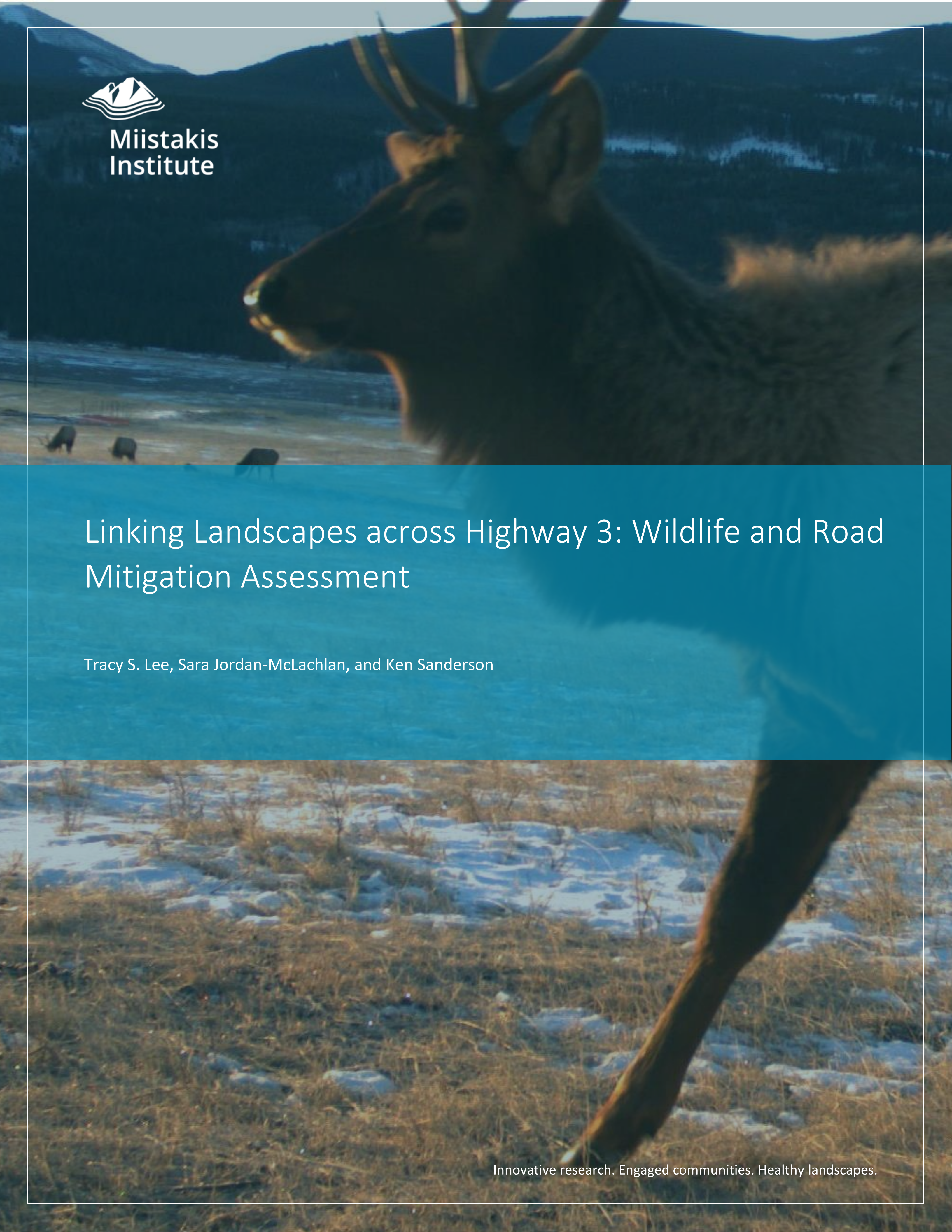

Miistakis Institute

Linking Landscapes across Highway 3: Wildlife and Road Mitigation Assessment

Tracy S. Lee, Sara Jordan-McLachlan, and Ken Sanderson

Innovative research. Engaged communities. Healthy landscapes.

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Prepared by Tracy S. Lee, Sara Jordan-McLachlan, and Ken Sanderson

February 2024

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Executive Summary

The Rocky Mountains in Southern Alberta and British Columbia are a vital movement corridor for wildlife, connecting important protected areas to the North and South. The Highway 3 transportation corridor bisects important wildlife habitat, creating a barrier to movement and leading to direct mortality of both people and wildlife. In 2010 conservation organizations identified key areas where wildlife movement across Highway 3 could be supported. Since this time the Government of Alberta has announced plans to twin Highway 3, including a highway realignment from Blairmore to east of Coleman, and has made investments to reduce motorist safety risk and provide safe crossing location for wildlife through infrastructure investments. In addition, private land conservation efforts have advanced due to investments by Land Trusts and the Government of Alberta via the Land Trust Grants Program. Lastly new information on large mammals has been documented. We aim to summarize new findings and revisit recommendations for road mitigation along Highway 3 from Coleman west to the Alberta, British Columbia Border.

Motorist Safety Risk

A key motivation to invest in road mitigation is to reduce animal vehicle collisions (AVCs) to improve motorist safety. We analyzed five years of AVC data from the Alberta Wildlife Watch program to identify AVC collision clusters and calculate per kilometre costs of AVCs to identify road sections with high motorist safety risk from Lundbreck, Alberta to Alberta/British Columbia border.

The Alberta government recorded an average of 134 AVCs per year costing $6,118,080 USD annually ($8,267,575 CAD) along Highway 3 from Lundbreck to the Alberta/British Columbia border. While diverse species were involved in AVCs, 82% were comprised of mule deer or white-tailed deer. Of interest bighorn sheep collisions were reported to the east and west of existing fence infrastructure around the Emerald Lake Road mitigation site. Our analysis identified five AVC clusters, at the Crowsnest River Bridge to the west of Lundbreck, three clusters from Rock Creek to Highway 3/507 junction and one near Sentinel. No AVC clusters were identified in the Jim Prentice Wildlife Corridor (JPWC). However, motorist safety risk could be considered as an annual average of 6 elk are involved in AVCs, costing an estimated $1,058,733 CAD annually.

Wildlife monitoring at existing highway infrastructure

We deployed 30 remote cameras in the JPWC and Rock Creek Corridor for two years between September 1, 2020, and January 1, 2023. Cameras were placed both away from the road to assess wildlife activity in the corridors and at existing road infrastructure where wildlife may be crossing. These included a highway underpass, a railway underpass and four culverts. A variety of species were detected on camera: 70% were ungulates, 9% carnivores and 21% humans and domestic animals. Eighteen different medium to large-sized terrestrial mammal species were detected in the area but not all were detected near or using existing infrastructure to cross

Highway 3. Grizzly bear, wolf, and moose were detected in the corridors but were not detected on any cameras near existing infrastructure.

The Crowsnest River Bridge (underpass) and railway underpass in the JPWC were used by certain species to cross Highway 3. Elk were detected near both the Crowsnest River Bridge underpass and the railway underpass but did not use the infrastructure to cross. Mule and white-tailed deer, cougar, coyote, black bear and several smaller mammals such as red fox were detected crossing using the Crowsnest River Bridge underpass in the JPWC. None of the species detected in Rock Creek corridor were detected using the existing Rock Creek culvert to cross.

Road mitigation for Wildlife

Current research supports previous recommendations made by Clevenger et al. (2010). We focused on recommendations for the region between Coleman to Alberta/British Columbia border. All recommendations were based on discussions with workshop attendees in January 2024 and represent our best available knowledge at the time. There are many other important sites along Highway 3 (for example Leitch Collieries) that were not discussed at the workshop.

The 2010 report recommended road mitigation at Iron Ridge, Crowsnest River Bridge, and an additional crossing opportunity for bighorn sheep to the east of the Crowsnest Lakes. Due to the proposed new Highway 3X realignment (which re-joins Highway 3 to the west of Allison Creek Road), road mitigation at or near Iron Ridge would best be paired with mitigation associated with Highway 3X. This is an important area for carnivore and elk movement and transportation planning needs to consider how wildlife will move across the existing Highway 3 and the new Highway 3X alignment. Consideration should be given to wildlife movement needs during the planning and construction phases of the new realignment.

To the west of the Highway 3X/3 junction, the best locations for movement safely across Highway 3 include the railway underpass and Crowsnest River underpass (referred to as Crowsnest West in the 2010 report) as both currently support wildlife crossings for some species. To accommodate larger species including elk, wolf and grizzly bear, workshop participants recommend the Crowsnest River Bridge underpass be modified (widened and the slope decreased) or a new structure is built to encourage multi-species use. Fencing the JPWC from Highway 3X/3 to the existing fence end for the Emerald Lake underpass will encourage more animals to cross safely and reduce risks to motorists. If fencing is installed, consideration of movement for elk and carnivore species to the east of Highway 3X/3 junction is also important to ensure access continued access to winter range.

Bighorn sheep are involved in AVCs, especially to the east of the Crowsnest River junction. Workshop participants recommend additional fencing from the Emerald Lake underpass road mitigation project, and a new crossing structure to accommodate movement to the west of the Crowsnest River bridge to accommodate bighorn sheep and other species (deer, elk, moose, and grizzly bear also use this area).

Introduction

Habitat connectivity has been identified as a critical component for maintaining wildlife populations across the Crown of the Continent Ecosystem. The Rocky Mountains in Southern Alberta and British Columbia are a vital movement corridor for wildlife within this ecosystem, connecting important protected areas to the North and South. The Highway 3 transportation corridor bisects this wildlife corridor, creating a barrier to movement and leading to direct mortality of both people and wildlife. In 2010, a report prepared by Dr. Tony Clevenger and colleagues identified the costs associated with animal vehicle collisions (AVCs), documented important areas where wildlife movement intersected with Highway 3, and provided recommendations for mitigation along the Highway 3 transportation corridor (Clevenger et al., 2010). Since that time, changes have been proposed for road twinning and a new alignment, Highway 3X, a road mitigation project at Rock Creek has been announced, private land conservation efforts have advanced and new information on large mammals has been reported.

We aim to summarize this new information and revisit Clevenger et al.'s (2010) recommendations for road mitigation along Highway 3 from Lundbreck to the Alberta British Columbia border.

Our report is presented in four thematic sections:

- Assessment of animal vehicle collisions rates and costs.
- Assessment of remote camera wildlife monitoring at existing highway crossing infrastructure.
- Overview of ecological connectivity models and corridors.
- Workshop recommendations on road mitigation for wildlife along Highway 3.

Building on Previous Research

In 2010, a coalition of ecologists and road mitigation specialists published a report on wildlife-human interactions along the Highway 3 Transportation Corridor in the Crown of the Continent ecosystem (Clevenger et al., 2010). They identified the scale of wildlife-vehicle collisions, large mammal movement needs, and mitigations available at that time. The impetus for the study was related both to motorist safety and wildlife conservation. The team found that collisions with deer dominated AVCs, but that other species including moose, elk, grizzly bear, bighorn sheep, cougar, wolf, black bear, and lynx were also being struck on the highway. They also reported concern for habitat fragmentation due to movement barrier effects as grizzly bears were avoiding Highway 3 due to traffic volumes. While overall deer population numbers are at little risk from mortality related to vehicle collisions, other species including grizzly bear, wolverine, and badger may experience population-level impacts even with few individuals being killed on the highway.

Wildlife vehicle collision data were collected from the British Columbia Ministry of Transportation, Alberta Sustainable Resource Development, Fish and Wildlife, highway maintenance contractors and a citizen science program — Road Watch in the Pass. With these data, the team identified 81 km of medium to very high wildlife collision hotspots in British Columbia and an additional 27 km in Alberta. Considering several factors, including local and regional conservation value, the security of lands from development on either side of the road, the number of wildlife mortalities, and existing opportunities for mitigation, the team identified 31 potential mitigation sites (nine in Alberta and 22 in British Columbia) (Figure 1). To further prioritize these sites, monetary costs were calculated based on vehicle damage and human injury or fatality costs from colliding with deer, elk, moose, or bighorn sheep. These numbers were calculated based on costs reported by (Huijser et al., 2007) for a study conducted in the United States. These values were then compared to construction and maintenance costs of mitigation, providing a cost-benefit analysis to prioritize areas that provide the greatest overall benefit.

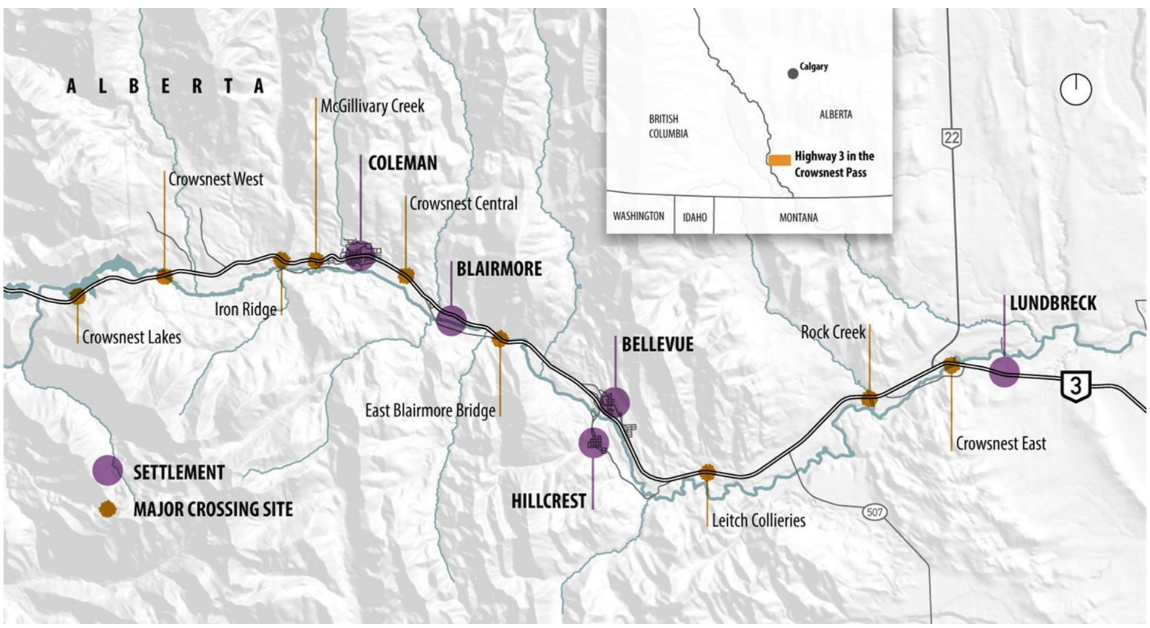


Figure 1: Highway 3 road mitigation sites in Alberta from Clevenger et al. (2010).

Recommendations were provided for both short- and long-term actions at each of the 31 sites to optimize motorist safety and wildlife protection. Short-term actions included steps such as changing de-icing materials to decrease ungulates' attraction to road salt and maintaining existing habitat. Long-term actions included construction of mitigation infrastructure including underpasses and culverts, wing fencing, and overpasses. Recommendations for future work included continued monitoring and updating predicted costs by tracking changing economic conditions.

In 2012, after field site visits to the Crowsnest Lakes area, we developed an amendment to the 2010 report. We focused on the Emerald Lake area based on recent investments from the Government of Alberta in both fencing and an existing river bridge (underpass) between Emerald Lake and Crowsnest Lakes (Appendix A).

Study Area

The study took place along a 45 km stretch of the Western Highway 3 Transportation Corridor from Lundbreck, Alberta to the Alberta/British Columbia border. The region includes a mosaic of crown, and private lands in a lower elevation, east-west valley of the Canadian Rocky Mountains. The region is bisected by a railway line, Highway 3, and several towns. The Government of Alberta has identified Highway 3 for an expansion to four lanes and recommends a realignment from Blairmore to west of Coleman. Private land conservation efforts to protect wildlife habitat and movement are focused on the Jim Prentice, Leitch Collieries and Rock Creek Wildlife Corridors (Figure 2).

Since 2010, road mitigation projects have been built to reduce the risk of wildlife vehicle collisions and facilitate the safe movement of wildlife across Highway 3 in Alberta. Alberta Transportation and Economic Corridors installed fencing and jump-outs[1] at Emerald Lake to prevent bighorn sheep from accessing the highway. The Rock Creek road mitigation project build phase was announced in late 2023 and includes fencing and jump-outs in the stretch of highway from the Crowsnest River Bridge (near Lundbreck) to North Burmis Road as well as crossings at the Crowsnest River Bridge (west of Lundbreck) and Rock Creek.

Wildlife vehicle collision data were analyzed along the entire 45 km stretch of highway while linking landscapes remote cameras were placed in two focal areas, the Jim Prentice Wildlife Corridor and Rock Creek. The Jim Prentice Wildlife Corridor spans 7 km of highway from the town of Coleman to the east end of Crowsnest Lake and Rock Creek lies west of the junction of Highway 22 and Highway 3. A total of 30 cameras were placed along 8 km of highway; Twenty-four were placed in the Jim Prentice Wildlife Corridor no more than 1 km from the highway and six cameras were placed in Rock Creek with all placed within 500 m of the highway.

[1] Wildlife jump-outs (or escape ramps) are designed to allow animals to escape from the fenced road corridor (https://www.marcelhuijserphotography.com/wildlifejumpouts).

WESTERN HIGHWAY 3 TRANSPORTATION CORRIDOR

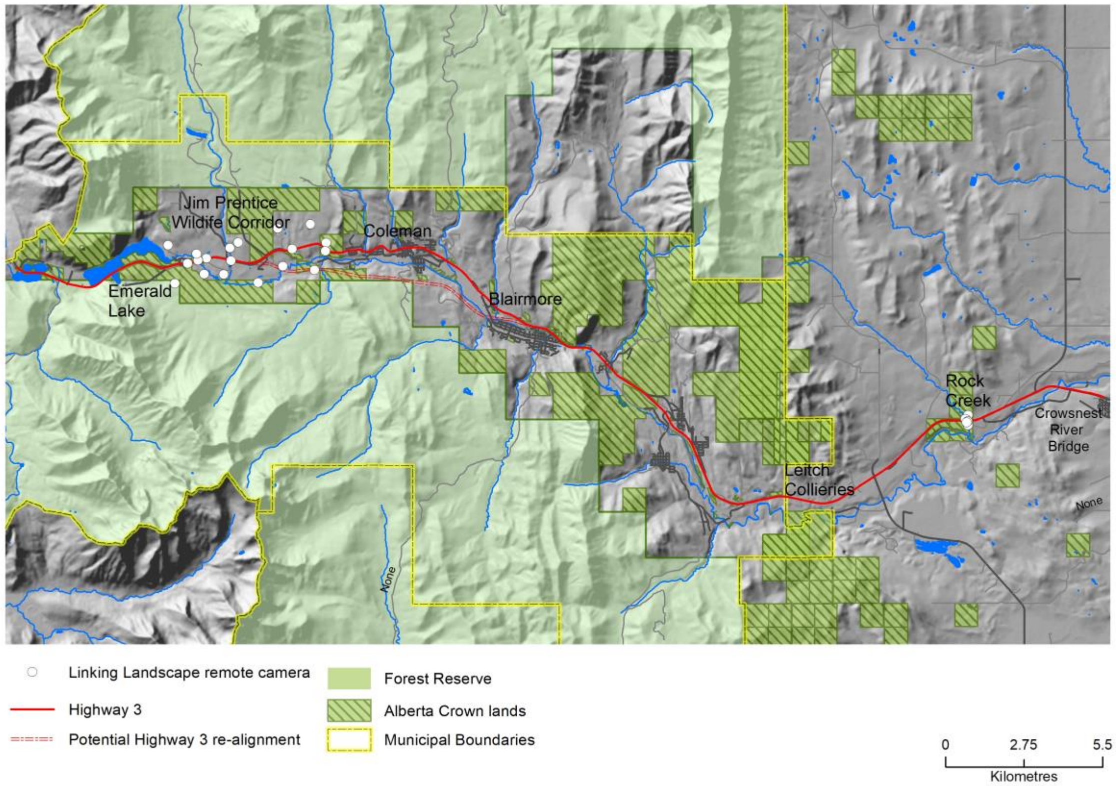


Figure 2: Alberta Western Highway 3 Transportation Corridor Study Area and land jurisdictions.

Animal Vehicle Collisions

A key motivation to invest in road mitigation is to reduce animal vehicle collisions (AVCs) to improve motorist safety. We analyzed AVC data to identify collision clusters and calculate costs of AVCs per kilometre of highway in our study area. We identified road sections with a motorist safety risk along the Western Highway 3 Transportation Corridor from Lundbreck, Alberta to the Alberta/British Columbia border.

Methods

To identify road sections with a high risk to motorist safety we obtained AVC data (2018–2022) from the Alberta Wildlife Watch Program[2]. We used the AVC data to identify road sections with statistically significant AVC clusters and to identify the cost of AVCs per kilometre road section.

[2] https://open.alberta.ca/opendata/alberta-wildlife-watch-animal-carcass-records

AVC Cluster Analysis

Alberta Wildlife Watch (AWW) data were used to identify hotspots using Kernel Density Estimation (KDE+) (Chung et al., 2011) We used KDE+ open-source software that analyzes observation clusters with repeated random simulations (Monte Carlo method) to objectively determine their significance (thresholds). Significant clusters can be ranked according to cluster strength (Bíl et al., 2016). A similar methodology is used by Alberta Transportation and Economic Corridors to identify clusters of provincial significance to guide investment in road mitigation to reduce risks to motorist safety (Alberta Transportation and Economic Corridors, 2023). Our methodology does not include police collision data which is used in the Alberta Wildlife Watch cluster process.

