REPORT ON THE JAFFRAY WILDLIFE CAMERAS

THE MOTHER TREE PROJECT

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INTRODUCTION

Forestry in British Columbia is a commercialized practice dating back to the early 1820s. The speed, agility and growth of the industry has made gigantic leaps since that time. Particularly since the creation of the Forest and Range Practices Act (FRPA) in 2002, logging in British Columbia has undergone policy changes to improve forest stewardship and the balance of economic and environmental values, including values pertaining to wildlife management. A wildlife resource value team was created to examine the effectiveness of FRPA, and it aims to address the longevity of ungulate winter ranges, habitat amount, quality and distribution (Province of British Columbia, 2018).

There has been growing concern for moose populations in British Columbia, especially in the central interior (Gorley, 2016). Research indicates that in northern British Columbia, moose populations are at risk from new tick-related diseases (Walsh, 2016). Increasing risks of disease and parasites, most notably winter ticks and meningeal worms, may be one of the reasons that moose populations are declining (Schwantje, 2018). This is of growing concern, as climate change has created conditions that allow for increased prevalence of parasites, and conditions will likely become continually more favorable with anthropogenic climate change (Schwantje, 2018).

In some parts of British Columbia's interior, there have been documented moose population declines of up to 50-70% since the early 2000s; however, it is worth noting that other provincial moose populations are stable or increasing (Kuzyk 2016). Across the province, hunting efforts have remained consistent, while successful hunts have declined by roughly half over the past 30 years (Kuzyk, 2016). In addition, roads associated with cut blocks may exacerbate impacts of hunting and predation on moose, providing new access to moose habitats year-round (Blood, 2000).

Wildlife camera trapping is a multi-species tool used to remotely obtain data and gather information about presence/absence, species distribution and relative abundance (Burton et. al, 2015). By examining moose, elk and deer, there is an opportunity to address if the effects of harvesting are more pronounced in one species, or if responses are shared across members of the community. If all ungulates respond in a similar way to a disturbance, the community response can be evaluated to implement management changes for that niche.

This wildlife camera project is set up within the experimental design of Dr. Suzanne Simard's Mother Tree Project, and is supervised by Dr. Simard and Dr. Cole Burton. The original aim of the project was to analyze the occupancy and usage trends of moose, elk and deer in three treatments of the Mother Tree Project – clearcuts, controls and 60% retentions. The project objective will be expanded to analyze mammalian diversity in all five of the treatments – controls, clearcuts, single tree retention, and 30% and 60% patch retention. This will be discussed further in the Future Plans portion of this report.

METHODS

Study Area

The sites at Jaffray are in the Interior Douglas fir biogeoclimatic zone of British Columbia, in the dry/mild variant found in many parts of the Kootenays, at elevation 1050 metres. The sites typically have gentle 5-15% slopes and are south-facing. Before logging, the sites had on average 882 stems per hectare with a sparse understory. Mature trees were estimated to be between 110-190 years old, with the lower co-dominant story being between 80-140 years old. The sites are predominantly made up of lodgepole and ponderosa pine (*Pinus contorta* and *Pinus ponderosa,* respectively), making up 80 per cent of the basal area. The herb and shrub plant community is dominated by pinegrass (*Calamagrostis rubescens*) and arnica (*Arnica cordifolia*). There is also a history in the area of partial cutting, in excess of twenty years ago.

Camera Set Up

Six Reconnyx PC900 cameras were set up at the Caven Road replicates near Jaffray, British Columbia on October 21st, 2017. The cameras were set up at roughly 1.2 metres height, facing north, and placed at the centre of the National Forest Inventory (NFI) plots established and measured by the Mother Tree Project crew. The selected treatments were controls, clearcuts and 60% retentions. One camera was placed in the centre of each treatment in two replicates (i.e. three cameras per replicate, one per treatment). These cameras were left running from October 14 to February 20, 2018. In February, the batteries and memory cards of the cameras were switched to allow the first four months of data to be analyzed.

In May of 2018, the batteries and memory cards of the original Caven cameras were switched, and an additional twelve cameras were set up at the same site. Currently, there are two cameras in each of the focal treatment units (clearcuts, controls and 60% retentions) facing north and south to account for missed captures. These cameras are set-up in all three replicates at the Jaffray site. East and west are less preferable directions to face the cameras, as movement of heated bodies triggers the cameras, and when the morning or afternoon sun shines on plants/abiotic materials, they can approach the heat that would trigger the camera (Erin Tattersall, personal communication, April 15, 2018). The cameras are still in the centres of the NFI plots, so that the vegetation, coarse woody debris, tree details, soil and site series data collected can be used as covariates when modeling the captures.

