Estimating Ungulate and Predator Population Densities in Chinchaga and Caribou Mountains

NWSAR Preliminary Report

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Written for: Northwest Species at Risk Committee

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Introduction

The Alberta Northwest Species at Risk (NWSAR) Committee was created to ensure local interests are reflected as part of woodland caribou management. Among the recommendations generated by NWSAR, data collection to support woodland caribou management is identified as a priority. To support the acquisition of new and more accurate data related to caribou, NWSAR worked with the Alberta Biodiversity Monitoring Institute (ABMI) and the Alberta Trapper's Association (ATA) to deploy remote cameras to collect data on ungulates and predators for density estimation in two woodland caribou ranges in northwestern Canada. These cameras will provide information on trends in mammal densities across time and space in an area where little data exists otherwise.

Remote cameras are currently the best approach for surveying the abundance of multiple species simultaneously. The use of cameras allows for: i) density estimation for species of interest; ii) simultaneous data collection for all medium- to large-sized mammals (i.e., monitor a large component of the biotic community); iii) standardized protocols to allow for comparison with regional/provincial datasets; and iv) involvement of local hunters, trappers, and citizens in data collection.

Methods

To align with the sampling design used by the ABMI's Caribou Monitoring Unit, cameras were deployed in three clusters of 25 sites in both the Chinchaga and Caribou Mountains caribou ranges (Figure 1); however, the northernmost cluster in Caribou Mountains was not successfully deployed due to access constraints. Clusters were placed throughout each range to capture a latitudinal gradient and to best match habitat conditions within that range (e.g., fire, upland/wetland). Cameras were deployed in locations with reasonable access for monitoring station maintenance. Cameras were programmed to collect data year-round to increase the cumulative detection probability, and are serviced once per year. Camera sites remain constant over time (Steenweg et al., 2016), and will be collected again in 2021.