To run the KDE+ analysis, we snapped AWW carcass date to Highway 3 (using 75 m buffer) and ran KDE+ in ArcMap using a 150 and 250 m moving window. To display results, we used Bíl et al. (2016) KDE+ cluster strength definitions; the strongest and most stable clusters are those with a strength ≥0.6 and at least five carcass records per cluster. Weaker or unstable clusters are those with a strength <0.6 and/or 4 or fewer carcass records per cluster. We also display clusters that do not meet these definitions, and label them as forming clusters.

AVC Costs per Kilometre

We used AWW data to identify the number of AVCs per species per kilometre along Highway 3. We extracted ungulate species and applied a correction factor to calculate the direct costs associated with AVCs. A correction factor was applied to AVC carcass reports to account for animals that are involved in a collision but die off the highway right of way and are undetected. A five-year research project from the area determined that for every carcass reported on the highway and right of way by highway maintenance contractors, 2.8 carcasses are found off the right of way and not reported (Lee et al., 2021). The correction factor value can be applied to AVCs data collected from road surveys to improve estimates of actual ACVs.
We attributed the cost of AVCs with ungulates using values reported by (Huijser et al., 2022) (Table 1). Since they did not include bighorn sheep in their analysis, we applied the costs for deer to bighorn sheep AVCs.

Table 1: Costs per ungulate collision (extracted from Huijser et al. 2022) in USD. Deer include both mule and white-tailed deer.

Cost category	Deer	Elk	Moose
Vehicle repair	$4,418	$7,666	$9,535
Human injuries	$6,116	$14,579	$26,811
Human fatalities	$3,480	$23,200	$46,400
Total	$14,014	$45,445	$82,646

TEC uses a different approach to model costs whereby a standard cost of a collision of $100,000 CDN is applied to the number of collisions/km/year based on AWW data (Government of Alberta Transportation and Economic Corridors, 2023)

Results

There were 688 AVCs reported (annual mean = 134, range = 91–186) from 2018 to 2022 along Highway 3 from Lundbreck, Alberta to Alberta/ British Columbia border (Figure 3). At least 10 species were struck over the study period, mule deer, followed by white-tailed deer, were the dominant species involved in collisions, representing 84% of AVCs along this stretch of Highway 3 (Figure 4). Peak AVCs occur in March, April, and November (Figure 5). We also plotted average AVC per kilometre per species along Highway 3 study area (Figure 6).

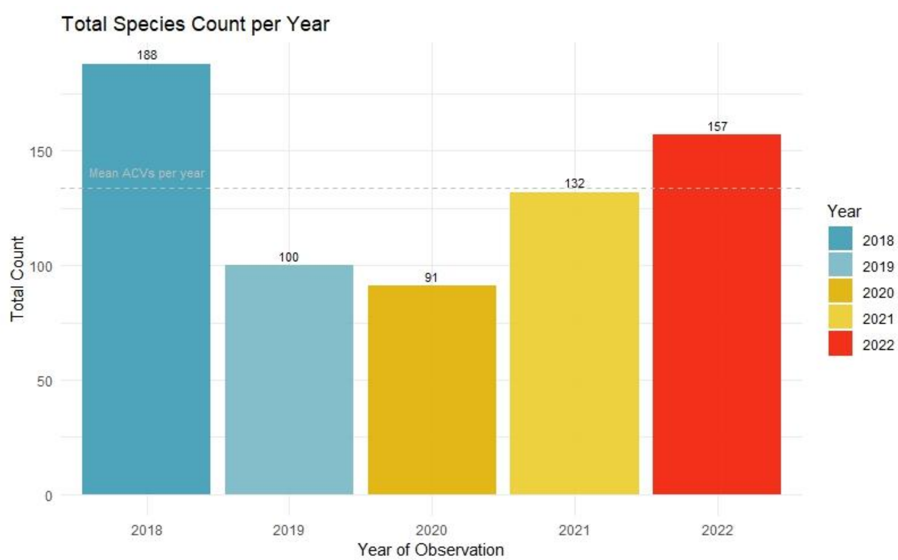


Figure 3: AVCs per year (2018–2022) along Highway 3 from Lundbreck, Alberta to the Alberta/British Columbia provincial border.

Table 2: Mean annual AVCs from 2018 to 2022 along Highway 3.

Species	Annual ACVs	% of AVCs
mule deer	71.6	53.59
white-tailed deer	40.2	30.09
elk	6.8	5.09
bighorn sheep	4.4	3.29
red fox	3.4	2.54
moose	2.4	1.80
black bear	2	1.50
deer spp.	1.8	1.35
coyote	0.8	0.60
cougar	0.2	0.15

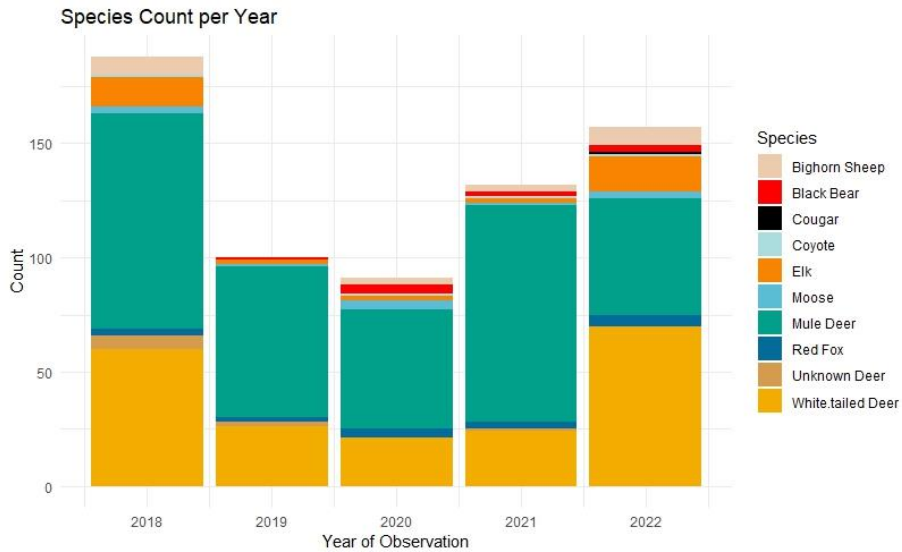


Figure 4: AVCs per year (2018–2022) per species along Highway 3 from Lundbreck, Alberta to the Alberta/British Columbia provincial border.

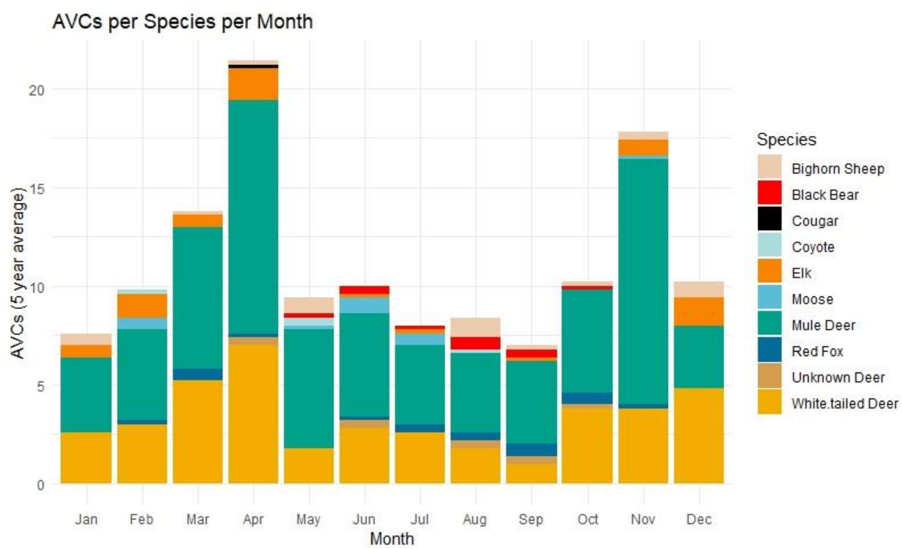


Figure 5: AVCs per month per species based on average over five years (2018–2022) along Highway 3 from Lundbreck, Alberta to Alberta/British Columbia provincial border.

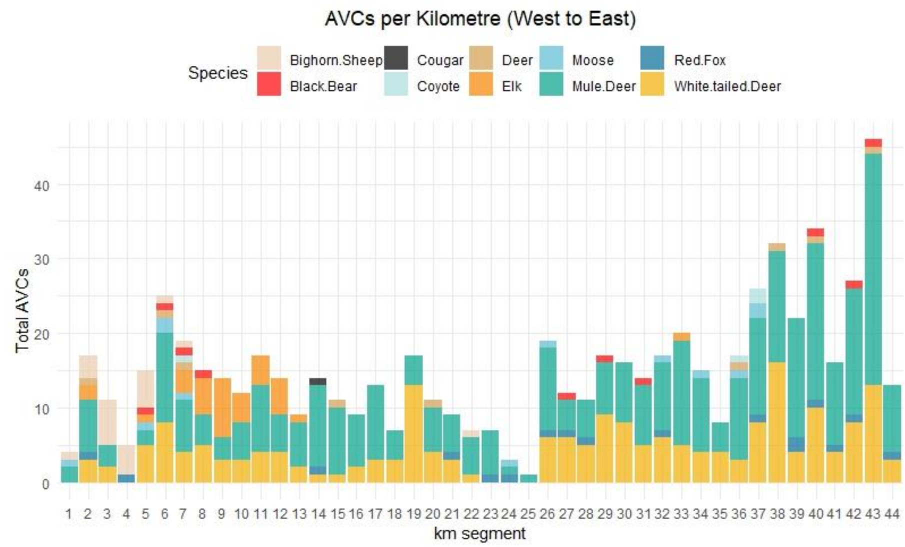


Figure 6: AVCs per kilometre per species from west to east along Highway 3 from Lundbreck, Alberta to Alberta/British Columbia provincial border.

We conducted KDE+ analysis on medium to large mammal AVC data along Highway 3 using a 250 m moving window to detect spatial patterns. Results indicate one strong (cluster ID 9), and three weak (cluster ID 1, 7 and 8) clusters (Table 3 and Figure 8). Cluster 9 is a clear grouping with greater than 5 carcasses per year and a strength greater than 0.60. Road mitigation at this location would address 11% of all AVCs in our study area. The planned Rock Creek mitigation project, which proposes a new underpass at Rock Creek tying into an existing underpass at Crowsnest River Bridge and fencing (encompassing clusters 7–9), would address 27% of AVCs along Highway 3 in the study area.

Table 3: KDE + results for 250 m moving window along Highway 3. Clusters are ranked based on Strength field where strongest (first) to weakest, or no cluster (last). Other field include NPTs_clus: number of AVCs over five years, NPTs clus_year: number of AVCs per year, Cluster Type: depicts if strong (statistically significant), weak (not statistically significant) or is not currently considered a cluster based on AWW defined threshold of <0.6 and 4 carcasses records per cluster).

ID_clust	NPts_clus	NPts_clust_year	Strength	Len_clus	Dens_Pnts	Str_Dens2	Cluster Type
9.0	79	16	0.6	2303.6	3.4	6.7	strong
7.0	61	12	0.4	2139.3	2.9	3.3	weak
8.0	47	9	0.4	1450.0	3.2	4.2	weak
1.0	24	5	0.3	840.2	2.9	2.8	weak
2.0	18	4	0.2	611.8	2.9	1.4	no cluster
5.0	19	4	0.2	728.2	2.6	1.1	no cluster
4.0	15	3	0.1	567.1	2.6	1.0	no cluster
6.0	14	3	0.1	592.8	2.4	0.6	no cluster
3.0	13	3	0.1	560.0	2.3	0.4	no cluster

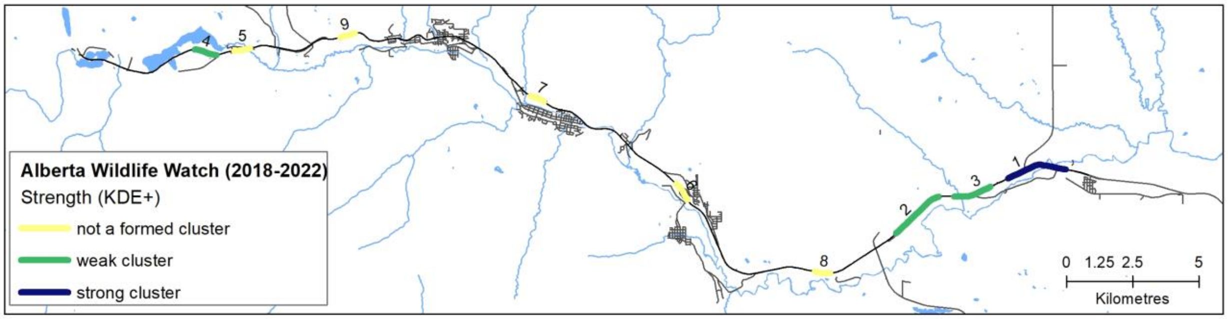


Figure 7: KDE+ analysis depicting strong, weak, and forming AVC clusters along Highway 3 from Lundbreck, Alberta to the Alberta/British Columbia provincial border. Cluster numbers match ID_clust in Table 3.

The average total annual cost of collisions along Highway 3 in our study area is $6,118,080 USD ($8,267,575 CDN) based on five years of available data. The number of collisions per kilometre, and hence the cost, varies considerably across the study area (Figure 8), ranging from almost zero at kilometre 25 to over $350,000 USD at kilometre 43 (Figure 9). From these spatial data (Figure 9), we can identify the location of the Rock Creek Corridor and the JPWC as key areas of high quality habitat and ecological connectivity for large mammal species. The cost of collisions in the Rock Creek Corridor is $258,754 USD annually ($349,663 CAD), while the stretch from Lundbreck to North Burmis Road which includes clusters 7–9 (kilometres 36–44) is $1,858,627 USD annually ($2,494,361 CAD).

The cost of AVCs in the JPWC (kilometre 7–12) is $783,472 USD annually ($1,058,733 CAD) and at Sentinel (cluster 1, or kilometre 5–6) is $447,921 USD ($601,130 CAD).

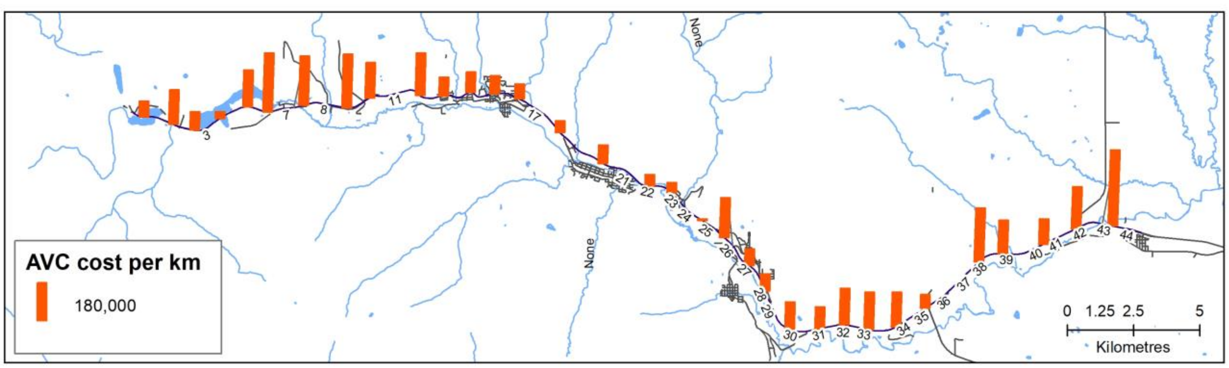


Figure 8: AVC cost per km, based on ungulate AVCs averaged per year based on five years of data along Highway 3 from Lundbreck, Alberta to Alberta/British Columbia provincial border.

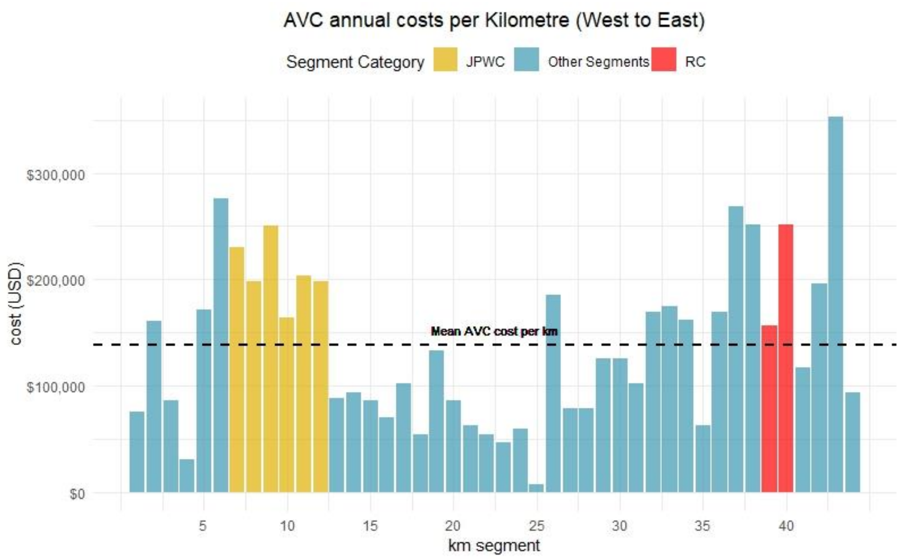


Figure 9: AVC annual costs per kilometre section along Highway 3 from Lundbreck, Alberta to Alberta/British Columbia provincial border. Here kilometre sections associated with Rock Creek Corridor are depicted in red and Jim Prentice Wildlife Corridor in yellow.

Discussion

Highway 3 from Lundbreck to the Alberta/British Columbia border is home to an average of 134 AVCs for medium to large mammals every year. If we apply a correction factor to account for animals that are involved in vehicle collisions that are injured in the collision but die once away from the highway right-of-way (= 2.8 additional animals from carcass reports due to injury bias) this average increases to 375 AVCs for medium to large mammals each year (Lee et al., 2021). Species involved in collisions along this stretch included most ungulates present in the region (mule deer, white-tailed deer, elk, moose, bighorn sheep) and diverse carnivores (black bear, coyote, cougar, and red fox). But deer species account for 82% of the AVCs. Importantly, from a motorist safety perspective, larger ungulates such as elk and moose are also involved in AVCs along this stretch of highway. There is a clear impetus from both wildlife protection and motorist safety perspectives to improve wildlife crossing infrastructure along this stretch of highway.

We assessed AVC data using two approaches: a KDE+ cluster analysis to identify highway sections with concentrations of risk to motorist safety and by calculating the cost of AVCs per kilometre section. These analyses highlight considerations of a road mitigation system in three highway segments that we will detail below:

- Lundbreck to North Burmis Road,
- Jim Prentice Wildlife Corridor and
- West of Sentinel

Lundbreck to North Burmis Road (kilometre 38–44)

This stretch of Highway 3 includes a stable AVC cluster near the Crowsnest River Bridge to the west of Lundbreck, and two weak clusters from Rock Creek to Highway 3/507 junction. These clusters are dominated by collisions with deer. Significantly, addressing this 7 km stretch of Highway 3 would address more than one quarter (27%) of all AVCs along Highway 3 and address a high financial cost to motorists — $2,494,361 CAD per year over our 5-year study period.

Jim Prentice Wildlife Corridor (kilometre 7–13) and West of Sentinel (kilometre 5–6)

The JPWC does not include stable or weak clusters according to the KDE+ analysis, but a major concern is the number of elk vehicle collisions occurring along this stretch — on average 6 per year. Larger ungulate species such as elk increase the risk of injury or death from a collision. The AVC costs associated with the JPWC based on a five-year average was $1,058,733 CAD annually.

West of Sentinel

Directly to the west of the JPWC, to the west of Sentinel, is a weak, but species diverse AVC cluster composed of deer, elk, moose, bighorn sheep, and black bear. ACV costs associated with this stretch of highway based on a five-year average is $601,130 CAD annually. This AVC cluster could be considered in combination with a road mitigation system tied into the JPWC due to proximity.

Remote Camera Wildlife Monitoring

The Linking Landscapes Program works to ensure wildlife habitat connectivity across the Western Highway 3 Transportation Corridor by connecting private land with protected areas, including the Castle Wildland Park, the Livingstone Range and High Rock Wildland Parks. To better understand wildlife movement and the use of existing road crossing infrastructure (such as culverts and bridges) we initiated a remote camera wildlife monitoring program in the JPWC and at the Rock Creek Corridor. These locations were selected due to high conversation value and investment from private land conservation, and they also represent areas of motorist safety concern. Other mitigation sites identified in the 2010 Clevenger et al. report are also important but were not included in camera monitoring due to funding limitations.

Methods

Between September 1, 2020, and January 1, 2023, 30 remote cameras were set up along Highway 3 in the Jim Prentice Wildlife Corridor and Rock Creek. A total of 24 cameras were placed in the JPWC with six placed near highway crossing infrastructure, 14 placed within a 1000 m buffer of the road on existing game trails (north and south of the road) and four placed more than 1000 m from the road in wildlife hotspots. To capture wildlife use of highway crossing infrastructure, one camera was placed at a railway underpass, two at an existing highway underpass (Crowsnest River Bridge) and three at existing culverts. At Rock Creek, two cameras were placed at an existing culvert, two were placed at a proposed Rock Creek mitigation site and two were placed as control cameras on game trails within 500 m of the highway. Cameras placed next to highway crossing infrastructure were situated to capture wildlife coming up to and attempting to cross the road while cameras within a 500 – 1000 m buffer were placed to detect all wildlife species that may be present in the area.