Data

Data were collected from October 21st, 2018 to May 12th, 2018. All captures on each camera were recorded in a raw data Excel file. The raw data includes camera number, block/replicate number, logging treatment, species, date, time (start and end) of capture sequence, number of photos and individuals in the sequence, snow presence/absence, offspring presence/absence and day/twilight/night status.

Excel was used to determine the basic trends of the data: to summarize the number of captures over space and time and to compare capture numbers between treatments and months. The next step in the analysis process will be obtaining the memory cards to include data from May to September 2018, and build zero-inflated negative binomial models for white-tailed deer, general deer species and elk. Other species with only a rare capture on the cameras are likely not statistically significant and so data for those species will not be analyzed. Further biometrics, coding and statistical studies must be undertaken at the graduate level in the 2018-2019 academic year to be able to code negative binomial models in the R program to allow data to be fully analyzed.

RESULTS

Overall Results

Across the six Jaffray cameras from October to May, there was a total of 242 captures of white-tailed deer, elk, unidentifiable deer species, mule deer, coyotes, squirrels and unidentifiable species. The results included in this report are preliminary – zero-inflated negative binomial models would likely fit this data with the greatest accuracy, much better than linear regression, and potentially better than a Poisson model. Quinn and Keough (2002) state that negative binomial models are measured by the mean and a dispersion parameter, "which measures the degree of 'clumping' in the distribution". It is noted that a negative binomial model can be more advantageous than Poisson models because the mean and variance do not have to be equal, and there is no assumption regarding the independence of trials (Quinn and Keough, 2002).

First, the general trends across all species will be shown, then the break down of captures by species, treatment and other factors will be analyzed. Generally, animals are most frequently seen browsing in the images, or passing by the camera field of view.

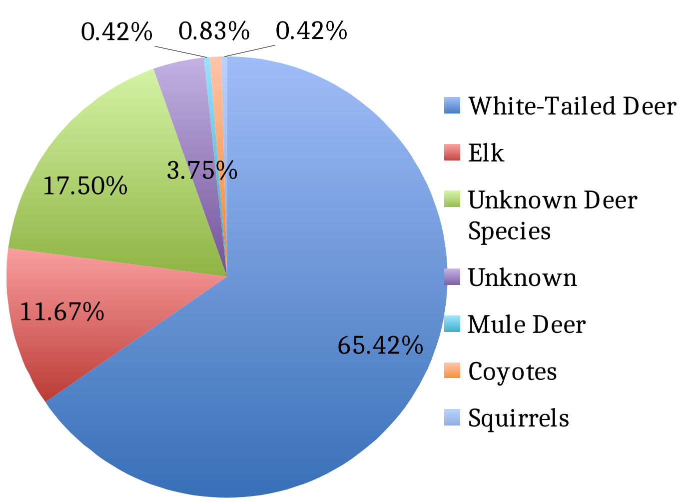
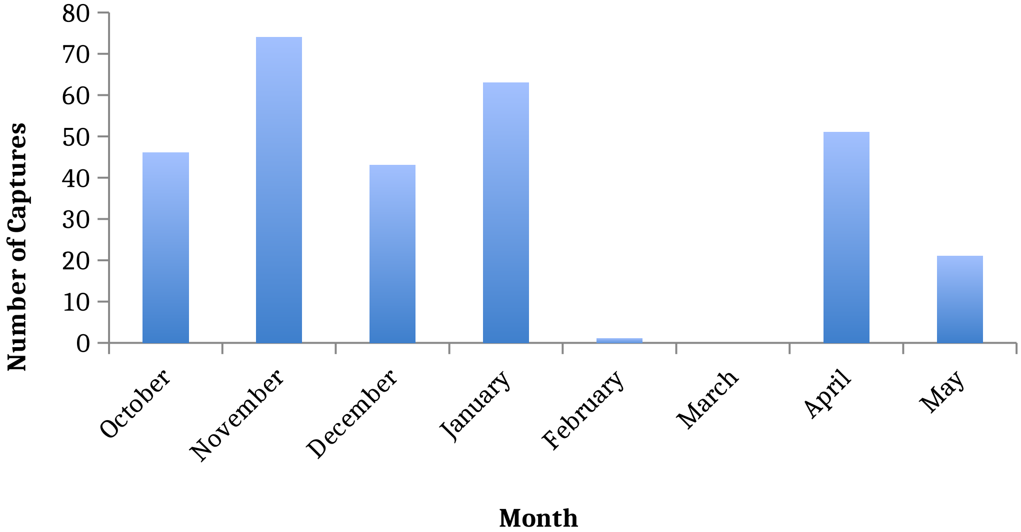


Figure 1: Pie chart showing the number of captures of each species.



Above is a pie chart showing the number of total captures by species – the vast majority of captures (nearly two thirds) were white-tailed deer, followed by deer species (either white-tailed or mule) at 18 per cent, and followed by elk at 12 per cent. No moose were captured over the course of the seven months.

