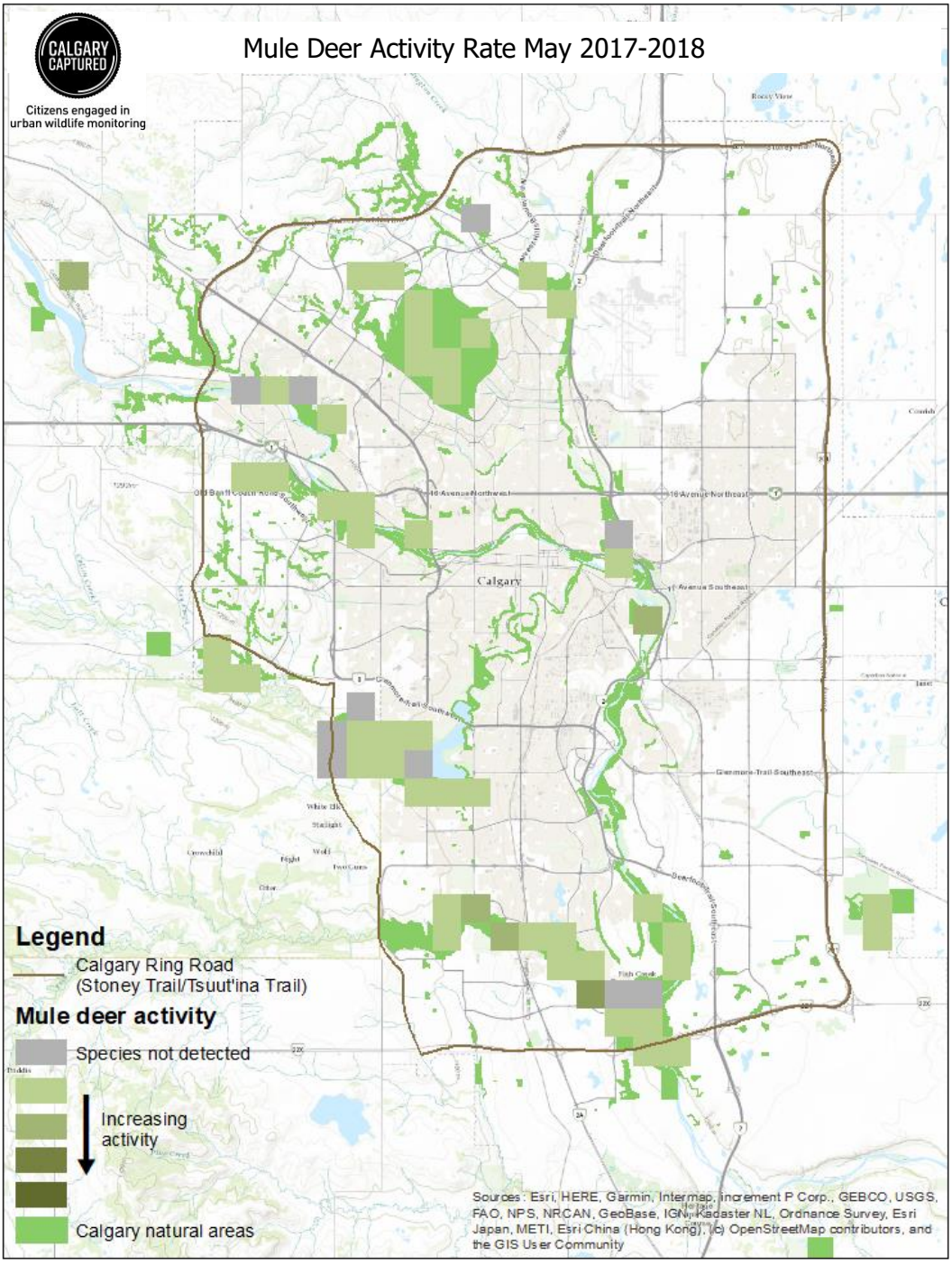
White-tailed deer

White-tailed deer were recorded at all study areas. White-tailed deer activity rates were highest at Nose Hill, Griffith Woods, Inglewood Bird Sanctuary, Weaselhead and Fish Creek.