As described above, each camera was associated with a corridor, kilometre section, treatment type and/or highway crossing (Table 4). Maps and plots below are represented either by camera number or by crossing infrastructure name depending on the context. Treatment types distinguish cameras at highway crossing infrastructure (culverts, underpass, bridge structure) from control sites (away from the highway). The kilometre sections match the analysis of AWW in the previous section, whereby kilometres start at Alberta/ British Columbia border and run east to Lundbreck, Alberta (kilometre 45). We used the crossing infrastructure name (Table 4) when referring to plots associated with highway crossings to link to type highway infrastructure (culvert [C], highway underpass [HU], railway underpass [RU]) and appropriate kilometre section.

Table 4: Camera cross reference table

Camera Num.	Corridor	Treatment type	Km section	Crossing infrastructure
HC1	JPWC	Culvert	11	C11
HC2	JPWC	Culvert	8	C8
HC3	JPWC	R. Underpass	8	RU8
HC4EAST	JPWC	H. Underpass	7	HU7
HC4WEST	JPWC	H. Underpass	7	HU7
HC5	JPWC	Culvert	7	C7
KM10N	JPWC	Control	10	
KM10S	JPWC	Control	10	
KM11N	JPWC	Control	11	
KM11S	JPWC	Control	11	
KM12N	JPWC	Control	12	
KM12S	JPWC	Control	12	
KM6N	JPWC	Control	6	
KM6S	JPWC	Control	6	
KM7N	JPWC	Control	7	
KM7S	JPWC	Control	7	
KM8N	JPWC	Control	8	
KM8S	JPWC	Control	8	
KM9N	JPWC	Control	9	
KM9S	JPWC	Control	9	
RCCN	RC	mitigation	39	mit39
RCCS	RC	mitigation	39	mit39
RCN	RC	Control	39	
RCNCULV	RC	Culvert	39	C39
RCS	RC	Control	39	
RCSCULV	RC	Culvert	39	C39
S1	JPWC	reference	n/a	
S2	JPWC	reference	n/a	
S3	JPWC	reference	n/a	
S4	JPWC	reference	n/a	

Cameras were checked approximately every three months by the Nature Conservancy of Canada, a Miistakis contractor, and Linking Landscapes volunteers. Images were classified using WildTrax, an on-line platform designed for storing, managing, and analyzing environmental sensor data. Images were classified by Nature Conservancy of Canada and Miistakis Institute staff and volunteers (images documented as verification needed where verified by either NCC or Miistakis Institute).

Results

Who is using the corridors?

There were 14,383 detections of mammals between September 1, 2020, and January 1, 2023 (Table 5) on remote cameras in the JPWC and Rock Creek. A variety of wildlife were detected — the most numerous were white-tailed deer (47%) followed by elk (13%), mule deer (6%), red fox (4%) and coyote (2%). Cougar, striped skunk, black bear, moose, grizzly bear, gray wolf, beaver, bighorn sheep, mink, long-tailed weasel, marten, common raccoon, northern flying squirrel, Canada lynx, and badger each account for less than 1% of captures during the study period. Wildlife were not the only detections on camera with humans and domestic animals accounting for 21% of all captures. Humans detected on the cameras were on foot, using heavy equipment, and on all-terrain vehicles. Domestic animals detected on camera included domestic cow, dog, cat, and horse (Figure 10).

While a variety of individual wildlife species appeared on camera, when categorized into ungulates and carnivores, wild ungulates account for 70% of all detections while carnivores represent 9% of all detections (Figure 11 and Figure 12).

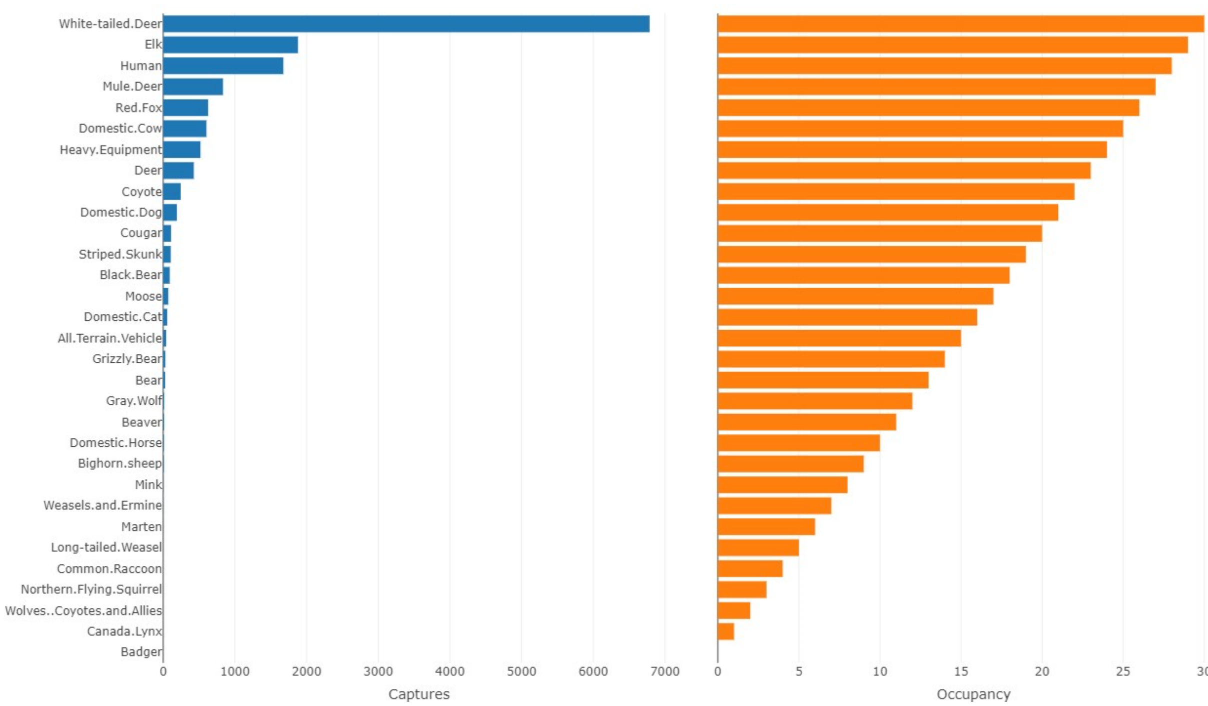


Figure 10: Total number of detections per species and species camera occupancy (left panel). The number of cameras where the species was detected is shown by the orange bars on the right panel.

Table 5: Species detections between September 1, 2020, and January 1, 2023

Species	Number of Detections	% Detections
White-tailed deer	6785	47.18
Elk	1880	13.07
Human	1676	11.65
Mule deer	834	5.80
Red fox	627	4.36
Domestic cow	603	4.19
Heavy Equipment	520	3.62
Deer	427	2.97
Coyote	244	1.70
Domestic dog	191	1.33
Cougar	110	0.76
Striped skunk	105	0.73
Black bear	91	0.63
Moose	71	0.49
Domestic cat	56	0.39
All Terrain Vehicle	41	0.29
Grizzly bear	30	0.21
Bear	27	0.19
Gray wolf	15	0.10
Beaver	14	0.10
Domestic horse	11	0.07
Bighorn sheep	10	0.07
Mink	4	0.03
Weasels and Ermine	3	0.02
Marten	2	0.01
Badger	1	0.01
Canada lynx	1	0.01
Common raccoon	1	0.01
Long-tailed weasel	1	0.01
Northern flying squirrel	1	0.01
Wolves, Coyotes, and Allies	1	0.01

.

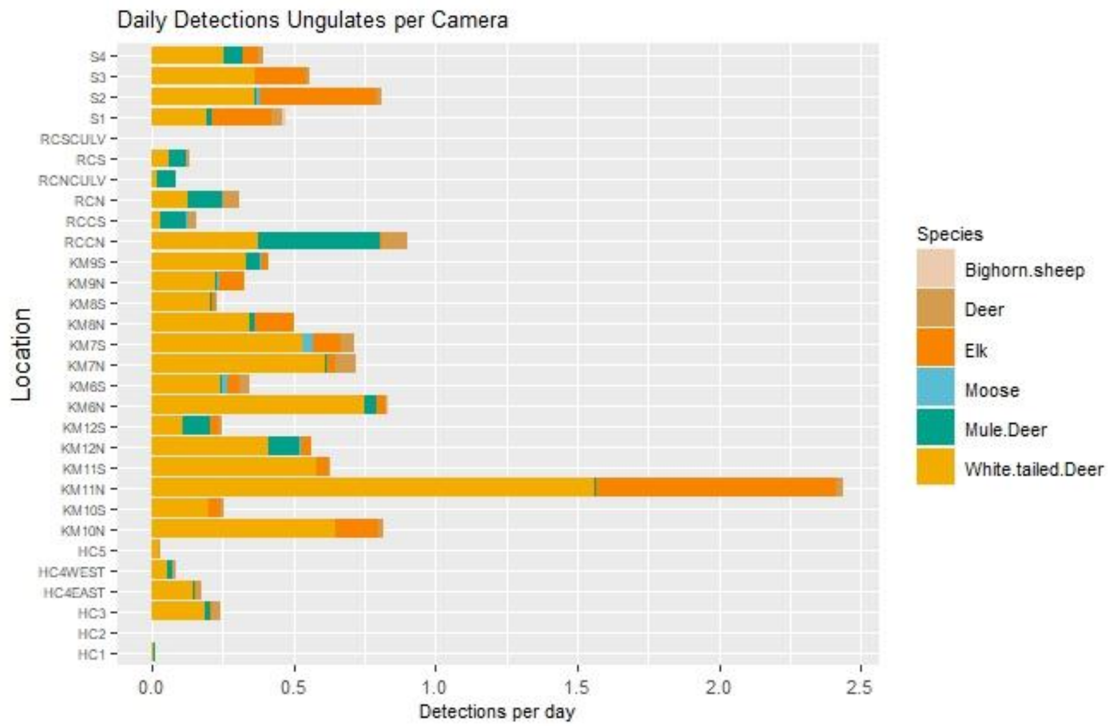


Figure 11: Number of ungulate species detections per day per camera.

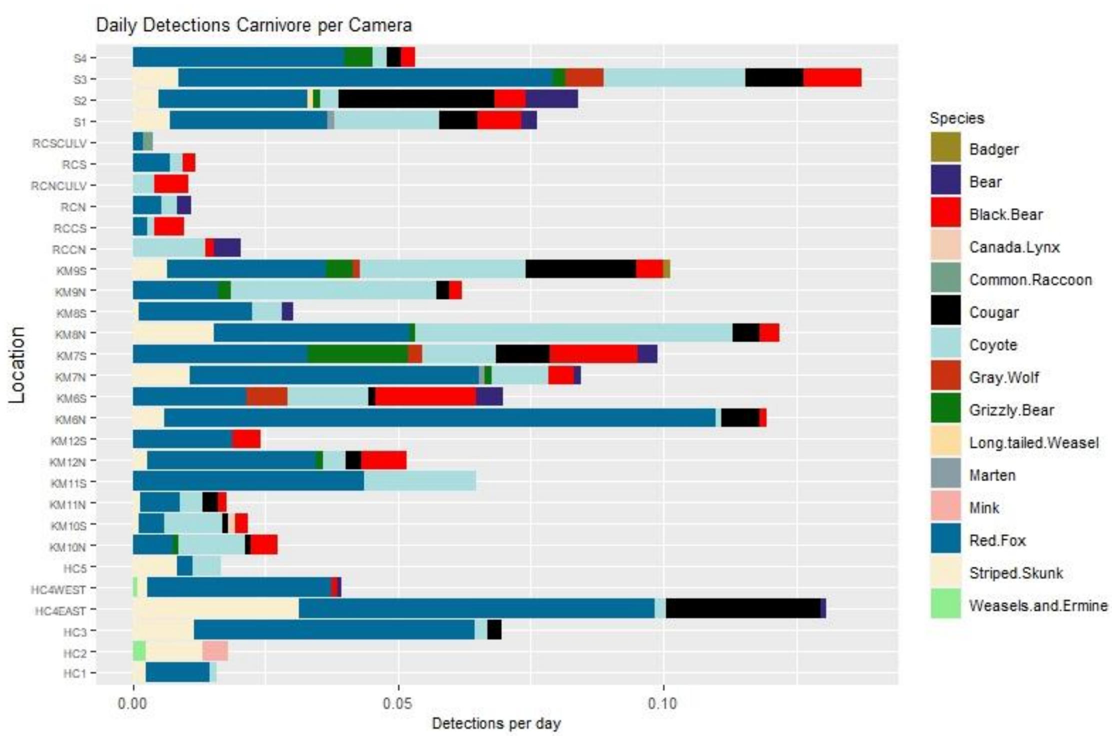


Figure 12: Number of carnivore species detections per day per camera.

When are wildlife using the corridor?

The number of active cameras and detections varied over the study period (Figure 13). We deployed the most active cameras in 2021, but highest level of activity was detected in 2022. Activity in 2020 was lower than 2021 while peak activity occurred in 2022. We observed sharp drops in detections in late fall with peaks in spring and summer in 2021 and 2022. Species detections per 100 camera trap days also varied among years. Several species (Canada lynx, common raccoon, long-tailed weasel, and northern flying squirrel) only appeared on cameras once during the study. Several other species occurred across all years including white-tailed deer, mule deer, elk, moose, cougar, coyote, black bear, striped skunk, and red fox. Species detections per 100 camera trap days also varied across years. Several species only appeared on cameras once across the study period including Canada lynx, common raccoon, long-tailed weasel, and Northern flying squirrel. Several other species occurred across all years of the study including white-tailed deer, mule deer, elk, moose, cougar, coyote, black bear, striped skunk, and red fox (Figure 14 and Figure 15). For ungulate species, bighorn sheep were the only species demonstrating a regular detection pattern across years. They showed distinctive peaks in activity around the beginning of spring in both 2021 and 2022 and another high peak in the fall of 2022 (Figure 15).

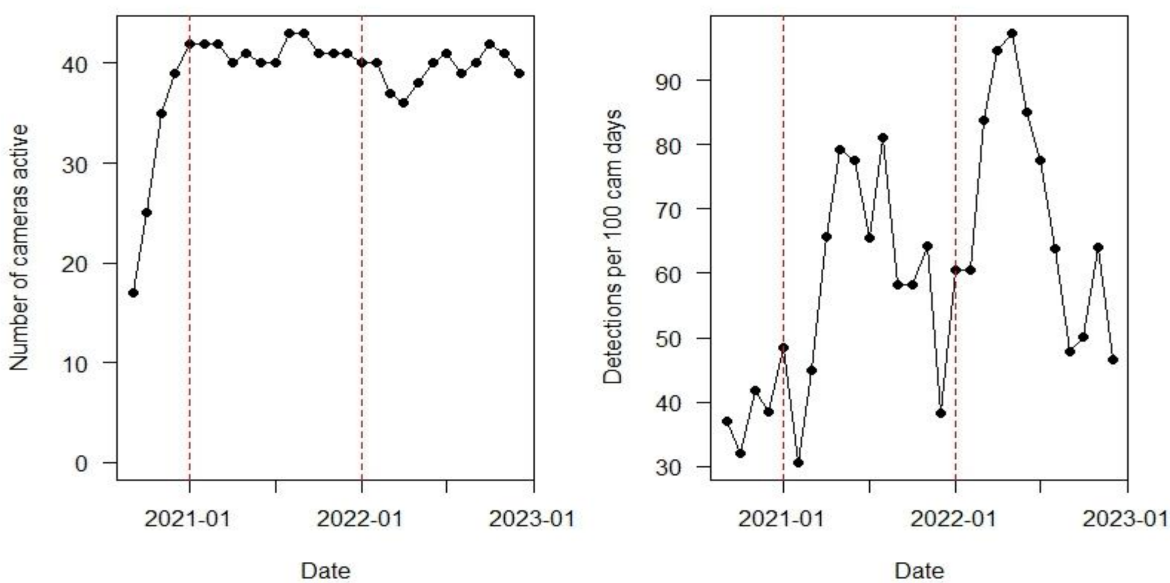
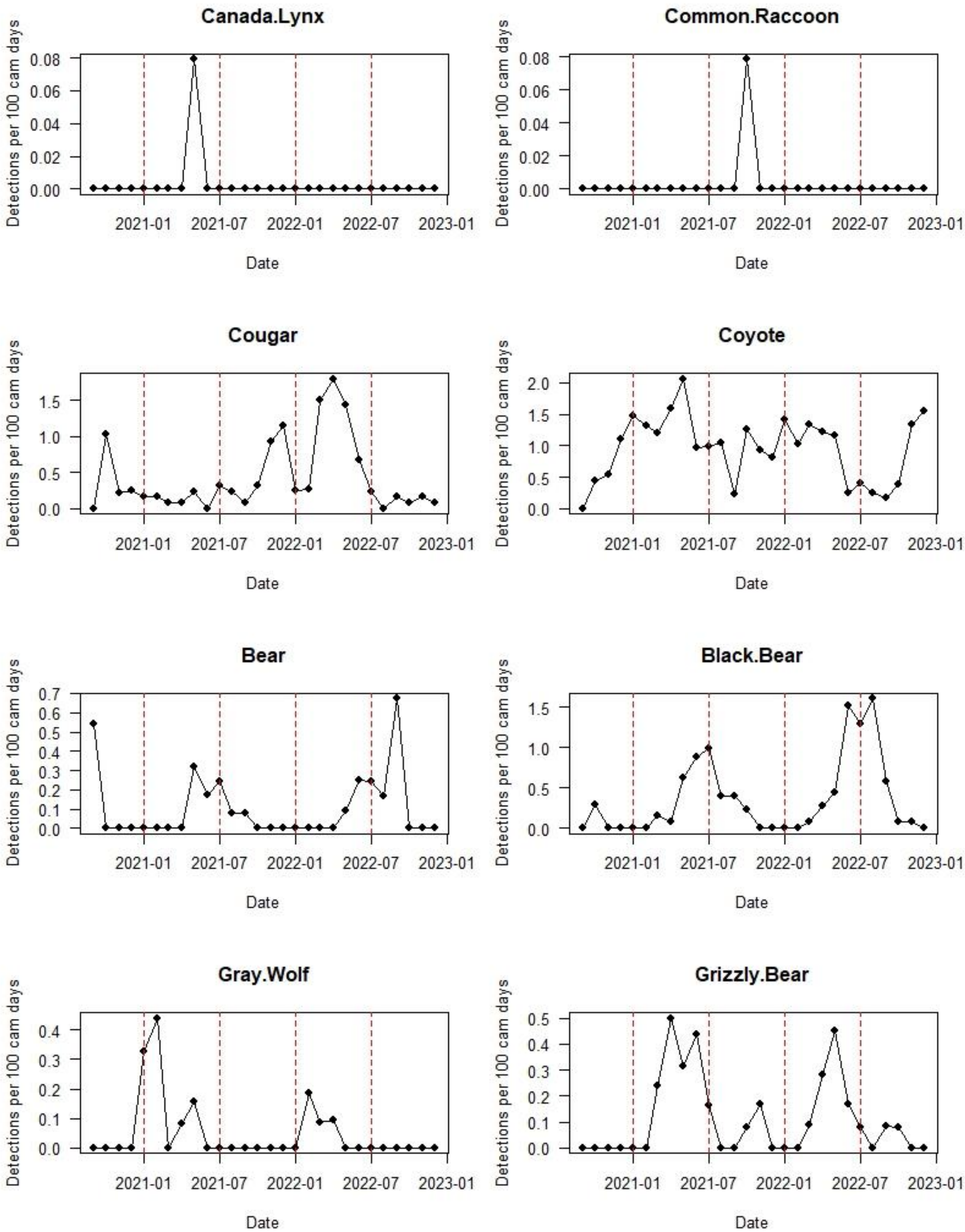


Figure 13: Number of active cameras and camera detections across years. Vertical dotted lines are provided to give a frame of reference for the beginning of each year.