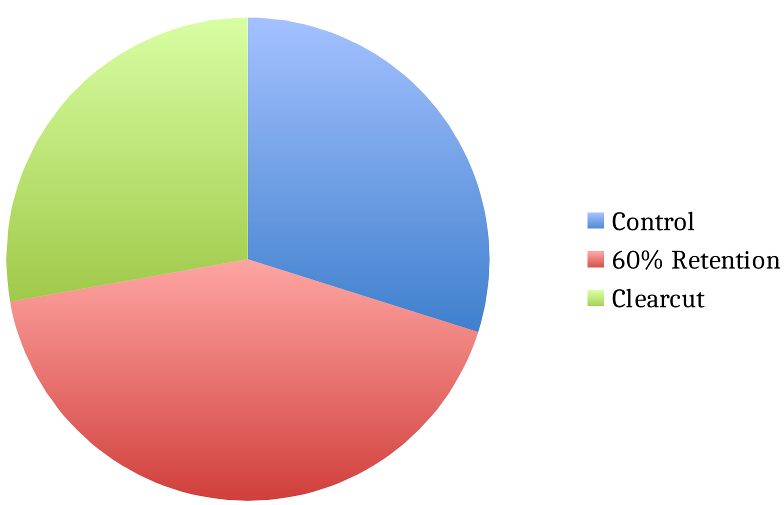


Figure 2: Number of captures of all species per month, regardless of treatment.

Figure 2 shows the overall seasonal trends, which shows relatively even numbers of captures between October and April, with the exceptions of February and March. The cameras were collected in the first week of May, which accounts for the few number of captures.

Figure 3: Proportions of total captures by treatment.

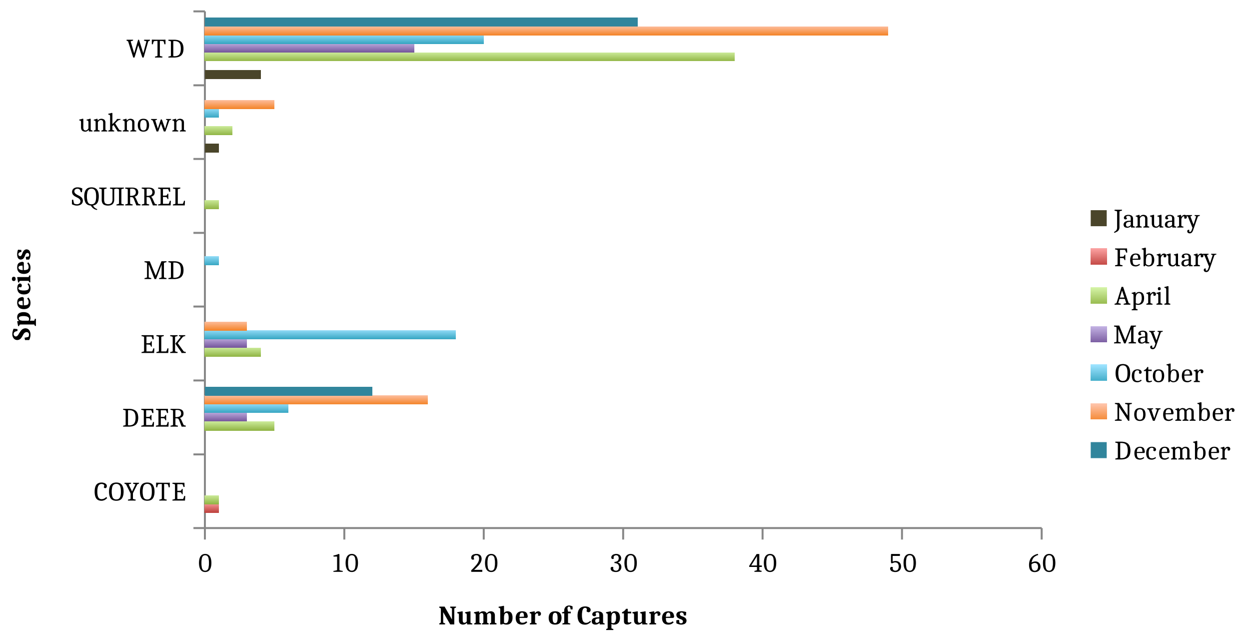
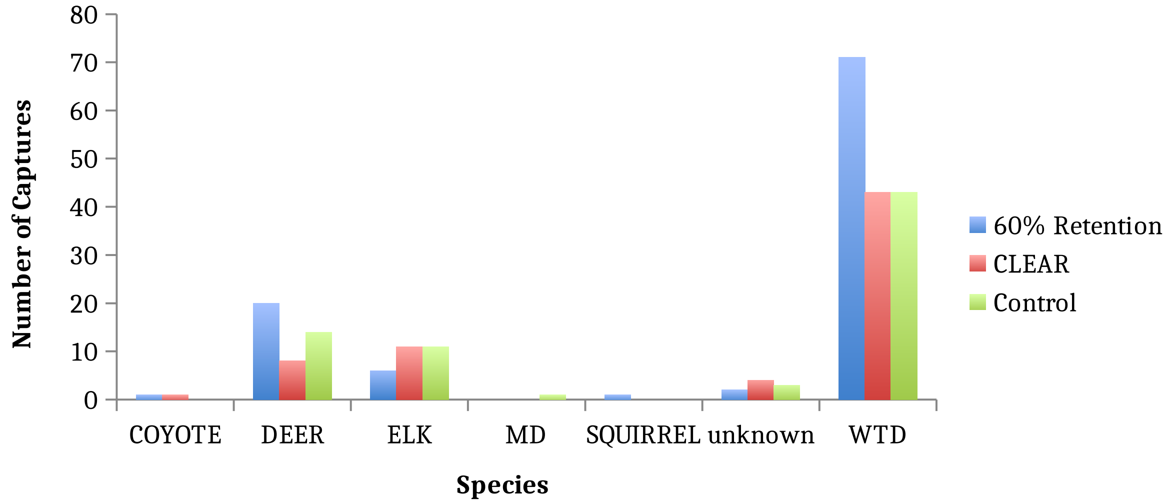