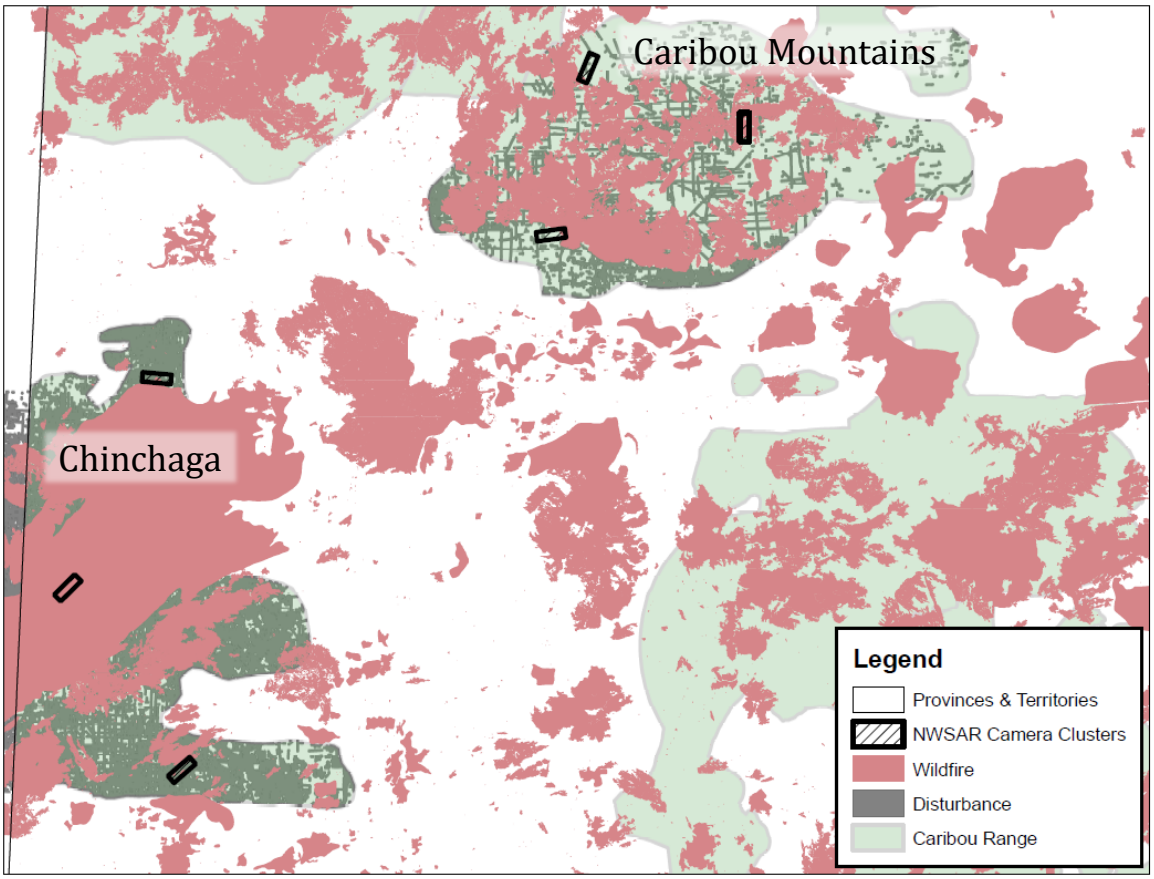

Figure 1. Study area map depicting camera clusters in the Caribou Mountains and Chinchaga caribou ranges. Wildfires from 1931 to 2020 are shown in red. Dark grey depicts disturbance from human habitat-alteration. The northernmost cluster in Caribou Mountains was not successfully deployed.

Clusters were placed within reasonable access from roads or established trails. Within each cluster, cameras were randomly placed in a 12.5 x 4 km area, with a minimum separation of 1 km between cameras. While this design biases clusters towards areas with roads, there is no a priori knowledge that this will be problematic for the metrics of interest. However, bias from other habitat factors such as land cover, linear feature density, road traffic levels, and planned industrial developments that would result in drastic changes over the monitoring period was avoided.

Remote cameras collect an index of use and abundance for a sample of each range, and knowledge is extrapolated throughout the range. We calculated the relative density using the Time in Front of Camera (TIFC) method (Laurent et al., 2020). This metric can be considered an index of relative density and can be conceptualized as an unknown, but constant, proportion of

the true density. TIFC counts the number of animals observed within a defined area over time and divides by the area and time monitored, using the formula:

$$D = \frac{\sum(N \cdot T_F)}{A_F \cdot T_O}$$

Density (D) at each camera is calculated as the total number of animals observed (N) multiplied by the time in front of the camera field-of-view (T_F), divided by the area of the camera field-of-view (A_F) multiplied by the total camera operating time (T_O). The units are animal-seconds per area-seconds, which equates to the number of animals per unit area. Additional methodological details are described in Laurent et al (2020).

Results

Sampling effort, or, the number of days cameras were active, in each cluster varied from a mean of 294 camera trap days in Mid-Caribou Mountains to 358 days in North-Chinchaga. Canada lynx was the most commonly detected species at any single cluster, with 78% of cameras detecting a lynx in Mid-Chinchaga. Bison, elk, and cougars were not observed at any cameras.

Of the species that were detected, wolverine, gray wolf, white-tailed deer, and woodland caribou were the least detected species at any given cluster, with zero wolverine detected in South-Chinchaga, zero wolves detected in Mid- and North-Chinchaga, zero white-tailed deer detected in Mid-Chinchaga, and zero caribou detected in South- and Mid-Chinchaga and South-Caribou Mountains.

Black bears had the highest density of all species, with a density of 0.38 bears/km^2 in South-Caribou Mountains, and 0.29 bears/km^2 in South-Chinchaga (Figure 2). In both caribou ranges, the density of black bear was highest in the south clusters. The density of Canada lynx was high in the Mid-Chinchaga cluster, with 0.25 lynx/km^2, with the next closest cluster (South-Caribou Mountains) having only 0.05 lynx/km^2 (Figure 2). The density of gray wolf was low in all clusters; only one camera detected wolves in Chinchaga, and densities were lower than 0.01 wolves/km^2 in both Caribou Mountains clusters (Figure 2). Grizzly bears were only detected at one camera, with an estimated density of 0.03 bears/km^2 in the South-Chinchaga cluster. Wolverine densities were also consistently low, with a maximum of 0.02 wolverine/km^2 in the South-Caribou Mountains cluster (Figure 2).