Canada.Lynx
Common.Raccoon
Cougar
Coyote
Bear
Black.Bear
Gray.Wolf
Grizzly.Bear
Detections per 100 cam days
Date
2021-01
2021-07
2022-01
2022-07
2023-01

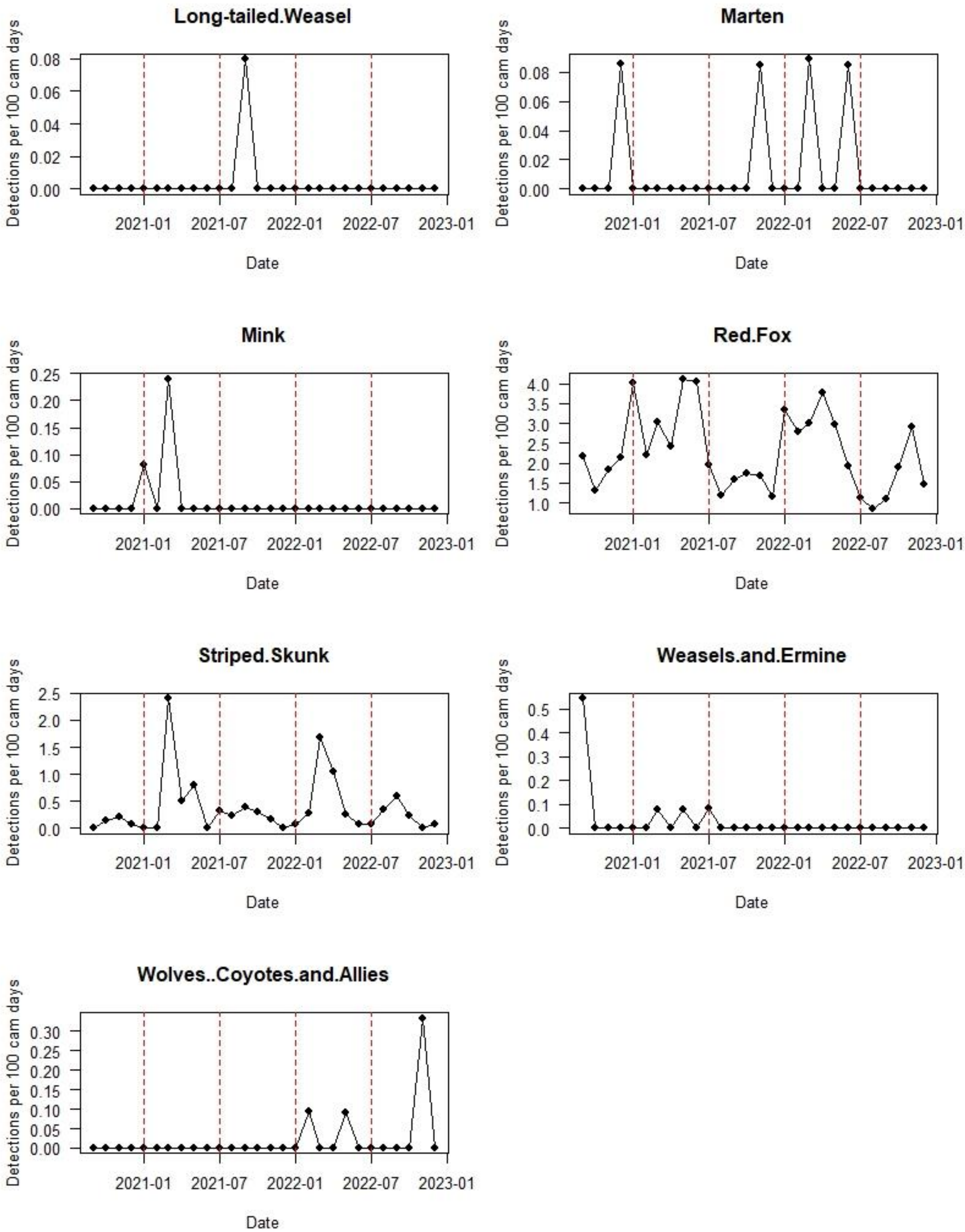


Figure 14: Carnivore detections per 100 camera trap days across years. Vertical dotted lines provide visual reference for six-month periods.

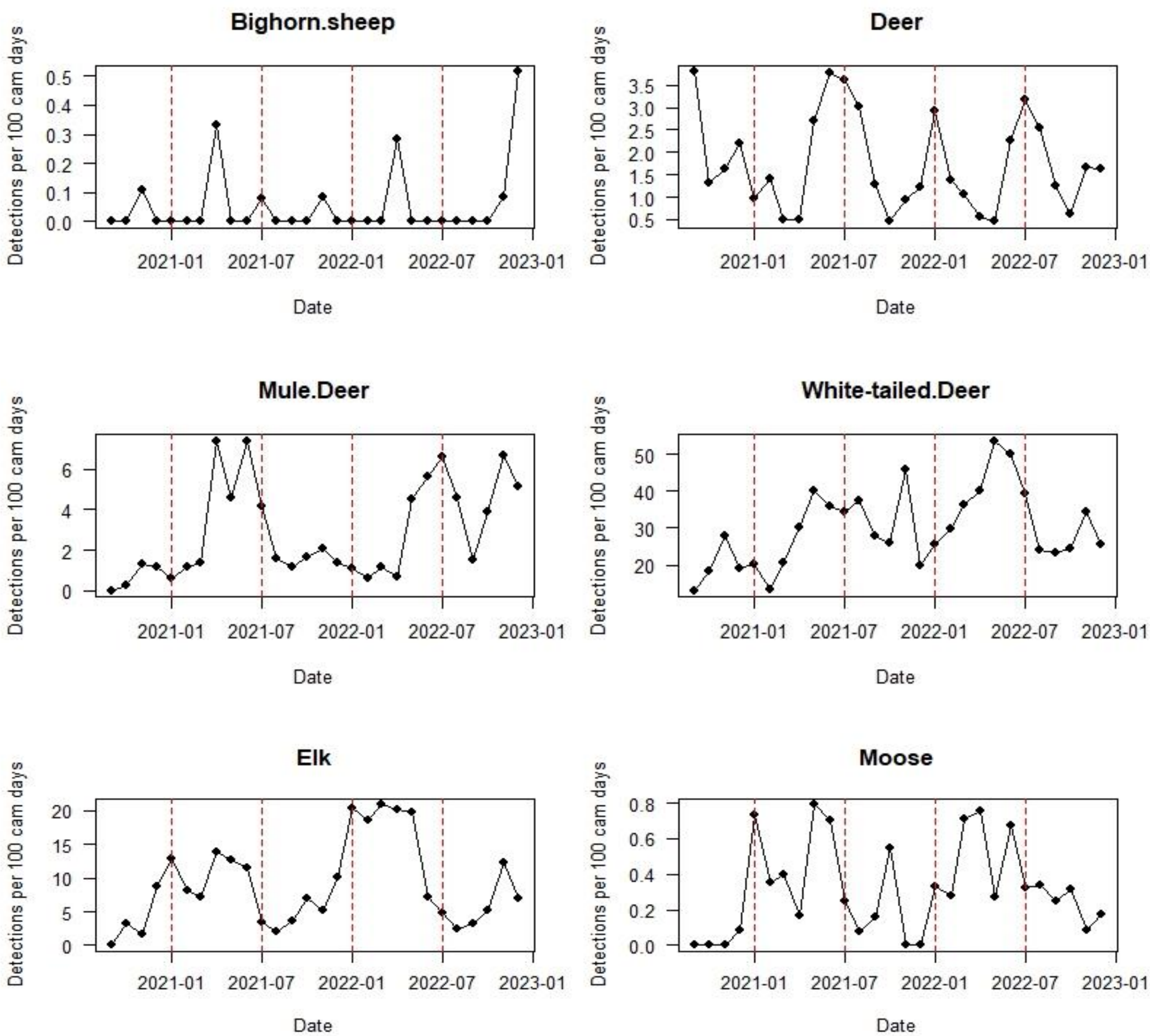


Figure 15: Ungulate detections per 100 camera trap days across years. Vertical dotted lines provide visual reference for six-month periods.

Daily activity patterns

Wildlife activity patterns differ among species and guilds with ungulates tending to be more active during the day compared with carnivores. However, black bear were active throughout the day with a peak between 6am and 9am while red fox and cougar both showed peaks between 6pm and 6am with lulls in activity from 6am to 6pm. Grizzly bear show a distinctive activity peak between 5am and 7am while gray wolf show activity throughout the day with a sharp drop around 6pm. Coyote peak between 11pm and 1am with lower activity between 11am and 5pm (Figure 16).

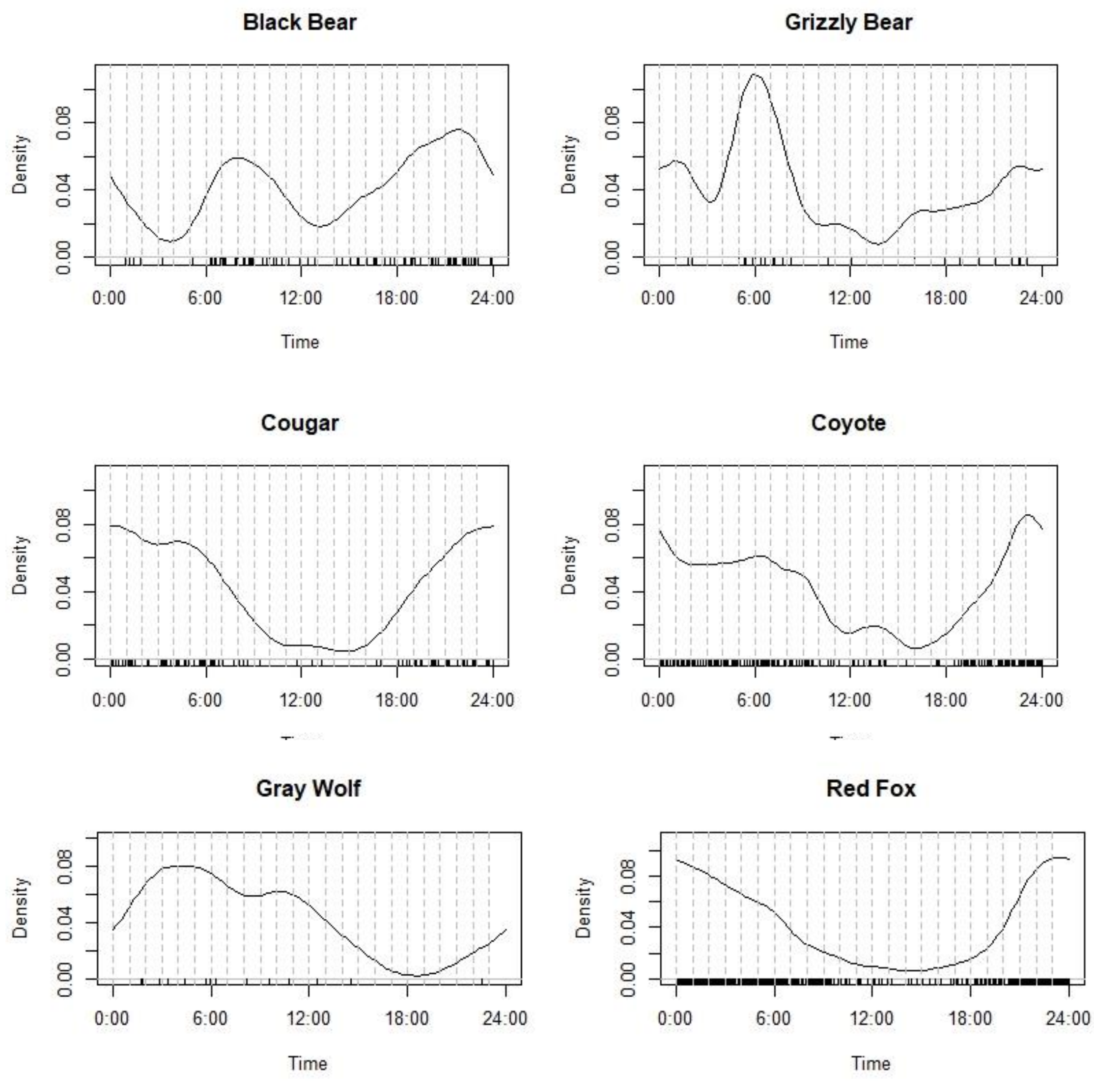


Figure 16: Carnivore daily activity patterns. Each vertical dotted line represents one hour. The density lines along the x axis represents relative detections per hour across the study.

All ungulate species that were detected, except bighorn sheep, showed activity throughout the 24-hour period. Bighorn sheep were not frequently detected on the cameras, but when detected, they occurred between 10am and 3pm. White-tailed deer, mule deer, elk and moose all showed activity throughout the day but elk showed a lull in activity between 10am and 4pm. Mule deer peaked between 6am and 8am while white-tailed deer have two peaks: between 7am and 10am and again between 6am and 8pm (Figure 17).

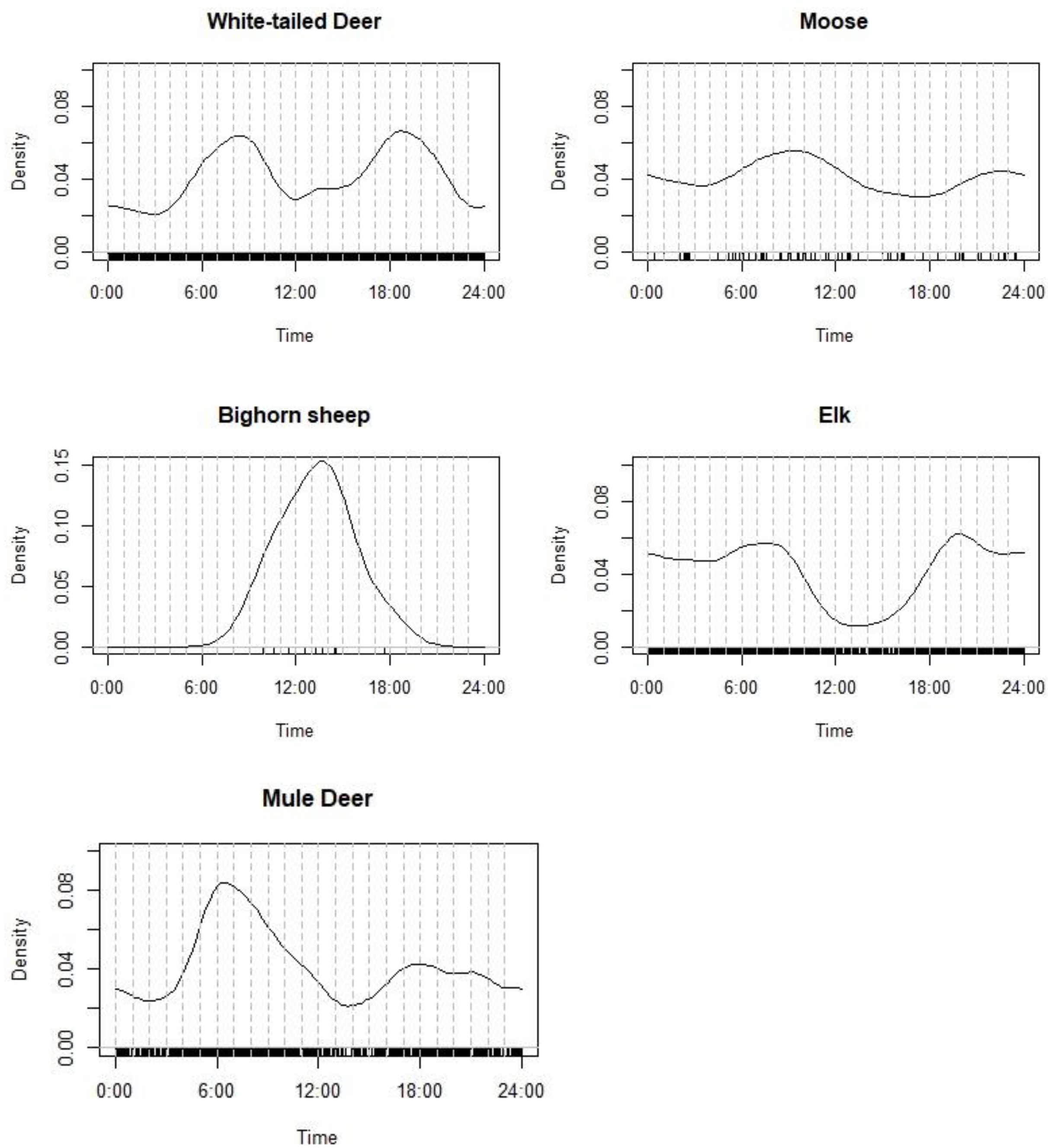


Figure 17: Ungulate daily activity patterns. Each vertical dotted line represents one hour. The density lies along the x-axis represents relative detections per hour across the study.

Jim Prentice Wildlife Corridor (JPWC)

Twenty-four cameras were set up in the Jim Prentice Wildlife Corridor, both along and away from the highway between September 1, 2020, and January 1, 2023 (Figure 18).

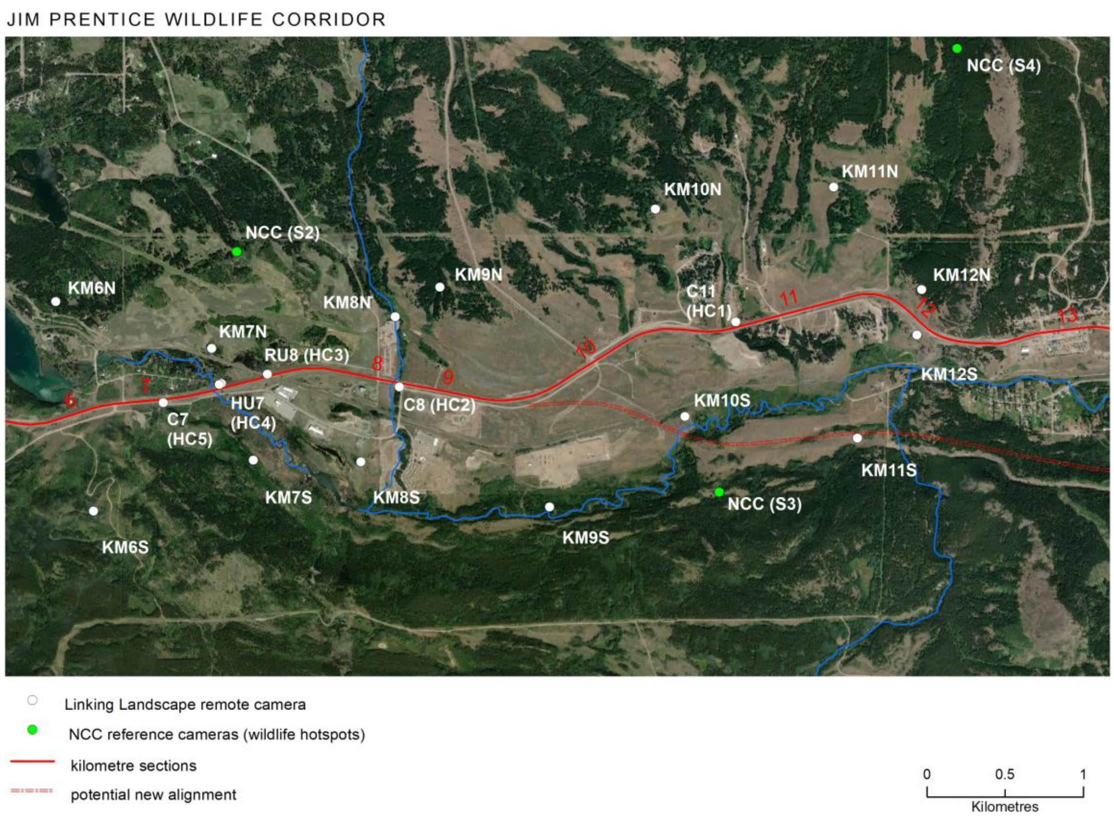


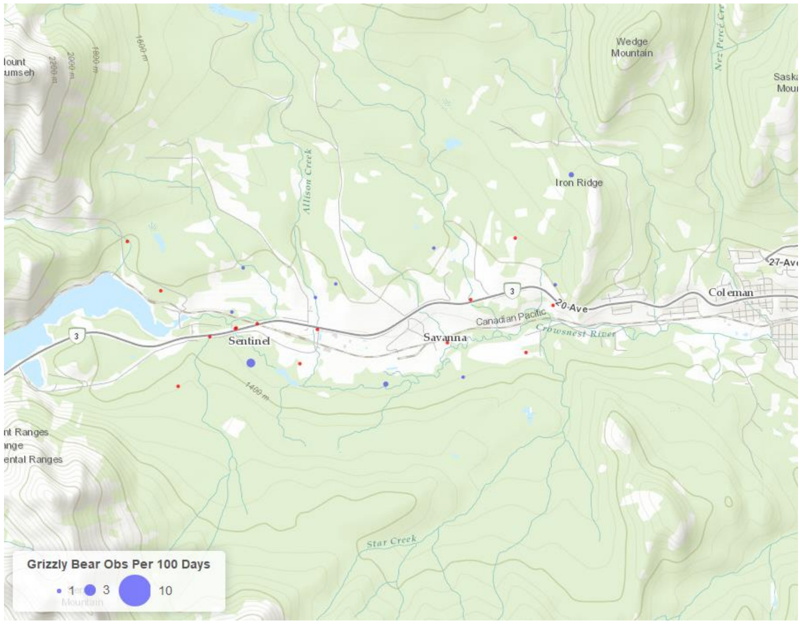
Figure 18: Jim Prentice Wildlife Corridor remote camera placement (for cameras at highway crossing infrastructure both camera number and crossing infrastructure name are displayed) and highway kilomere numbers (in red).

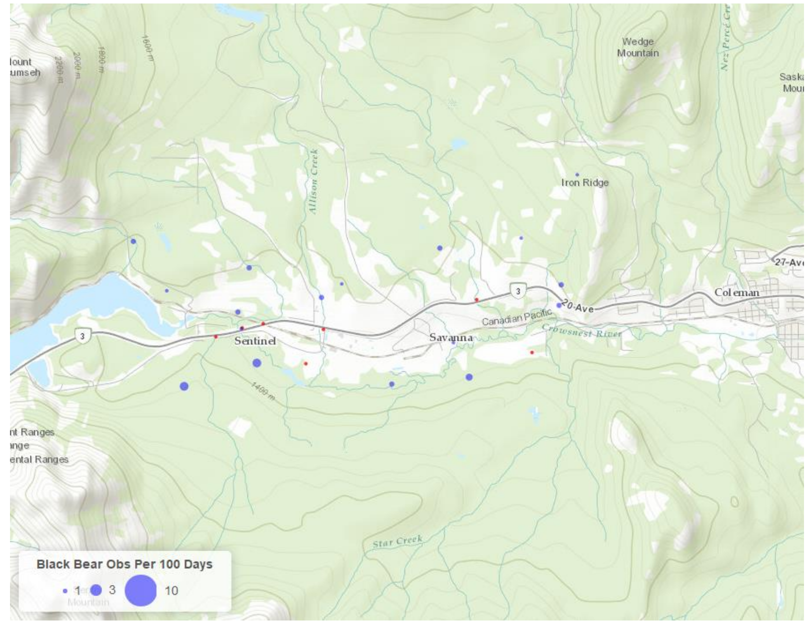
In the JPWC, we measured a combined total of 13,060 detections of humans, domestic species and wildlife (Table 6). Domestic species included dog, cat, cow, and horse representing a total of 638 (5%) of detections. Humans on foot, ATVs and heavy equipment represented an additional 2,139 (16%) of all detections. The remaining 10,283 (79%) detections were wildlife species including black bear, grizzly bear, badger, bighorn sheep, Canada lynx, cougar, coyote, white-tailed deer, mule deer, elk, gray wolf, marten, mink, long-tailed weasel, moose, red fox, northern flying squirrel and striped skunk. Canada Lynx, badger, northern flying squirrel and long-tailed weasel were only detected once during the study.