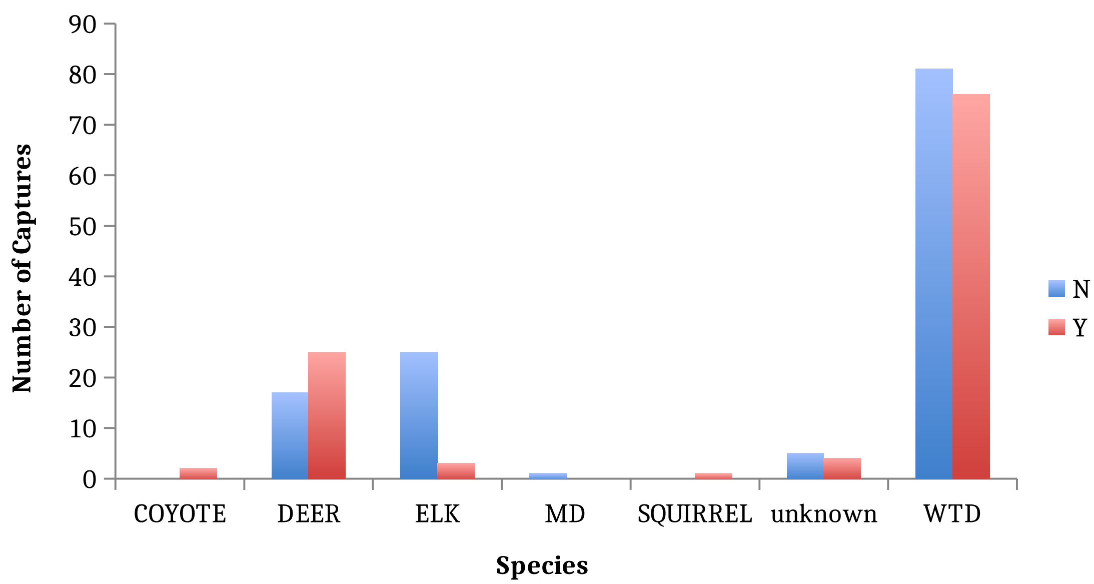
Figure 3 shows relatively even proportions of captures in all three treatments types across all species, with a slightly larger portion attributed to the 60% patch retention.

Figure 4: Number of captures by month and by species. MD stands for mule deer and WTD stands for white-tailed deer.



White-tailed deer and unidentified deer species show similar seasonal patters, while the majority of elk captures were in October, with even captures across November, April and May.

Figure 5: Species captures by treatment.



White-tailed deer and

unidentified deer species were captured more frequently in the 60% patch retention sites than controls or clearcuts, while elk captures showed the opposite trend.

Figure 6: Species captures based on snow presence (Y) or absence (N).