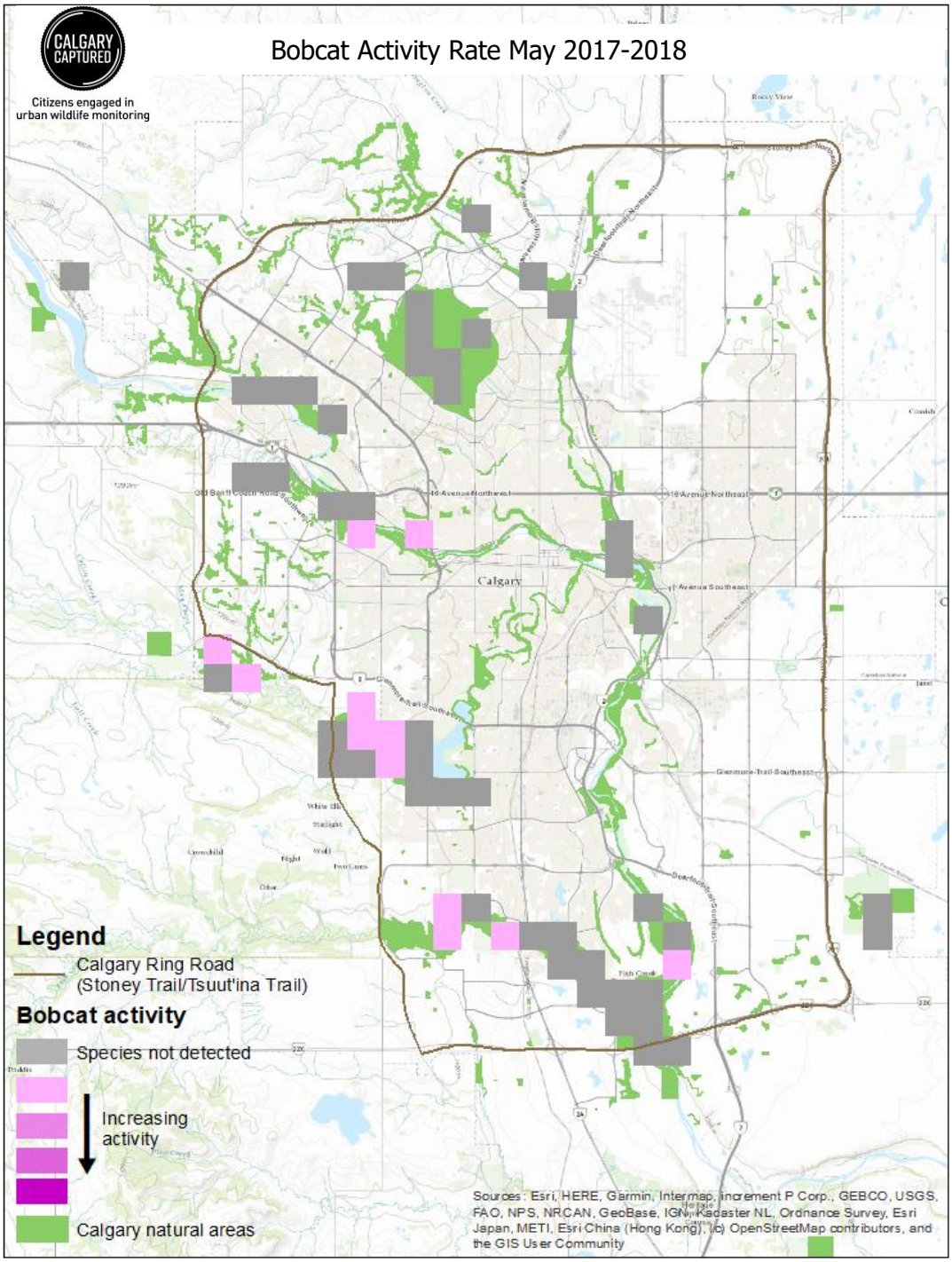
Mule deer

Mule deer were not recorded at HID241. Mule deer activity rates were highest at Haskayne, Nose Hill, Griffith Woods, Inglewood Bird Sanctuary, South Glenmore and the western portion of Fish Creek.