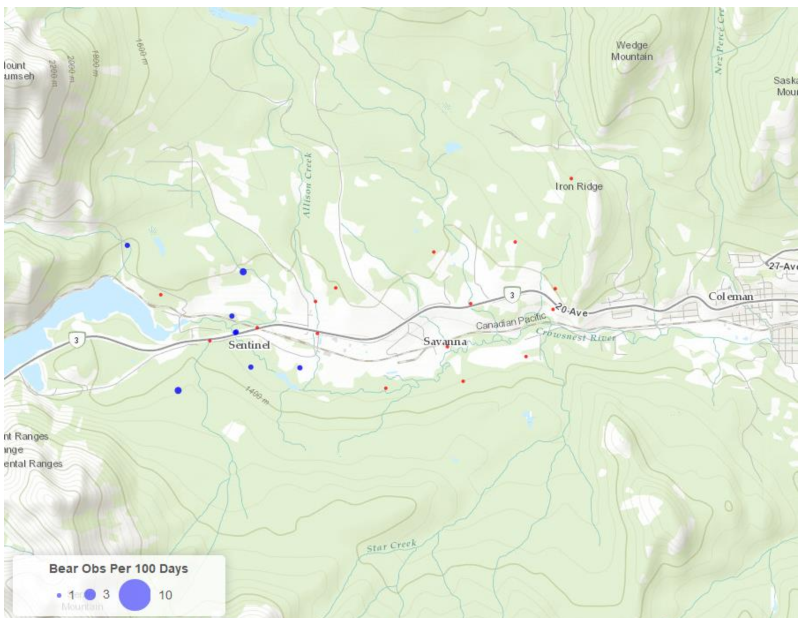
Camera placements allowed us to analyze spatial activity patterns for carnivore and ungulate species in the study area (Figure 19 and Figure 20; for additional species and human activity maps, see Appendix B). Most species were detected on both the north and south side of the highway, except for gray wolf which was only detected on the south side of the Highway.

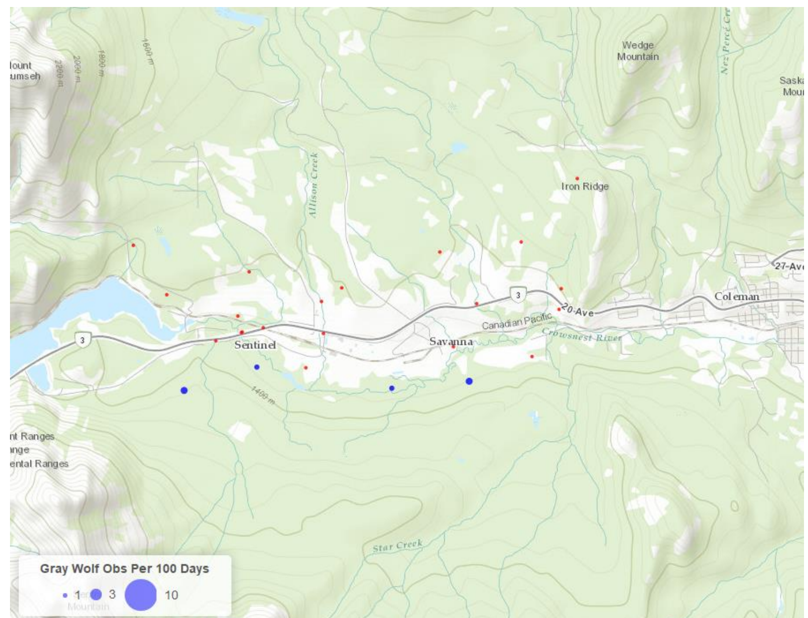
Table 6: Species detections in the Jim Prentice Wildlife Corridor September 1, 2020, to January 1, 2023

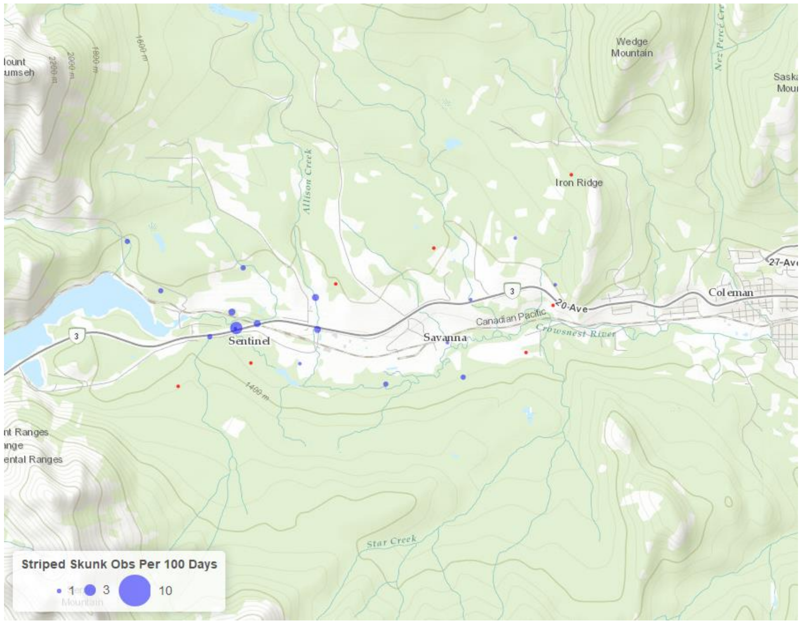
Species	Number of Detections	Percent Detections
White-tailed deer	6425	49.20
Elk	1877	14.37
Human	1578	12.08
Red fox	617	4.72
Heavy equipment	520	3.98
Domestic cow	387	2.96
Mule deer	365	2.79
Unidentified Deer	301	2.30
Coyote	230	1.76
Domestic dog	187	1.43
Cougar	110	0.84
Striped skunk	105	0.80
Black bear	82	0.63
Moose	66	0.51
Domestic cat	53	0.41
All Terrain Vehicle	41	0.31
Grizzly bear	30	0.23
Bear	22	0.17
Gray wolf	15	0.12
Beaver	14	0.11
Domestic horse	11	0.08
Bighorn sheep	10	0.08
Mink	4	0.03
Weasels and Ermine	3	0.02
Marten	2	0.02
Badger	1	0.01
Canada lynx	1	0.01
Long-tailed weasel	1	0.01
Northern flying squirrel	1	0.01
Wolves, Coyotes, and Allies	1	0.01

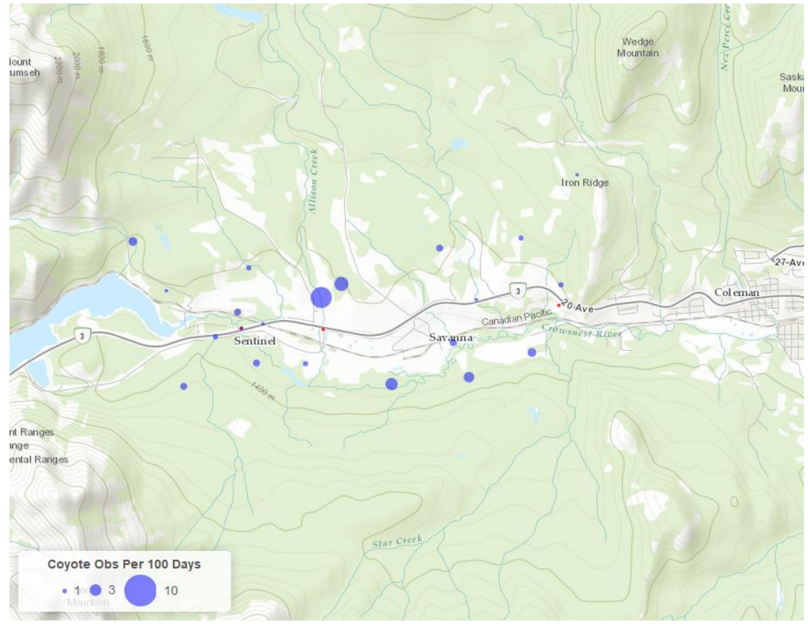

Grizzly Bear Obs Per 100 Days
1
3
10
Wedge Mountain
Iron Ridge
Coleman
Sentinel
Savanna
Canadian Pacific
Crowsnest River
Allison Creek
Star Creek
20 Ave
27 Ave

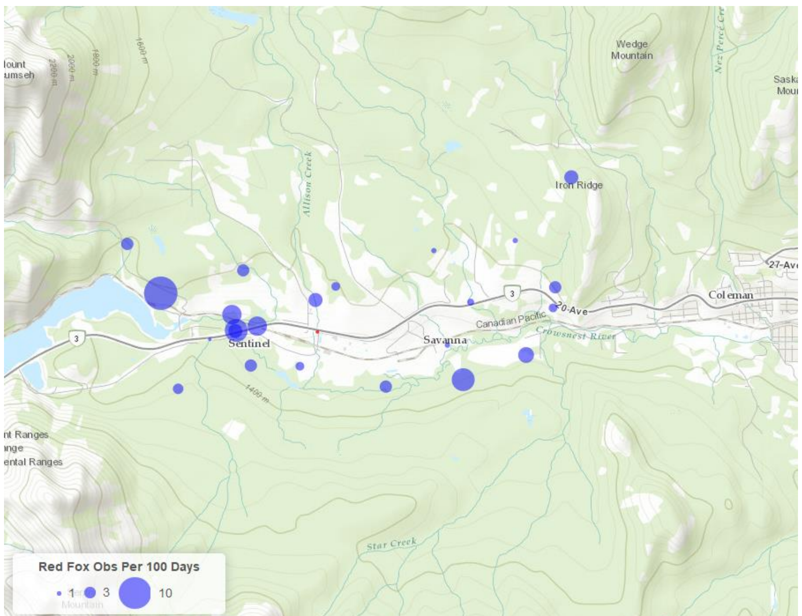

Black Bear Obs Per 100 Days
1
3
10
Wedge Mountain
Iron Ridge
Coleman
Sentinel
Savanna
Canadian Pacific
Crowsnest River
Allison Creek
Star Creek
20 Ave
27 Ave

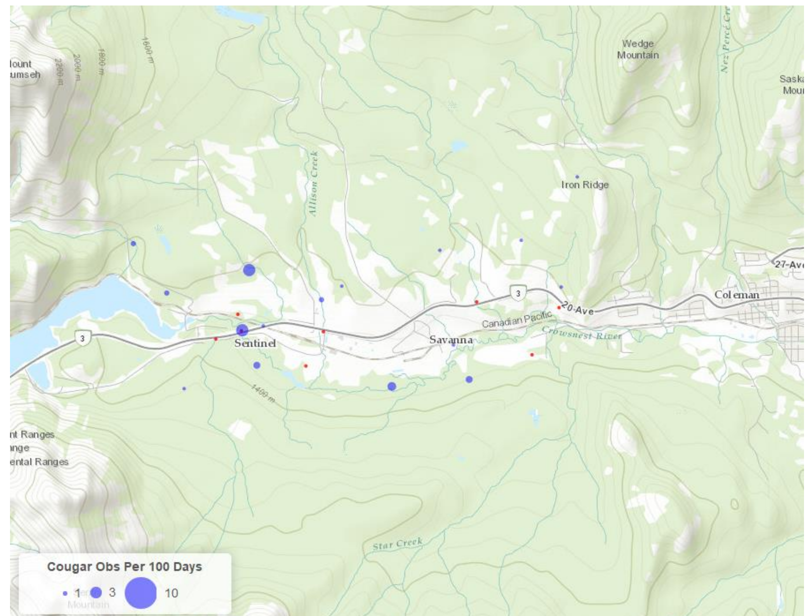

Bear Obs Per 100 Days
1
3
10
Wedge Mountain
Iron Ridge
Coleman
Sentinel
Savanna
Canadian Pacific
Crowsnest River
Allison Creek
Star Creek
20 Ave
27 Ave


Gray Wolf Obs Per 100 Days
1
3
10
Wedge Mountain
Iron Ridge
Coleman
Sentinel
Savanna
Canadian Pacific
Crowsnest River
Allison Creek
Star Creek
20 Ave
27 Ave


Striped Skunk Obs Per 100 Days
1
3
10
Wedge Mountain
Iron Ridge
Allison Creek
Sentinel
Savanna
Coleman
Canadian Pacific
20 Ave
27-Ave
Crowsnest River
Star Creek
3


Coyote Obs Per 100 Days
1
3
10
Wedge Mountain
Iron Ridge
Allison Creek
Sentinel
Savanna
Coleman
Canadian Pacific
20 Ave
27-Ave
Crowsnest River
Star Creek
3


Red Fox Obs Per 100 Days
1
3
10
Wedge Mountain
Iron Ridge
Allison Creek
Sentinel
Savanna
Coleman
Canadian Pacific
20 Ave
27-Ave
Crowsnest River
Star Creek
3


Cougar Obs Per 100 Days
1
3
10
Wedge Mountain
Iron Ridge
Allison Creek
Sentinel
Savanna
Coleman
Canadian Pacific
20 Ave
27-Ave
Crowsnest River
Star Creek
3

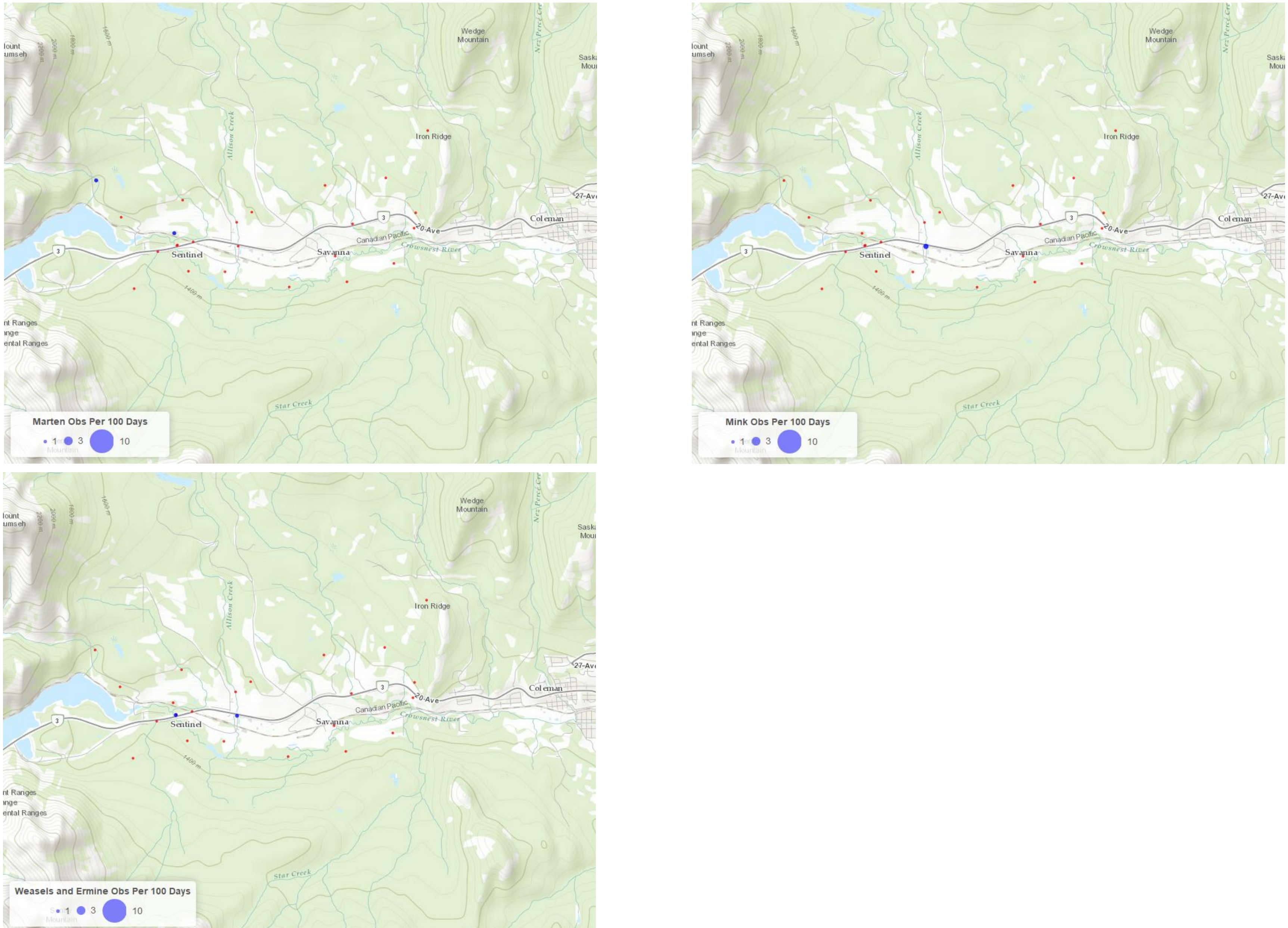


Figure 19: Carnivores detected on remote cameras per 100 camera trap days. Red dots show camera locations where carnivore species were not detected.

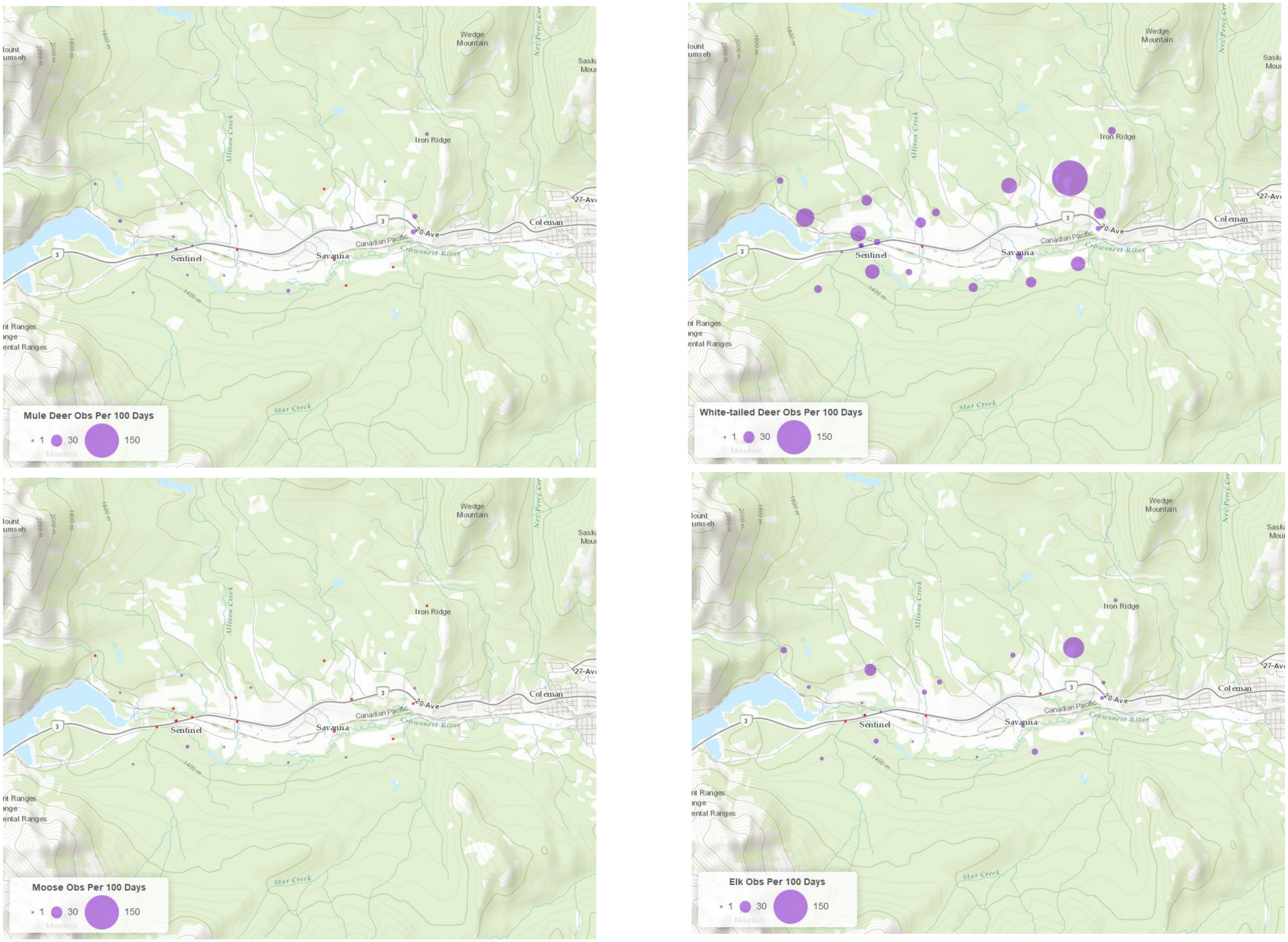


Figure 20: Ungulates detected on remote cameras per 100 camera trap days. Red dots indicate camera locations where ungulate species were not detected.