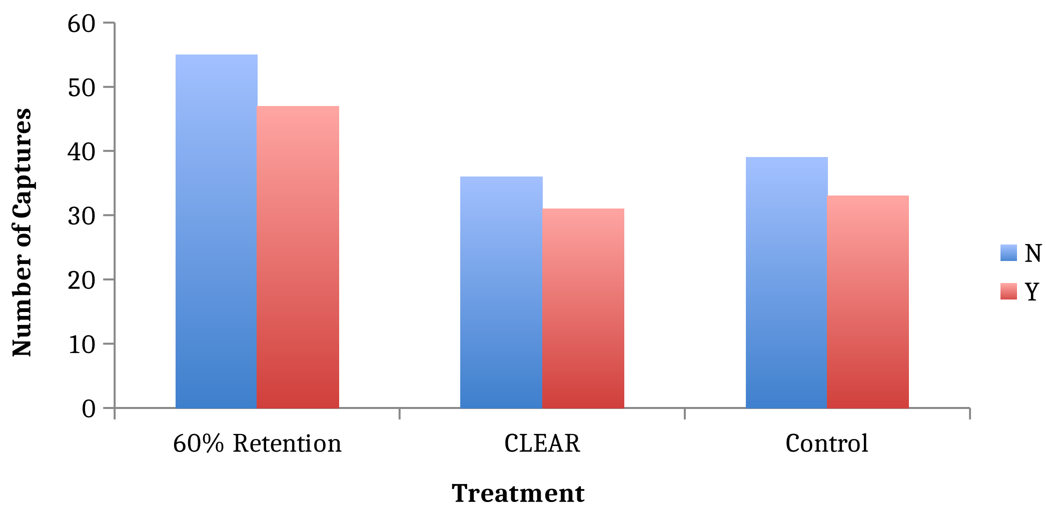
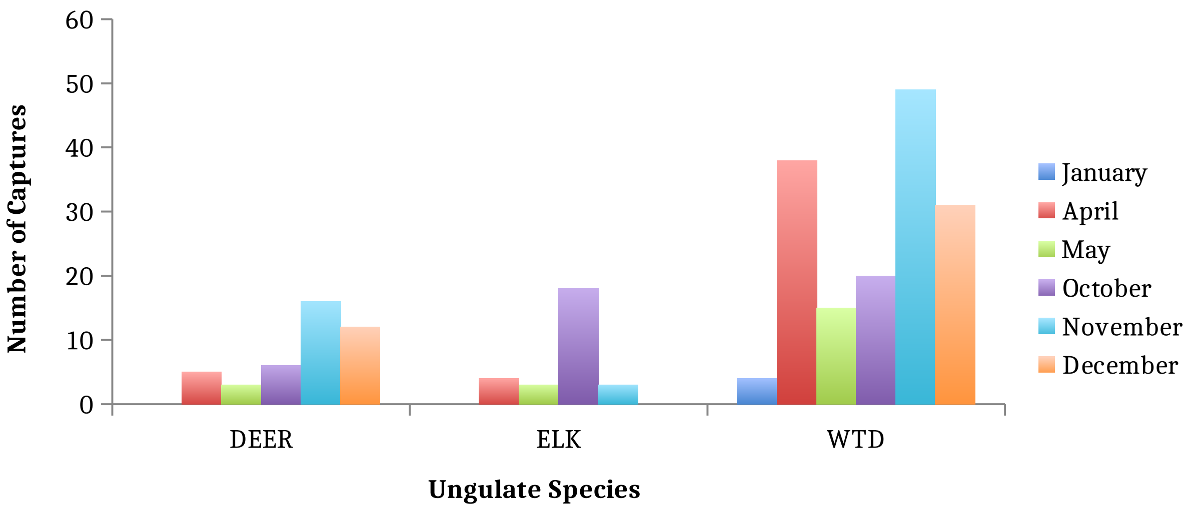


Figure 6 illustrates that there is no significant difference in the number of captures with or without snow for most species, while elk are captured five times more frequently with no snow.

Figure 7: Number of captures in each treatment based on snow presence/absence.

Figure 7 shows a non-significant trend of a slightly higher number of captures in every treatment type when snow is absent.



Among the ungulate species, deer species were captured most frequently in November and April, while elk were captured far more frequently in October, seen below in Figure 8.