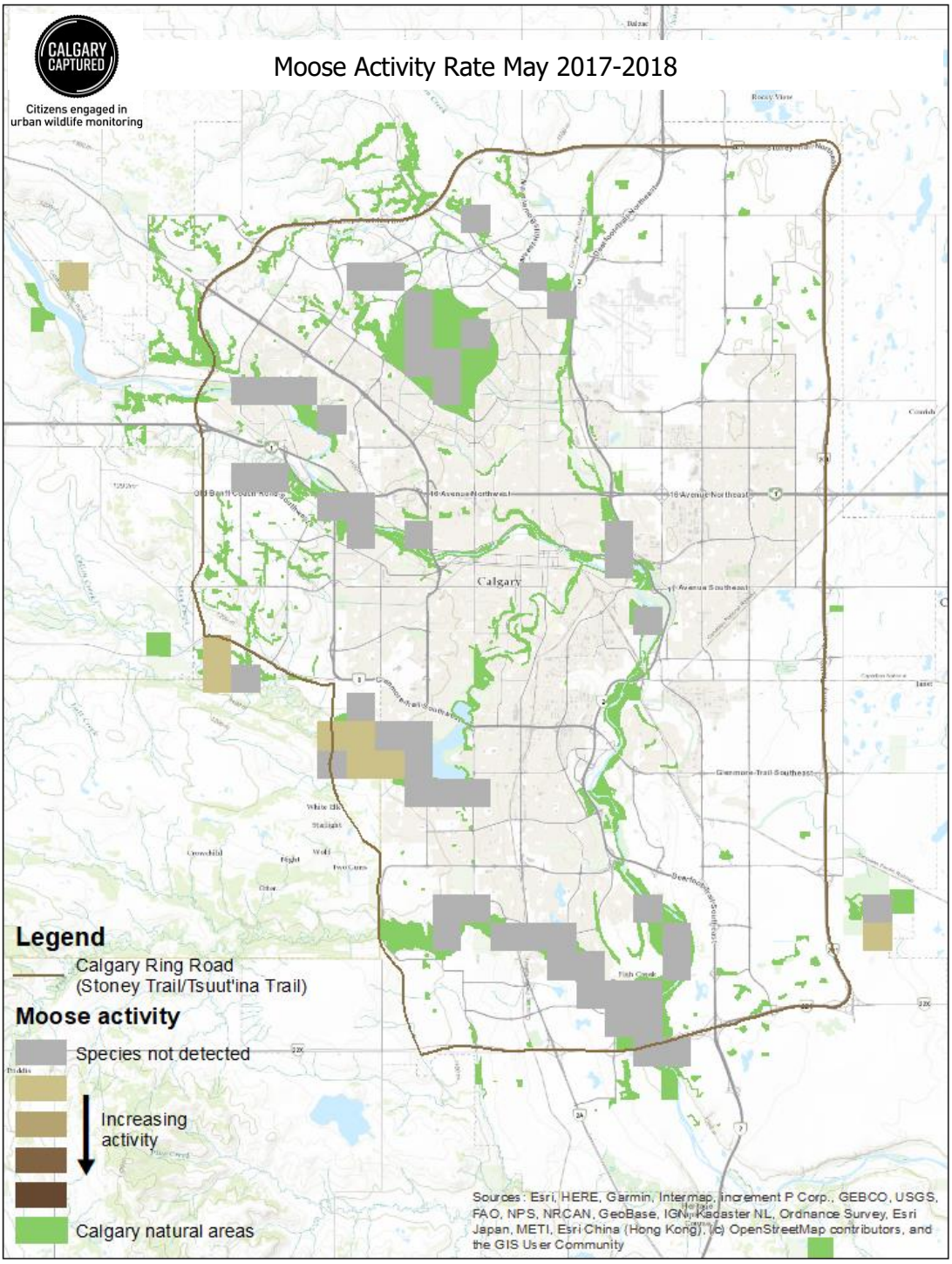
Bobcat

Bobcats were recorded at Edworthy, Fish Creek, Griffith Woods, Weaselhead, North Glenmore and South Glenmore.