Rock Creek

Six cameras were set up in the Rock Creek area both adjacent to and away from the highway between September 1, 2020, and January 1, 2023 (Figure 21).

Figure 21: Rock Creek Corridor remote camera locations along Highway 3.

We documented 1323 detections in the Rock Creek Corridor during the study including humans, domestic species, and wildlife (Table 7). Domestic species detected included cat, dog, and cow. Human activity was much lower in Rock Creek compared to the JPWC and there was no heavy equipment or ATVs detected. Mule deer were the most common wildlife species detected (469 detections [35%]) and common raccoon was the least with only one detection during the study.

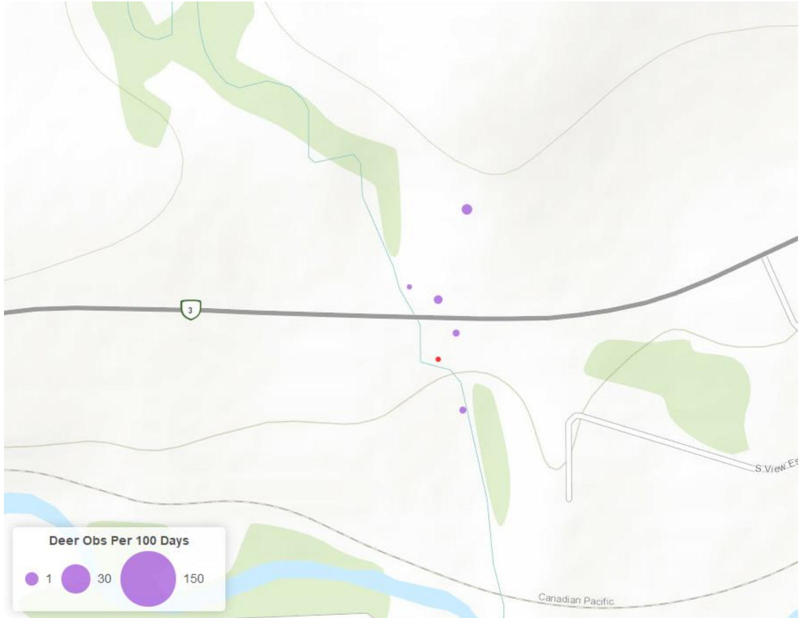
Table 7: Species detections across 6 cameras in Rock Creek between September 1, 2020, and January 1, 2023.

Species	Number of Detections	% Detections
Mule deer	469	35.45
White-tailed deer	360	27.21
Domestic cow	216	16.33
Deer	126	9.52
Human	98	7.41
Coyote	14	1.06
Red fox	10	0.76
Black bear	9	0.68
Bear	5	0.38
Moose	5	0.38
Domestic dog	4	0.30
Domestic cat	3	0.23
Elk	3	0.23
Common raccoon	1	0.08

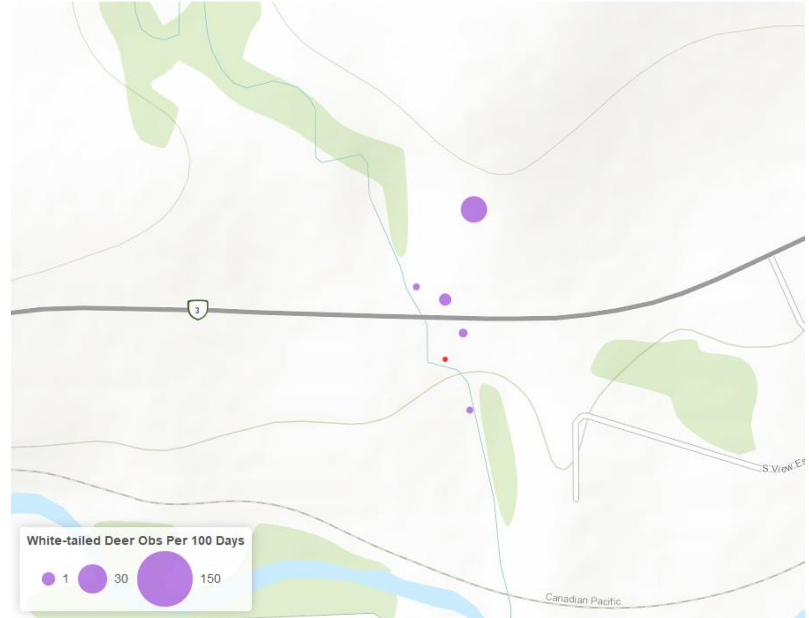
Species detected on cameras in Rock Creek include mule deer, red fox, white-tailed deer, black bear, and coyote. Species detected on control cameras (500 m from the highway) but not on highway crossing infrastructure cameras, included elk, raccoon, and moose. Several species that were detected on cameras in the JPWC were absent from all Rock Creek cameras during the study — badger, cougar, Canada lynx, grizzly bear, gray wolf, long-tailed weasel, marten, mink, striped skunk, and rodents (porcupine and beaver). However, grizzly bear were recently detected on a remote camera on the south side of the highway after our study was concluded.

In the Rock Creek Corridor, all species that we captured on camera were detected on both sides of Highway 3 (Figure 22 and Figure 23; for additional species and human activity maps, see Appendix B).

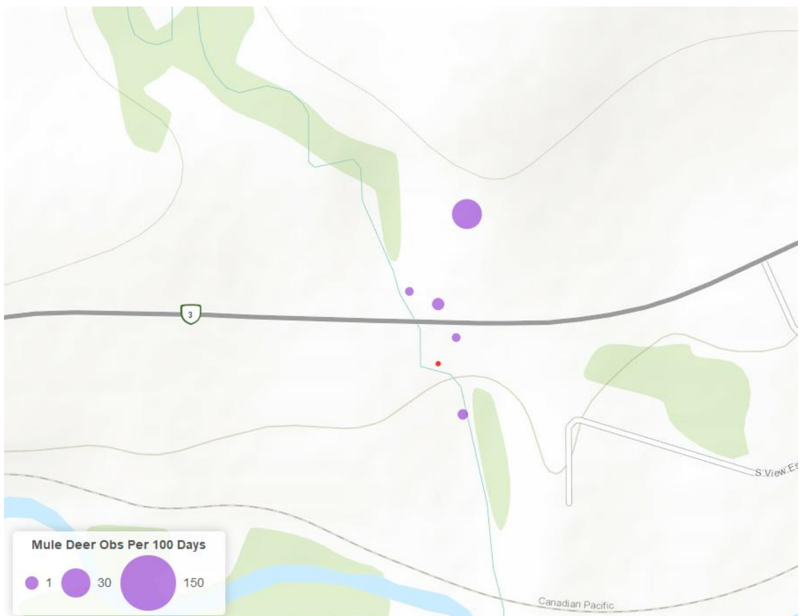
Figure 22: Carnivores detected per 100 camera trap days. Red dots represent camera locations with no carnivore detections.



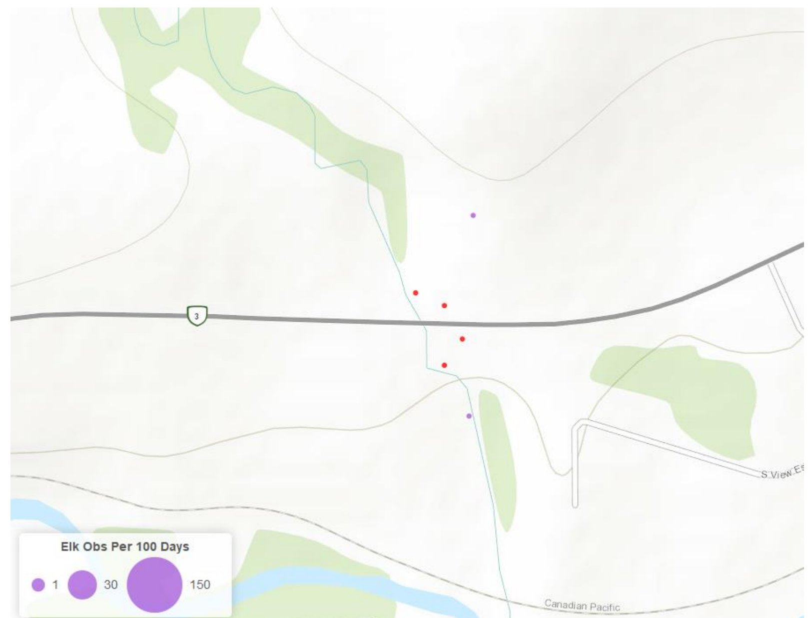
3
S View Es
Canadian Pacific
Deer Obs Per 100 Days
1
30
150



3
S View Es
Canadian Pacific
White-tailed Deer Obs Per 100 Days
1
30
150



3
S View Es
Canadian Pacific
Mule Deer Obs Per 100 Days
1
30
150



3
S View Es
Canadian Pacific
Elk Obs Per 100 Days
1
30
150

Figure 23: Ungulates detected per 100 camera trap days. Red dots represent camera locations with no ungulate detections.

Wildlife Activity at Highway Crossing Infrastructure

Activity across the study area was not uniform with some areas experiencing substantially higher levels of overall species detections. Comparing kilometre sections with highway crossing infrastructure with control sites provides insights into potential causes of this activity variation for both carnivores and ungulates (Figure 24 and Figure 25). We found more carnivore detections per day on control cameras at kilometre sections 6, 8, 9–12, and 39 compared to sections with highway crossing infrastructure. The exception was kilometre 7, where the highway underpass (Crowsnest River Bridge) had more detections than the control cameras. For the carnivores, the most used crossing structure was the highway underpass located in kilometre 7 (Crowsnest River Bridge), followed by the railway underpass located in kilometre 8 (Figure 24). This included detections of larger carnivore species such as black bear and cougar. All cameras in the JPWC near culverts (C11, C7, and C8) had few carnivore detections but included smaller species such as striped skunk, red fox, mink, coyote, and weasel spp. Cameras near the Rock Creek culvert (C39) detected back bear and smaller species such as red fox, coyote, and racoon. Grizzly bear were not observed at any highway crossing infrastructure.

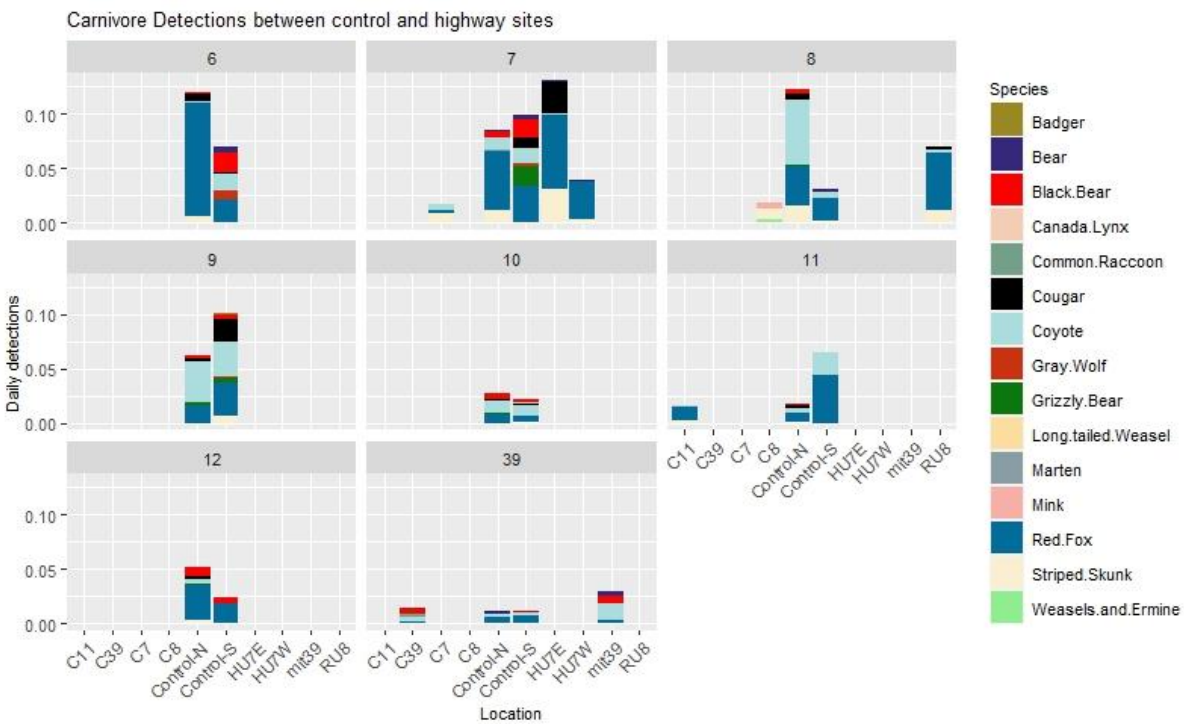


Figure 24: Carnivore detections per day per kilometre north and south of the highway, and at highway crossing infrastructure (per kilometre). Not all kilometre sections had highway crossing infrastructure (note on the labels, C = culvert [only in kilometre 7, 8, 11, and 39], HU = highway underpass [only in kilometre 7], RU = railway underpass [only in kilometre 8]). Mit39 = the proposed road mitigation site (underpass) at Rock Creek.

For the ungulates, the most used highway crossing structure was the railway underpass located in kilometre 8, followed by the highway underpass located in kilometre 7 (Crowsnest River Bridge). At both of these sites deer (white-tailed and mule) and elk were detected. All cameras in the JPWC near culverts (C11, C7, and C8) had few ungulate detections but included deer.

Cameras near the Rock Creek culvert (C39) detected deer. The proposed Rock Creek Road mitigation site (underpass) had the highest number of daily detections of deer. Moose were not detected on any cameras near highway crossing infrastructure.

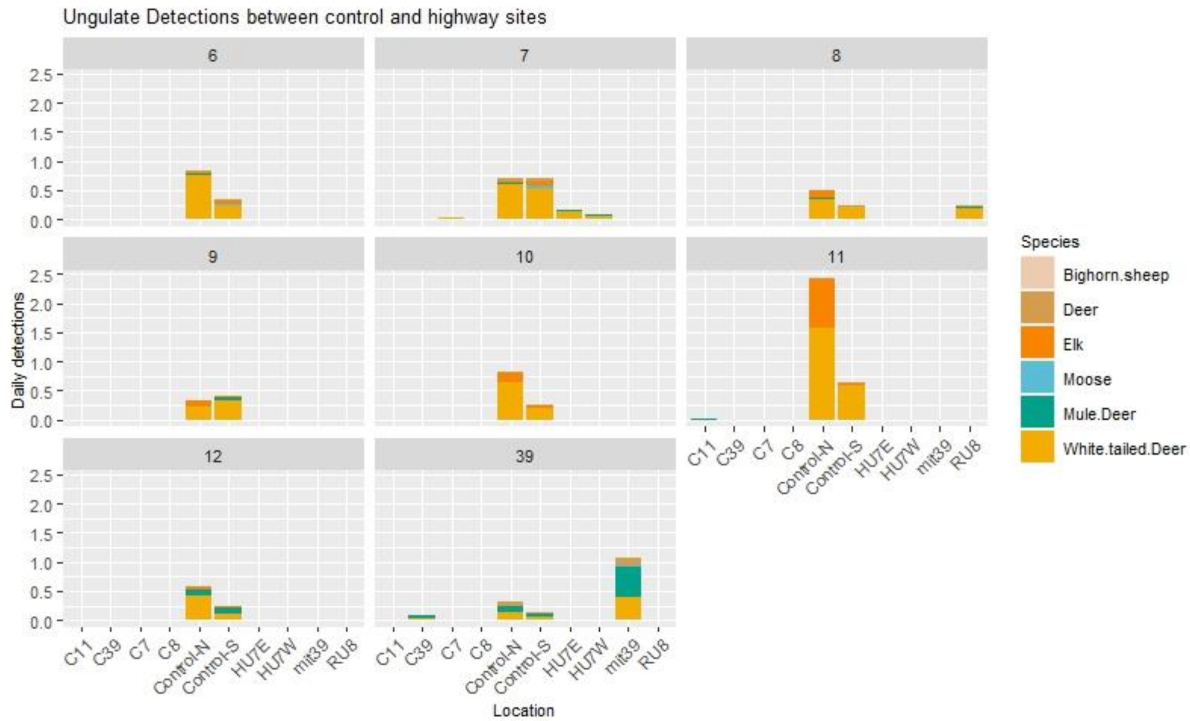


Figure 25: Ungulate detections per day per kilometre on control camera north and south of the highway, and at highway crossing infrastructure. Not all kilometre sections had highway crossing infrastructure (note on the labels, C = culvert [only in kilometre 7, 8, 11 and 39], HU = highway underpass [only in kilometre 7], RU = railway underpass [only in kilometre 8]). Mit39 = the proposed road mitigation site (underpass) at Rock Creek.

Successful use of highway crossing infrastructure

While many species were detected on cameras near the road, not all species were found using the highway crossing infrastructure to successfully cross to the opposite side of the highway. We therefore classified wildlife detected on remote cameras into three categories: present (no attempt to cross), successful crossing (entered crossing infrastructure and did not return for at least five minutes) and unsuccessful (attempted to cross but returned within five minutes). Most wildlife detections near road infrastructure were classified as “present only” meaning they did not attempt to cross the highway (Figure 26).

For wildlife that did attempt to use the highway crossing infrastructure, success varied by crossing structure type. Crossings at the railway and highway underpasses (Crowsnest River Bridge) were the most successful. The highway underpass was used successfully by white-tailed deer, striped skunk, red fox, mule deer, coyote and cougar. Elk were detected on camera at this location but did not successfully cross. At the railway underpass (RU8), white-tailed deer, red fox, mule deer and cougar successfully crossed while elk were detected on camera but did not successfully cross. Wildlife are generally not using the culverts to cross, with the exception of culvert (C8) where weasels, striped skunk and mink were all detected successfully crossing

(Figure 27). Species detected at the Rock Creek highway mitigation site at kilometre 39 included mule deer and black bear but neither were detected successfully crossing using the culvert.

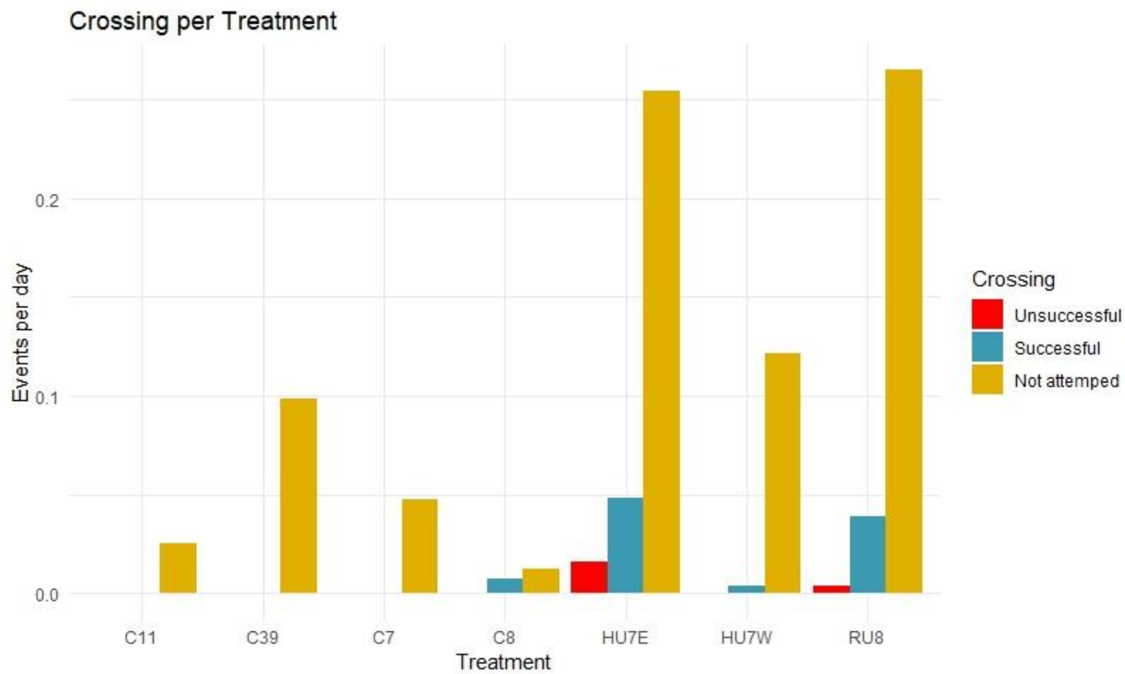


Figure 26: Wildlife presence, unsuccessful, and successful crossings using existing road infrastructure.