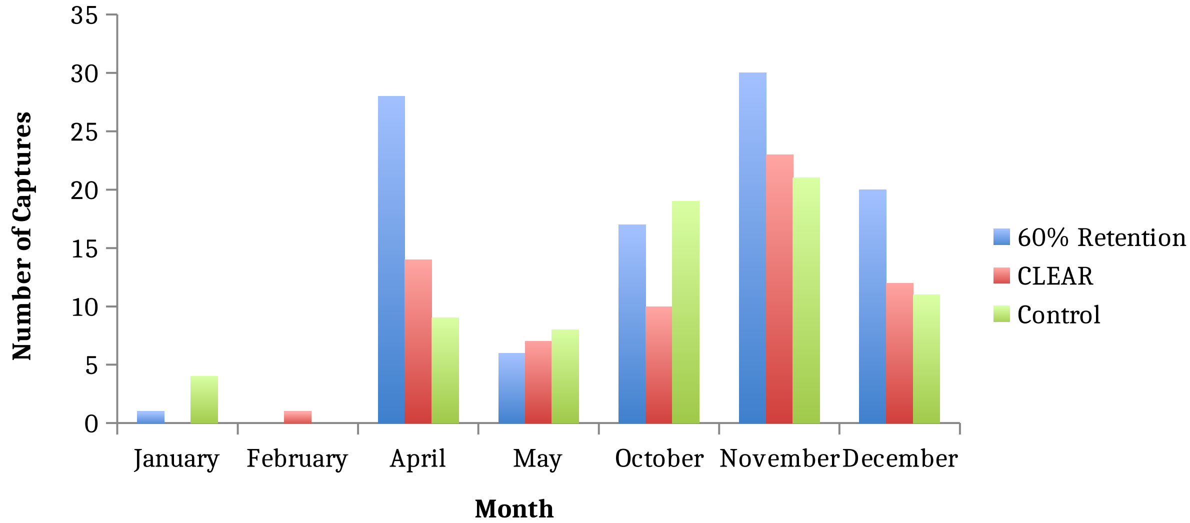


Figure 8: Number of ungulate captures by month.
Figure 9: Number of captures monthly by treatment.

Figure 9 shows the low number of captures in January and February (as well as none in March), and the predominance of 60% patch retention captures in April, November and December.

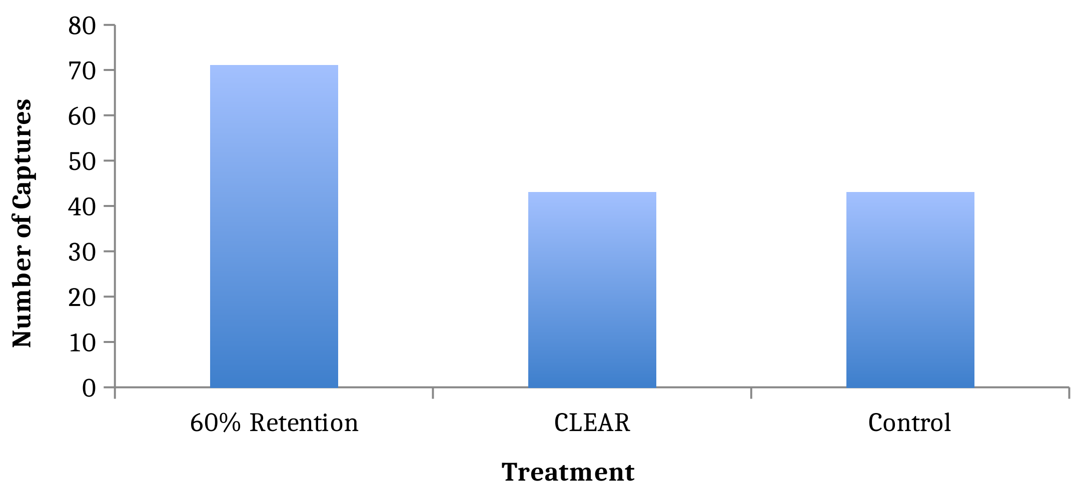


Figure 10: Number of captures of white-tailed deer by treatment.

Figure 10 illustrates that white-tailed deer were captured nearly twice as frequently in the 60% patch retentions rather than control or clearcut treatments.

DISCUSSION

As white-tailed deer are generalists, and seem to be quite resilient to anthropogenic changes to their habitat, it is no surprise that they were the species seen most frequently. It is surprising, and potentially of concern that no moose were captured on the cameras over a nearly seven month period. While it is known that there are fewer moose in the Kootenay region, it was not anticipated that zero individuals would be captured, which is one reason why twelve cameras were added to the Jaffray site –to account for missed captures of animals in the vicinity of the camera.

The amount of data thus far still does not paint an entire picture of the seasonal trends of white-tailed deer, as the summer data (May-September) is yet to be included in an analysis. Once this data is included, it could reveal seasonal usage of the types of harvesting treatments, or show a maintained preference among deer for 60% patch retention. It is possible that the patch retention provides browsing forage simultaneously with some level of cover and protection, however it is noted earlier in this report that the treatments are not so far apart as to prevent animals from running to nearby controls for cover or clearcuts for forage.

The demonstrated difference in elk captures with or without snow likely show that it is increasingly difficult to access forest floor forage in deep snow, especially in areas where there is little canopy overhead and snow can accumulate without being intercepted. Lynch and Margantini (1984) showed that moose in western Canada had much larger winter ranges due to difficulties finding vegetation in snow. This finding can be extrapolated to elk, which are also heavy ungulates, unable to travel through snow without increased metabolic output.

It is also of note that there were very few captures in January and February, and none in March. It is possible that in general, the animals were traveling less to conserve metabolic energy in harsher conditions and were therefore not crossing in front of the cameras as frequently. It is also possible that there was a technical issue with the cameras operating less optimally in extremely low temperatures – this will be addressed by setting a daily time lapse photo on each camera to ensure that the cameras are operating even on days when they do not obtain any images of animals.