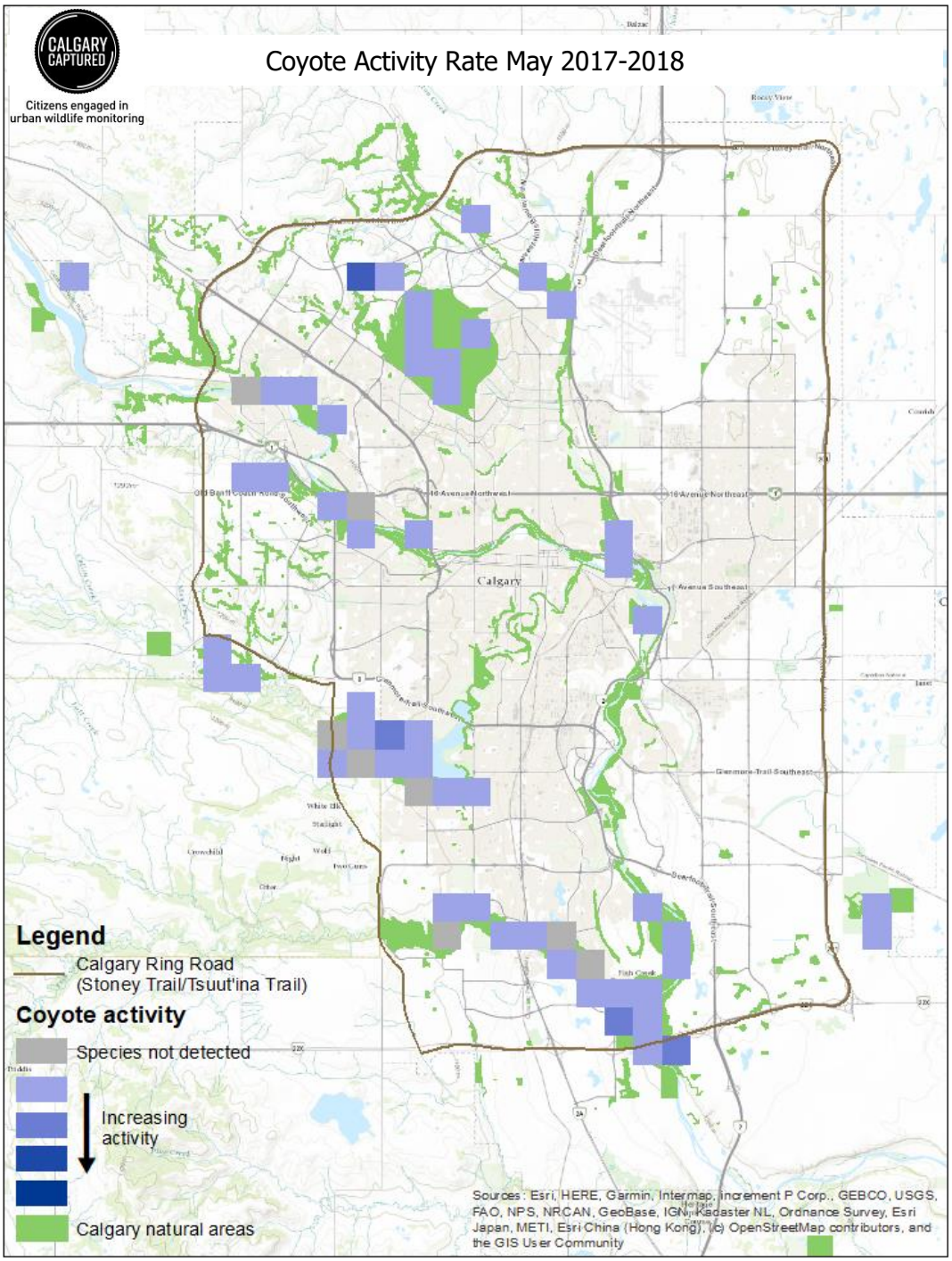
Moose

Moose were recorded at Griffith Woods, Haskayne, Ralph Klein, South Glenmore and Weaselhead. The map suggests Moose are found only at locations on the outer edge of the city.



Coyote

Coyote were found in all study areas.



Fox

Fox were recorded at Bowmont, Griffith Woods, Ralph Klein, Tom Campbell and Weaselhead.