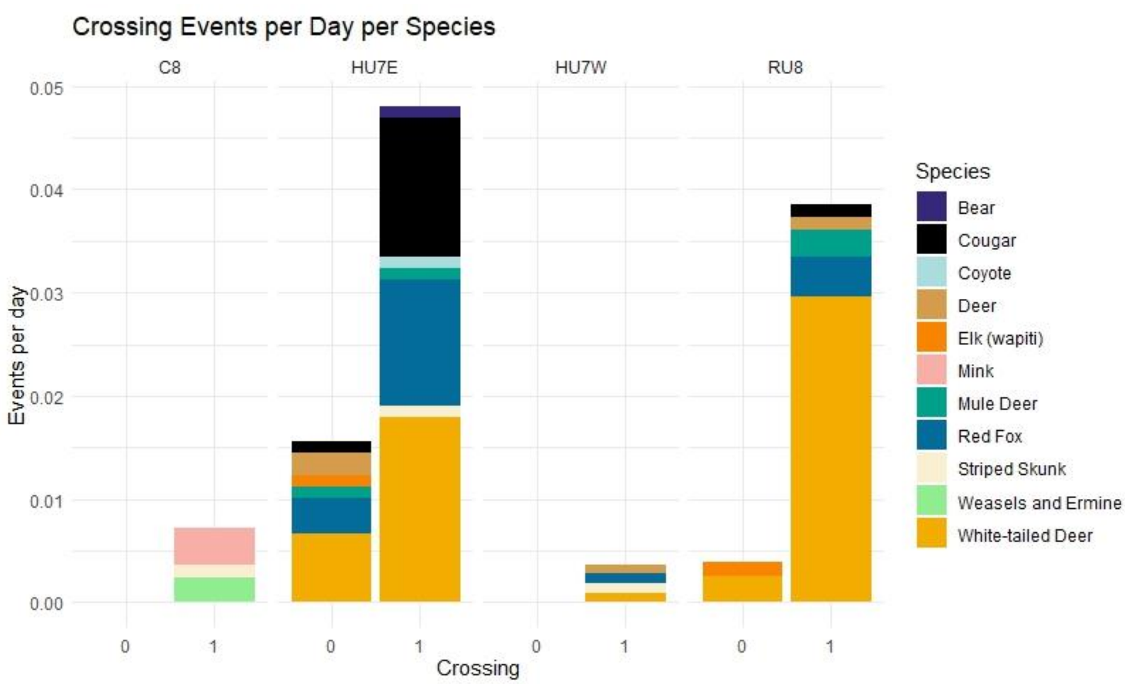


Figure 27: Successful vs. unsuccessful use of road mitigation infrastructure by species. 0 = unsuccessful crossing and 1 = successful crossing.

Discussion

In the 27 months between September 1, 2020, and January 1, 2023, we detected a wide diversity of species in the landscape around the Western Highway 3 Transportation Corridor. Many were detected on both control cameras (away from the highway corridor) as well as near highway crossing infrastructure. These included white-tailed deer, mule deer, elk, red fox, cougar, coyote, and black bear. Interestingly, grizzly bear, Canadian lynx, bighorn sheep, badger, and wolf were detected on control cameras but not on cameras at highway crossing infrastructure.

Species of large mammals (deer, coyote, cougar, and bear) are using the railway underpass and a highway underpass (Crowsnest River Bridge) to successfully cross Highway 3. Results demonstrate that wildlife are active near highway crossing infrastructure but not all species are able to successfully cross. Elk were detected near the railway and highway underpass but were not seen successfully crossing using the existing infrastructure during the study. A bear species that we couldn't positively identify was detected crossing at the highway underpass.

Culverts in the study areas are small in diameter and so only allowed minimal crossing activity from small species like skunk, weasel, and mink.

Currently there is no fencing along these stretches of Highway 3 to help direct wildlife to safe crossing opportunities. An existing Highway 3 underpass (Crowsnest River bridge) at kilometre 7 should be considered for modification to better encourage safe wildlife movement — the addition of fencing would facilitate movement to this crossing infrastructure.

Wildlife Connectivity and Corridors

A key consideration for maintaining healthy wildlife populations is to ensure wildlife are able to move through the landscape to access critical resources. To contextualize our findings of wildlife movement along the Highway 3 corridor, we modeled ecological connectivity and delineated ecological corridors to inform conservation planning and decision-making. Ecological connectivity, or the unimpeded movement of species and the flow of natural processes that sustain life on earth, can be disrupted, degraded, and fragmented by human activity. Ecological corridors are a clearly defined geographical space that is governed and managed over the long-term to maintain and/or restore effective ecological connectivity (Hilty et al., 2020).

Ecological Corridors

In 2016, ecological corridors that would be effective for large terrestrial mammals were identified in the Municipal Districts of Crowsnest Pass and Pincher Creek (Figure 28). Corridors were identified through multi-stakeholder engagement that included scientists, provincial and local government staff, and ENGOs. Existing research on target species (elk (Benz et al., 2016), bighorn sheep, wolverine, and grizzly bear (Braid and Nielsen, 2015; Chetkiewicz and Boyce, 2009)) was used to identify important land parcels that link the protected areas to the north and south of Highway 3 (Miistakis Institute, 2016). It is important to note that many of the areas within the corridors are not only important movement corridors, but also seasonal habitat for target species. For example, the JPWC and components of the Rock Creek Corridor are important elk winter range such that additional loss of habitat in this corridor would be detrimental to maintaining healthy elk populations even if elk were able to move through the landscape (Figure 29).

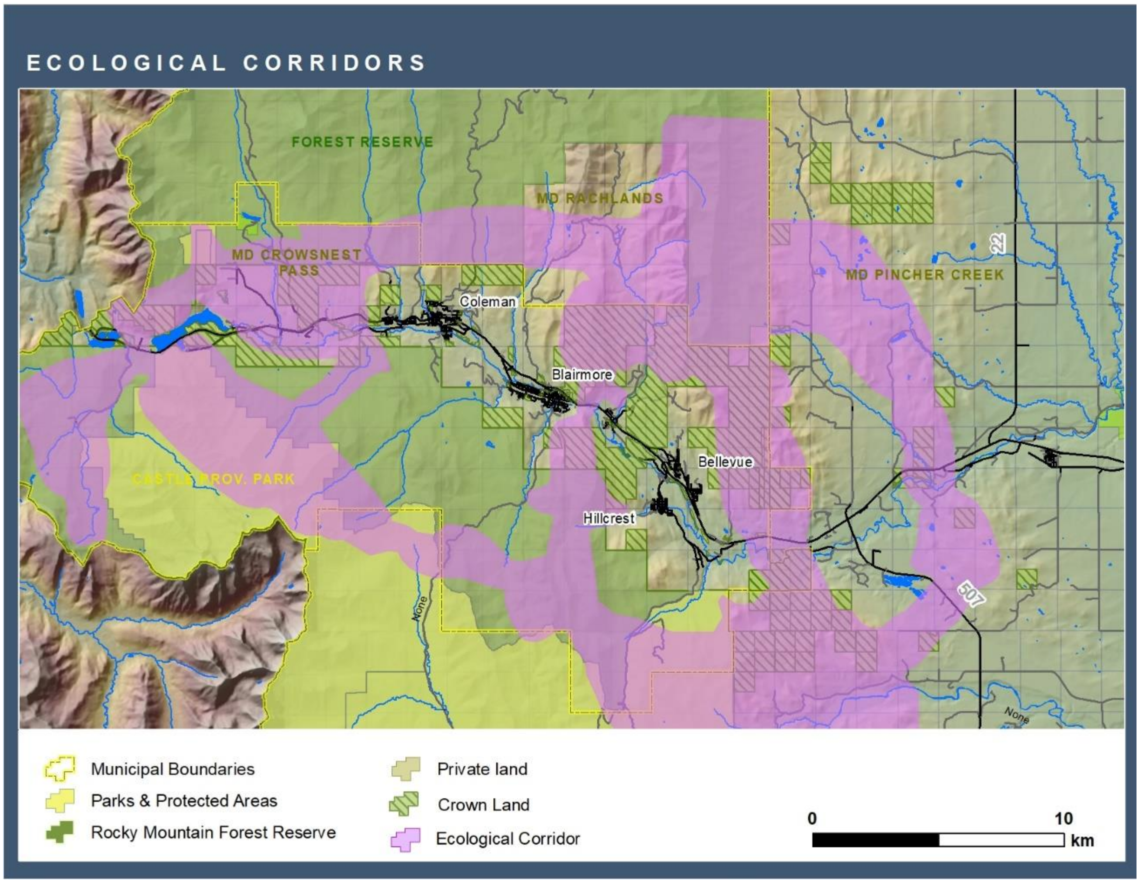


Figure 28: Ecological Corridors in the Western Transportation Corridor.

Elk are a key species of interest in the JPWC as this region contains important winter range habitat and also calving areas. Elk are also killed by AVCs in this corridor. Like grizzly bear, elk require large areas seasonal habitat to have sufficient resources to sustain them throughout the year — their habitat needs tend to differ between summer and winter ranges.

Elk winter range occurs throughout the study area (Figure 29). Within the JPWC there is a potential area of concern for both motorist and elk safety where elk are more likely to frequently cross to access winter habitat. In our study, elk were using existing road crossing infrastructure to cross safely, suggesting a new structure or modification of existing structure is needed to better assist elk movement.

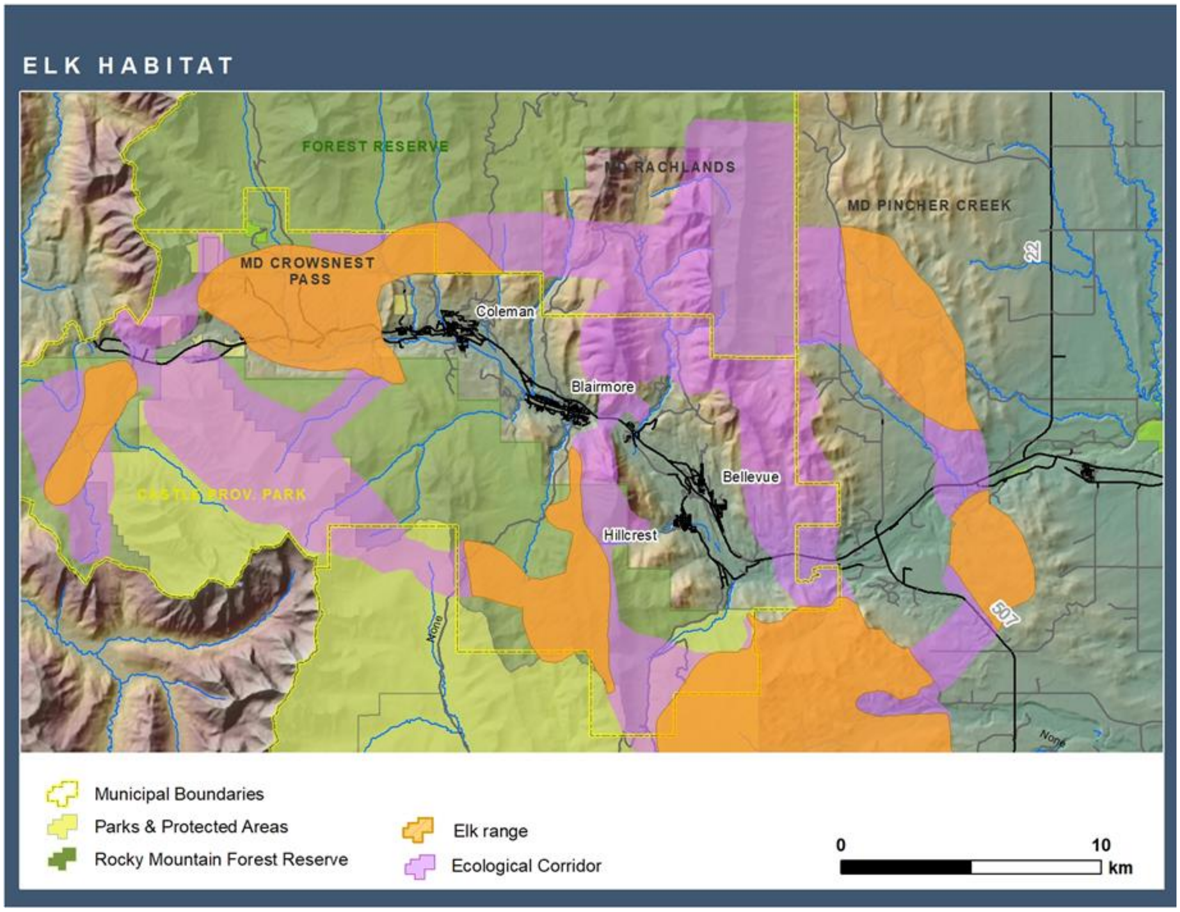


Figure 29: Elk winter range (orange) in the Western Highway 3 Transportation Corridor

Grizzly Bear connectivity modeling

Lamb and Palm, (2023)recently developed a grizzly bear connectivity model based on GPS collared data (2000–2020) from British Columbia and Alberta. Modeling generated an expected annual grizzly bear utilization distribution, using simulations from three seasonal integrated step selection models (spring, summer, fall). The model predicted relative spatial probability of grizzly bear use of the whole landscape along a scale from low (value of 1) to high (value of 11) use probability (Figure 30; (Lamb and Palm, 2023)).

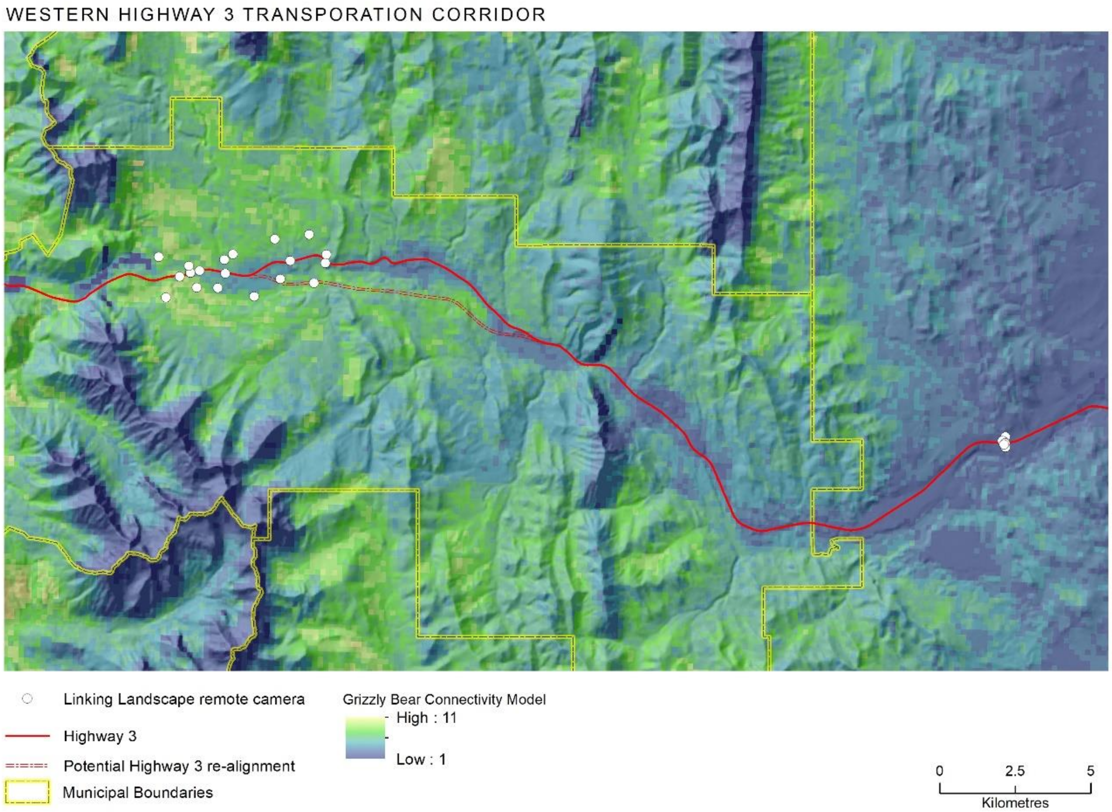


Figure 30: Grizzly Bear connectivity model. Yellow represents high probability of grizzly bear use and movement in this colour ramp and blue is a low probability of grizzly bear use and movement.

Within the JPWC, the most probable crossing locations for grizzly bear based on new modeling supports existing highway mitigation sites identified in the Clevenger et al. (2010) report. Habitat quality varies throughout the corridor with high quality patches on both sides of the highway (Figure 31). Areas adjacent to the highway, from kilometre 8 through 11, tend to be low to moderate habitat that grizzly bear would move through but would be unlikely to spend time in. The region around kilometre 7 and the south side of the highway both contain high quality habitat where grizzly bears may spend more time. Grizzly bears were detected on cameras 500m from the Highway on both the south and north side in moderate habitat across the Jim Prentice Wildlife Corridor. Grizzly bears were not detected successfully crossing at any existing road mitigation infrastructure.

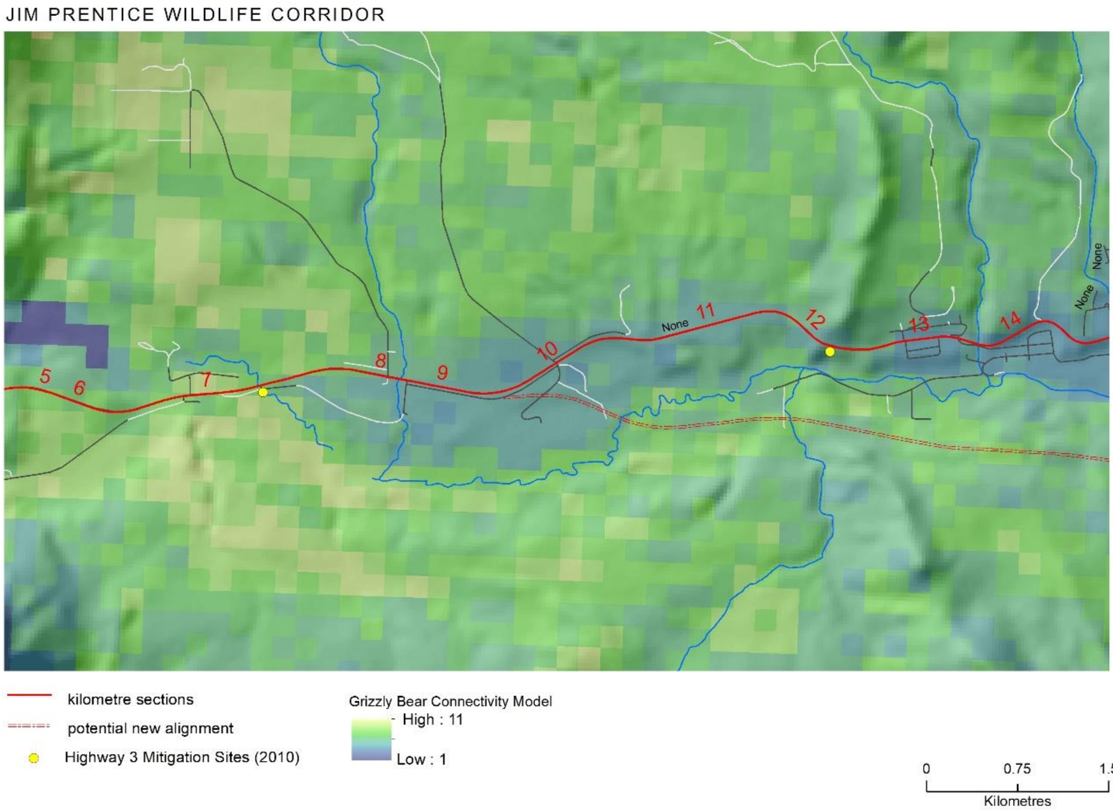


Figure 31: Grizzly bear connectivity model depicting habitat and movement quality in the Jim Prentice Wildlife Corridor

Recommendations for Safe Wildlife Passage

In 2010, Clevenger and colleagues provided recommendations for road mitigation along Highway 3 in the Crown of the Continent ecosystem. We revisited these recommendations based on new information and development plans for the region. The Government of Alberta has plans to twin Highway 3 and realign a section from Blairmore to the JPWC (Highway 3X), making a reanalysis necessary.

In January 2024, a virtual workshop was held with 20 attendees representing provincial and municipal government ministries, research institutes, ENGO's, and local wildlife experts (see Appendix C). The purpose of the work was to:

- Review new information and research relevant to Highway 3 and wildlife; and
- Identify amendments to the 2010 mitigation recommendations.

We focused discussions on Jim Prentice Wildlife Corridor to the Alberta/British Columbia provincial border as a key area of conservation value and investment. Other mitigation sites in the 2010 report are still relevant to transportation construction considerations in the future. We did not focus on Rock Creek area as recently the GOA announced plans to mitigation from Crowsnest River Bridge near Lundbeck to North Burmis Road, including a new underpass structure at Rock Creek.

Road Mitigation Recommendations

Data from Alberta Wildlife Watch, remote cameras in the area, and recent wildlife studies demonstrate that the recommendations made in the Clevenger et al. (2010) report still identify key locations where road mitigation would improve safe wildlife movement across Highway 3. Additional considerations include from workshop discussions included:

- Due to the proposed highway realignment around Iron Ridge, the mitigation suggested in the 2010 report at this site would need to be considered in conjunction with the proposed Highway 3X alignment. The realignment should include wildlife movement in its design and include discussion on wildlife movement across the existing Highway 3 route (which will remain operational after the construction on Highway 3X).

- Movement of some species is occurring at the Crowsnest River underpass at kilometre 7. Currently, large mammal species such as white-tailed deer, mule deer, black bear, and cougar have crossed Highway 3 using the underpass, however, elk, moose, grizzly bear and wolf were not documented. To accommodate all species that need to cross the highway, the structure could be modified (widened and reduced slopes) or replaced with a design to include the needs of multiple species.

- Highway 3 within the JPWC continues to be risky for motorists due to AVC's — specifically, elk vehicle collisions. Highway 3 should be fenced from the interchange with the new alignment to the existing fencing linked to the bighorn sheep underpass site at Emerald Lake providing additional movement options for movement of elk and grizzly bear to cross Highway 3.

- At the workshop we discussed bighorn sheep GPS collar data (from Wild Sheep Foundation project, University of Alberta, and Government of Alberta) and vehicle collision data (Alberta Wildlife Watch Program) both of which emphasize the need to add an additional crossing opportunity to the east of the Crowsnest Lakes, as well as an extension of the existing fencing to the west.