Once a full year of data is collected, conclusions can be made regarding the seasonal preferences of each species for different levels of cover, forage and temperatures.

FUTURE PLANS

This project is the basis of the author's Master's of Science project in the Faculty of Forestry at the University of British Columbia. The project aim was expanded to include all mammals because of issues encountered with the scale of ungulate movement and the size of the treatment units of the Mother Tree Project. Ungulates can travel the distances between the cameras without any difficulty, and occupancy at each site could confirm preferences for cover or temperature, but would not produce novel academic results. Instead, it will be more fruitful to include the 'by-catch' on the cameras – the coyotes, squirrels and any other non-ungulate species that will cross the cameras. The distribution and frequencies of ungulate species will still be a focus of the project, as the effects on moose and other ungulates could have significant management and/or hunting conclusions. Considering the lack of captures of moose in particular, and the climatic gradient of sites available in the Mother Tree Project, the current set of cameras at Cranbrook will be moved to the Peterhope Lake site just north of Merritt. There is opportunity to gain pre-logging preliminary data due to the timeline of logging operations at that site. There is also more evidence of animals via feces and marks on trees than at the Jaffray sites. There will also be cameras set up at Alex Fraser Research Forest, northeast of Williams Lake, and John Prince Research Forest, north of Fort Saint James. All five treatments of the Mother Tree Project will be monitored with cameras in all three replicates (controls, 30% and 60% patch retentions, single tree retentions and clearcuts). This involves fifteen cameras per location, facing only north (five per replicate).

It is also a major goal of this project to engage with the appropriate First Nations groups associated with the Merritt, Alex Fraser and John Prince sites. John Prince is co-managed by the University of Northern British Columbia and the Tl'azt'en First Nation, while Alex Fraser and Merritt are sites where the Williams Lake Band and Upper Nicola Band will be contacted to discuss data sharing and/or creating press releases regarding the conclusions of the most up-to-date results and their meaning.

The use of wildlife cameras is of incredible importance to our understanding of how natural resource extraction practises affect the complex adaptive ecosystems seen in British Columbia's forests. As a remotely used tool, thousands of images of species interactions and species' use of landscapes can be collected over all types of weather conditions without human presence or influence. It is the aim of this project to use wildlife cameras to show the differences in mammalian diversity depending on the types and amounts of vegetation and forest structure left intact on a landscape.

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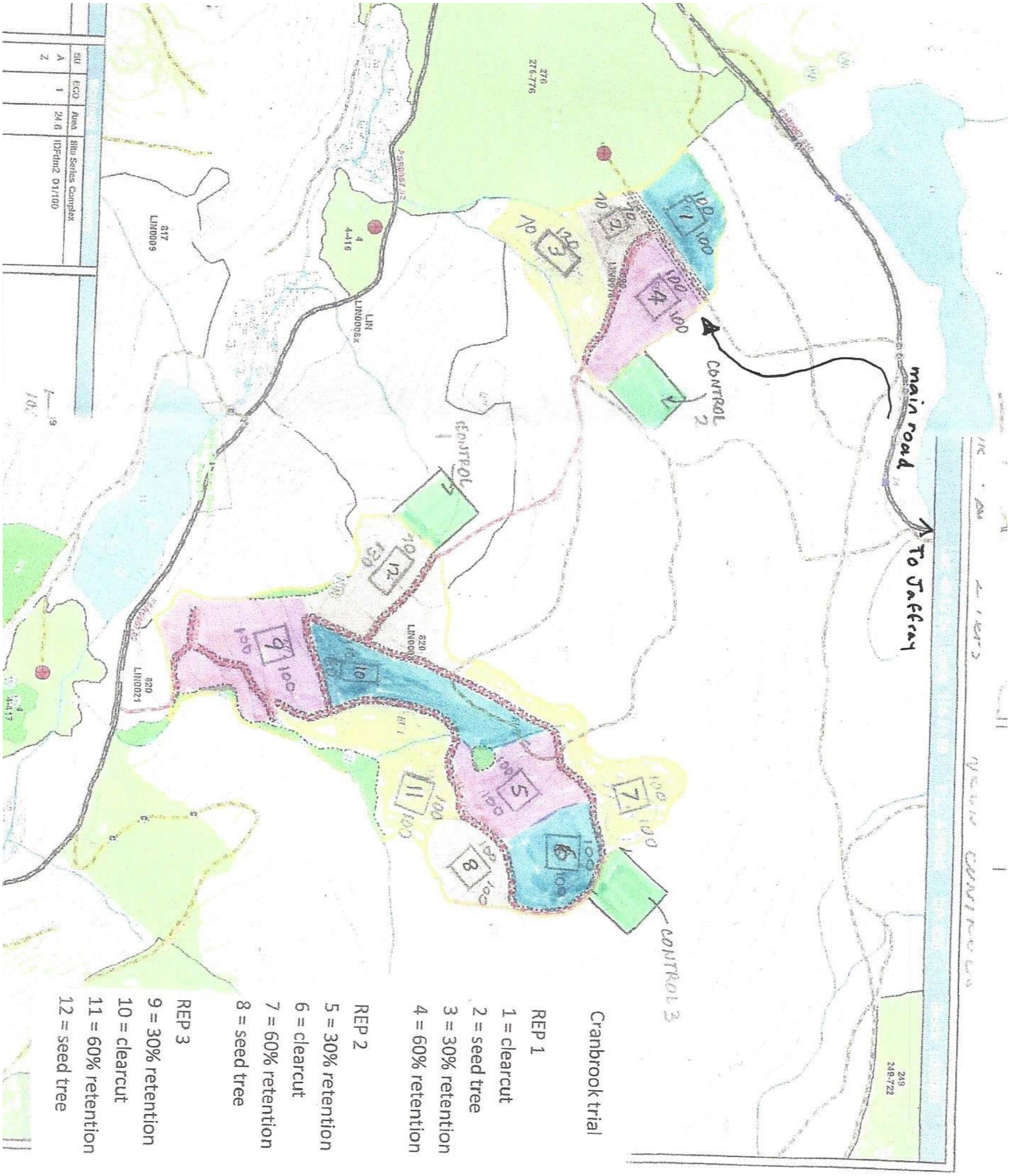
APPENDIX A – Map of Caven Sites



APPENDIX B

A	B	C	D	E	F	G	H	I	J	
Camera #	DATE	SPECIES	START TIME	END TIME	# of IMAGES	# of INDIVIDUALS	D/T/N	SITE TREATMENT	REPLICATE/BLOCK	CAL
1	2017-10-14	DEER	17:29	17:29:24	4	1	T	Control	L8	
1	2017-10-18	WTD	14:53:16	14:53:20	5	3	T	Control	L8	
1	2017-10-21	ELK	13:14:47	13:15:51	37	1	D	Control	L8	
1	2017-10-22	MD	1:41:41	1:41:44	5	2	N	Control	L8	
1	2017-10-27	WTD	8:40:33	8:40:37	4	1	T	Control	L8	
1	2017-10-29	ELK	18:23:03	18:23:06	5	1	N	Control	L8	
1	2017-11-10	WTD	16:42:12	16:42:15	2	1	T	Control	L8	
1	2017-11-25	unknown	10:11:34	10:12:03	17	1	T	Control	L8	
1	2017-11-25	unknown	10:20:02	10:20:22	5	1	T	Control	L8	
1	2017-12-06	WTD	11:09:11	11:09:14	5	1	T	Control	L8	
1	2018-01-19	WTD	9:27:37	9:27:39	4	1	T	Control	L8	
1	18-04-15	DEER	14:17:57	14:17:59	2	1	D	Control	L8 Rep 2	
1	18-04-20	WTD	10:02:06	10:02:11	5	1	D	Control	L8 Rep 2	
1	18-04-23	ELK	8:25:39	8:25:43	5	1	D	Control	L8 Rep 2	
1	18-04-25	DEER	14:01:47	14:01:50	3	1	D	Control	L8 Rep 2	
1	18-05-10	WTD	6:43:15	6:43:19	5	2	T	Control	L8 Rep 2	
1	18-05-10	WTD	9:06:15	9:06:19	5	1	D	Control	L8 Rep 2	

I	J	K	L	M	N	O	P
SITE TREATMENT	REPLICATE/BLOCK	CALF/FAWN	SNOW PRESENT	Temperature	Notes		
Control	L8	N	N	4	passing by edge, male		
Control	L8	N	N	11	smaller one in the middle - calf?		
Control	L8	N	N	6	male interested in camera, finished browsi		
Control	L8	N	N	2	two passing through in rain (mother & juve		
Control	L8	N	N	0	2 point buck		
Control	L8	N	N	5	one male passing through		
Control	L8	N	Y	4	passing through bottom edge		
Control	L8	N	N	4	individual close to camera, mostly images		
Control	L8	N	N	5	individual close to camera, mostly images		
Control	L8	N	Y	-3	passing by edge, dark spot/marking on bod		
Control	L8	N	Y	-1	passing through (female)		

Figure 11: A sample image of the raw, processed camera data which includes: the camera number, the date, the species captured, the start and end times of the image sequences of the individual(s), the number of images and individuals, and the day/twilight/night status of the images, as well as notes based on the individuals seen and their activities.

APPENDIX C – Sample Images of Main Species Captured

Images 1a and b: Elk captured in October (60% retention) and May (control), respectively.

Images 2a and b: White-tailed deer captured in November (clearcut and 60% retention).

Images 3a and b: Coyotes captured in February in clearcut and April in 60% retention treatments, respectively.