- An assessment of bighorn sheep jump-outs identified improvements needed at two locations to reduce the slope of the landing (Dale Paton, personal communication, 2024).

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Appendix A:

JULY 2012

RE: AMENDMENT TO HIGHWAY 3 TRANSPORTATION CORRIDOR MITIGATION AND ASSESSMENT REPORT — CROWSNEST LAKES MITIGATION SITE BASED ON DISCUSSIONS WITH ALBERTA ENVIRONMENT SUSTAINABLE RESOURCE DEVELOPMENT (AESRD) AND THE SOLICITOR GENERAL AND MINISTER OF PUBLIC SECURITY

BACKGROUND

In 2010, The Highway 3 Transportation Mitigation and Assessment report was released by the Miistakis Institute, Western Transportation Institute, and Yellowstone to Yukon Conservation Initiative. The report examined data on wildlife-vehicle collisions, regional wildlife movement patters, and the current state and future plans of the highway. The report made specific short- and long-term recommendations for cost-effective wildlife mitigations for this section of highway.

One of the sites recommended for mitigation is the Crowsnest Lakes site where big horn sheep are killed in WVCs. Over the last five years, 8% of the local Bighorn Sheep population has been killed on Highway 3. In the summer of 2012, the Highway 3 project team (Dr. Tony Clevenger, Dale Paton, Tracy Lee, and Dr. Dave Poulton) met with representatives from AESRD (Jon Jorgenson and Greg Hale) and the Solicitor General and Minister of Public Security (John Clark) at the Crowsnest Lakes. Their objective was to review mitigation recommendations to reduce mortality for Bighorn sheep. Based on the expertise of government staff and discussions with the project team we proposed the following amendments to the Crowsnest Lakes mitigation site.

MITIGATION RECOMMENDATIONS

The amendment to the mitigation recommendations from the report are identified in italics and include;

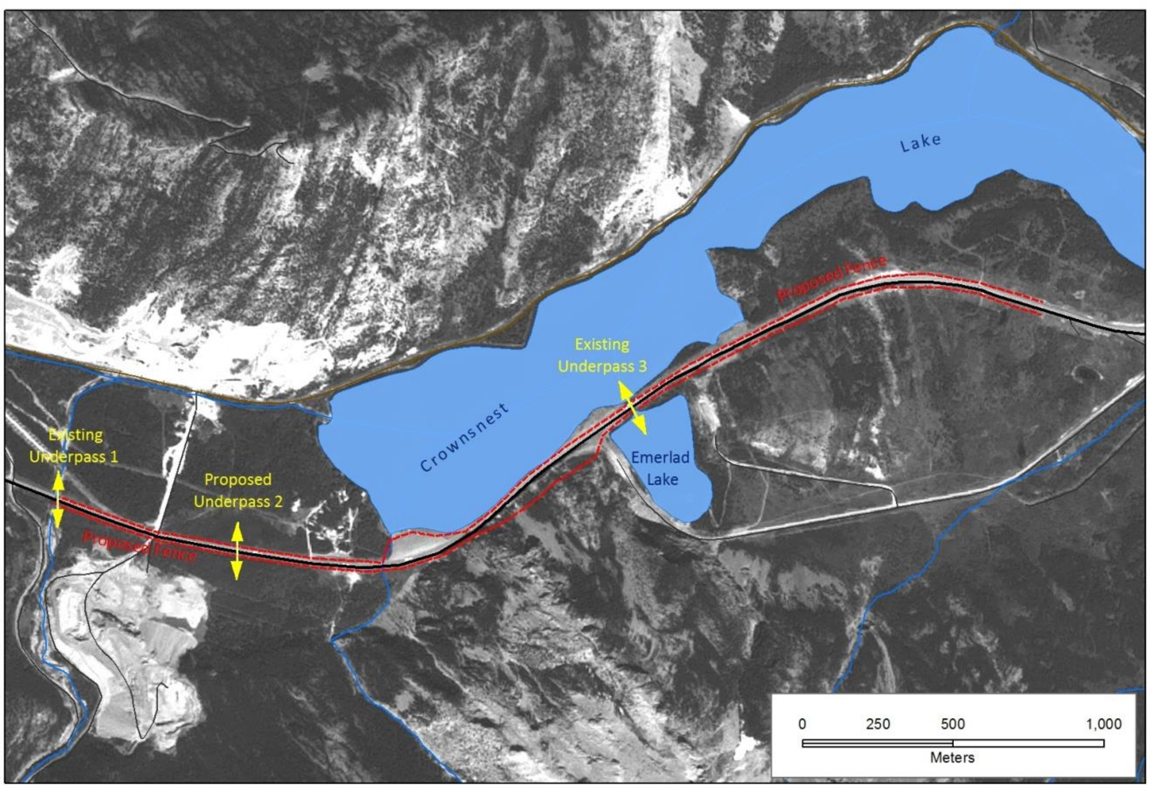
- an extension in the fence length
- identification of a location of an underpass near at the west end of high-risk area
- suggestions on managing road access points and fence ends

- combining long- and short-term mitigation recommendations — the project team felt that mitigations need to occur at the same time.

There are three recommendations to reduce wildlife-vehicle collisions at the Crowsnest Lakes:

- install changeable message signage warning motorists of wildlife on the highway
- during winter, replace road salt with other de-icing agents to reduce attraction to bighorn sheep
- *Install fencing from Crowsnest River Bridge near Tent Mountain Road to the west and to the end of the Rock Cut to the east, tying into two existing underpasses (Figure A1):*
    - *Tie in fencing at the west end to the existing Crowsnest River underpass (Figure A1 Underpass 1). This underpass would need to be modified to enable wildlife movement under Highway 3.*
    - *Develop an underpass between Lime works mine road and the Crowsnest Lakes parking lot (Figure A1 Underpass 2).*
    - *At Emerald Lake, tie the fencing into existing underpass linking Emerald Lake to Crowsnest Lakes.*
    - *Suggest using electric mats at access roads to prevent wildlife from entering the highway right-of-way.*

Figure A1: Transportation Mitigation at Crowsnest Lakes for Bighorn Sheep



These amendments to the recommendations update both a human and wildlife safety issues occurring at the Crowsnest Lakes. If this entire stretch were to be mitigated, it would incur an annual cost savings of $80,000, assuming an 80% reduction in wildlife vehicle collisions. Within this stretch of highway there are records of elk, moose, deer, and bighorn sheep moralities, with a bighorn sheep collision hotspot near Emerald Lake.

Appendix B:

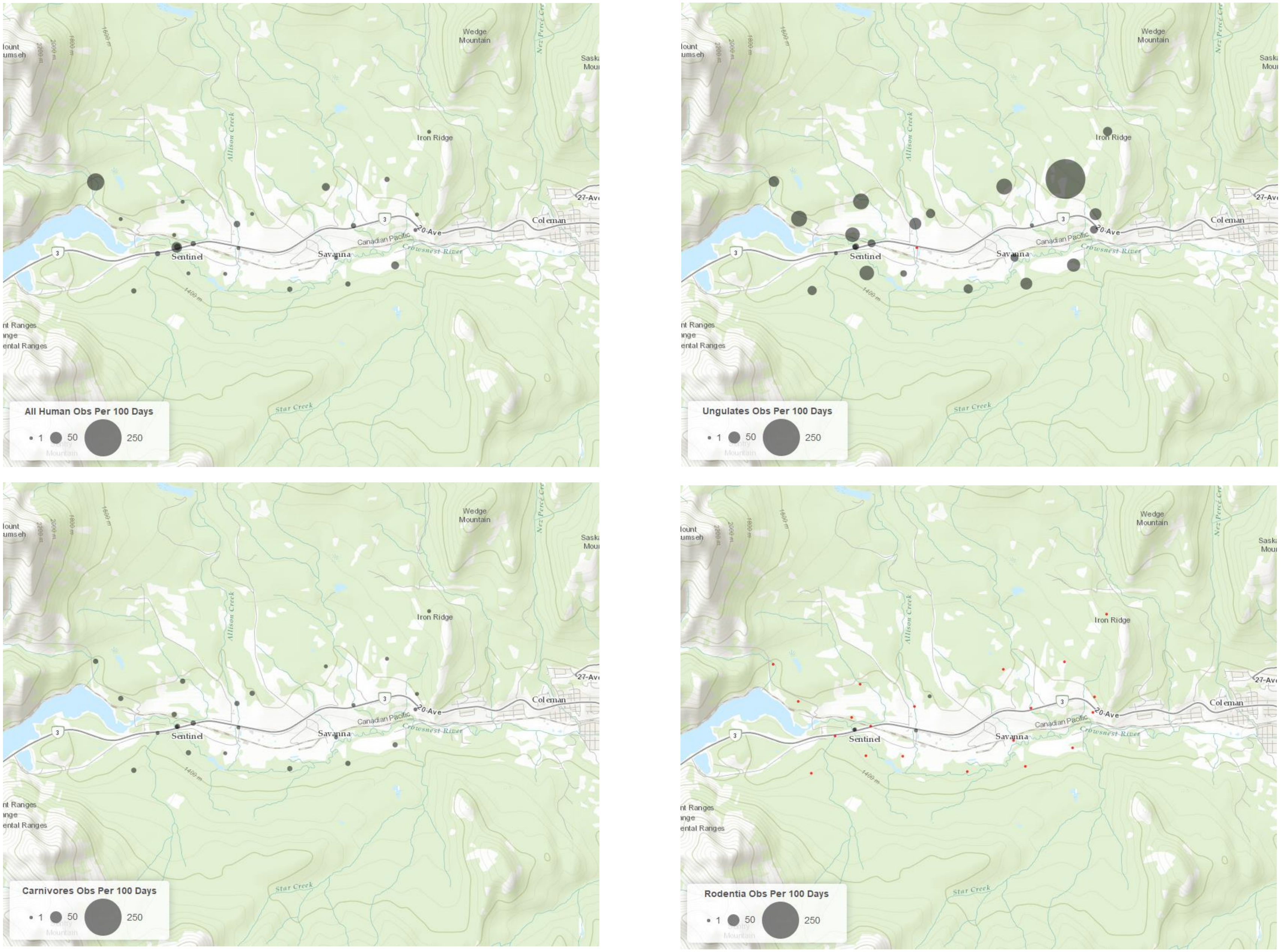


Figure 32: Total human, ungulate, carnivore, and rodents detected per 100 camera trap days in the JPWC. Red dots indicate camera locations with no detections.

Figure 33: Carnivores detected on camera fewer than five times and rodents per 100 camera trap days in the JPWC. Red dots indicate camera locations with no detections.

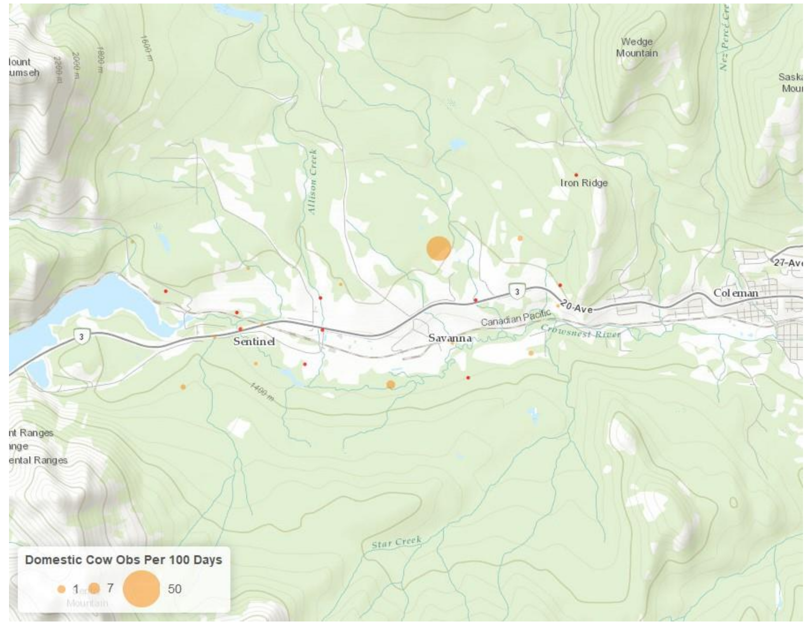
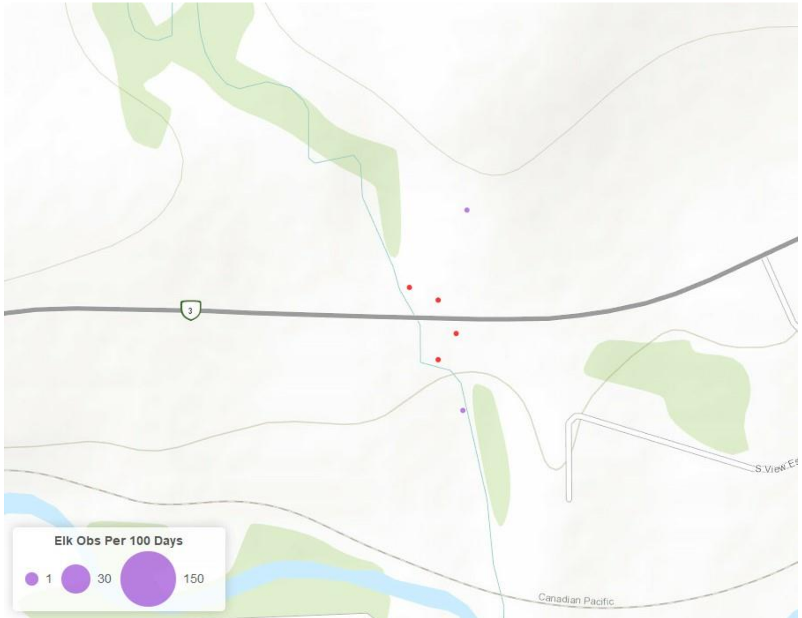


Figure 34: Domestic animal detections per 100 camera trap days in the JPWC. Red dots indicate camera locations with no detections.

Figure 35: Total human, ungulate, carnivore, and rodent detections per 100 camera trap days in Rock Creek. Red dots indicate camera locations with no detections.



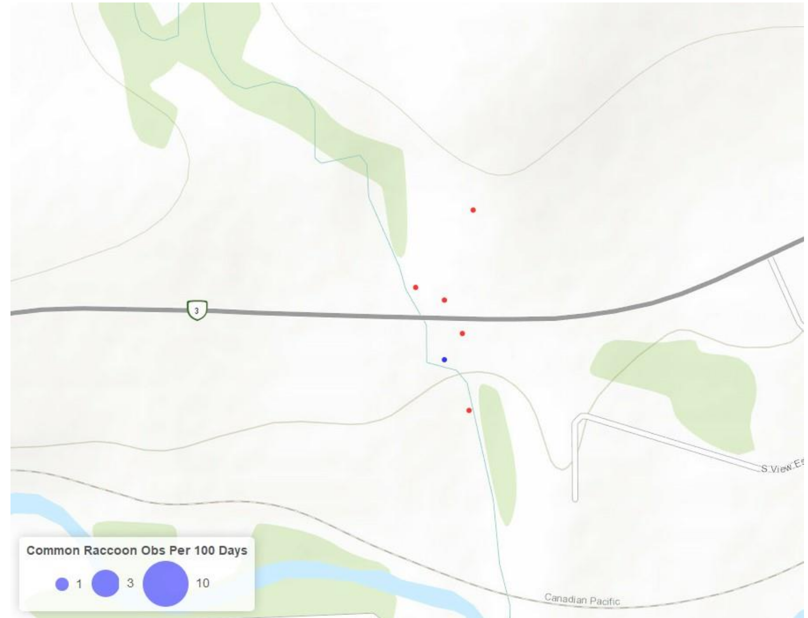


Figure 36: Elk and common raccoon detections per 100 camera trap days in Rock Creek. Red dots indicate camera locations with no detections.

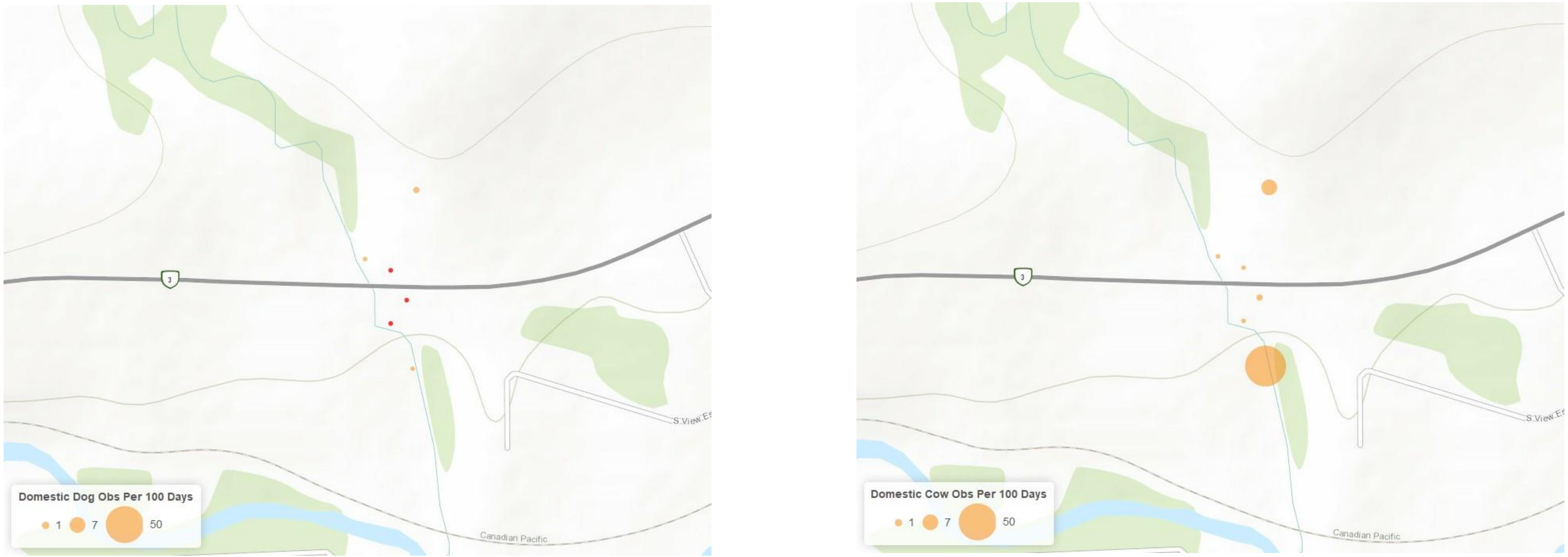


Figure 37: Human and domestic animal detections per 100 camera trap days in Rock Creek. Red dots indicate camera locations with no detections.

Appendix C:

Agenda for Linking Landscapes Workshop

On-line: January 15, 2024, 1:00pm to 4:00pm
Hosted by Miistakis Institute and Nature Conservancy Canada

Purpose

To review and identity amendments to the Alberta section of the Clevenger et al. (2010) report: *Highway 3: Transportation Mitigation for Wildlife and Connectivity*.
See: https://www.rockies.ca/files/reports/H3%20Final%20Report%200607_June8.pdf

Objectives

- Review new information and research relevant to Highway 3 and wildlife.
- Identify amendments to the 2010 mitigation recommendations with a focus on the Jim Prentice Wildlife and Rock Creek Corridors.

Attendees

Name	**Organization**
Tracy Lee	Miistakis Institute
Danah Duke	Miistakis Institute
Sara Jordan-McLachlan	Miistakis Institute
Emilie Brien	Nature Conservancy of Canada
Beth McLarnon	Nature Conservancy of Canada
Craig Harding	Nature Conservancy of Canada
Tony Clevenger	Western Transportation Institute
Maria Didkowsky	Alberta Environment and Protected Areas
Erin Miller	Alberta Environment and Protected Areas
Stephen Legaree	Transportation and Economic Corridors
Steven Smid	Transportation and Economic Corridors
James Herian	Transportation and Economic Corridors
Jody Hilty	Yellowstone to Yukon Conservation Initiative
Morgan Marks	Yellowstone to Yukon Conservation Initiative
Kelly Zenkewich	Yellowstone to Yukon Conservation Initiative
Sarah Palmer	Yellowstone to Yukon Conservation Initiative
Johan Van Der Bank	MD of Crowsnest Pass
Dale Paton	Anatum Ecological
Rob Schaufele	Miistakis Institute
Rob Anderson	Alberta Conservation Association

Agenda

Time	Agenda Item
1:00pm – 1:10pm	Introductions Overview of workshop purpose
1:10pm – 2:30pm	**Context setting presentations:** 1. Linking Landscapes Wildlife Monitoring Program and AVC analysis. Tracy Lee, Miistakis Institute 2. Bighorn Sheep and Highway 3. Maria Didkowsky, Alberta Environment and Protected Areas 3. Do bighorn sheep use the Emerald Lake jump-outs? Dale Paton, Anatum Ecological Consulting 4. Update on Highway 3 road mitigation plans (Rock Creek, Crowsnest Lakes). James Herian, Alberta Transportation and Economic Corridors
2:30pm – 3:45pm	**Road Mitigation Discussion**: 1. Overview of 2010 recommendations for JPWC and RC - Tony Clevenger, Western Transportation Institute, Montana State University 2. Discussion questions: - Where is road mitigation needed for the JPWC? - Where can we tie into existing infrastructure? - What type of road mitigation is needed? - Are there other areas we want to highlight along Hwy 3 that would benefit from road mitigation?
3:45pm – 4:00pm	Next steps and other items for discussion

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