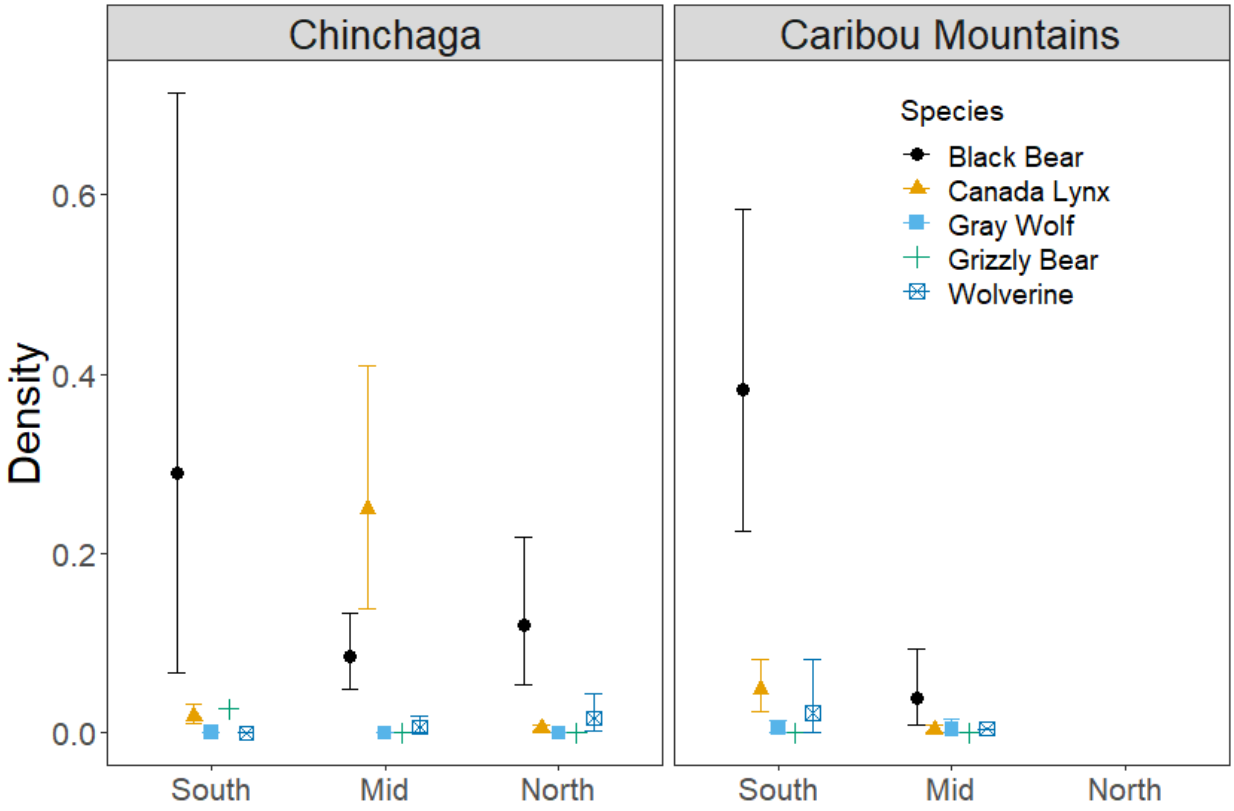

Figure 2. Density (# animals/km^2) with 90% confidence intervals of black bear, Canada lynx, gray wolf, grizzly bear, and wolverine in the Chinchaga and Caribou Mountains caribou ranges. Densities are provided for each range, arranged from south to north.

Moose density tended to be higher than that of woodland caribou and white-tailed deer. Moose and deer both tended to decrease as latitude decreased in both Chinchaga and Caribou Mountains (Figure 3). The highest observed density was 0.26 moose/km^2 in South-Chinchaga. White-tailed deer densities tended to be highest in the southern clusters (Figure 3). White-tailed deer density was 0.21 deer/km^2 in South-Caribou Mountains and 0.08 deer/km^2 in South-Chinchaga. Woodland caribou density tended to be highest in the mid-latitude camera clusters (Figure 3), with 0.21 caribou/km^2 in Mid-Caribou Mountains and 0.04 caribou/km^2 in Mid-Chinchaga.

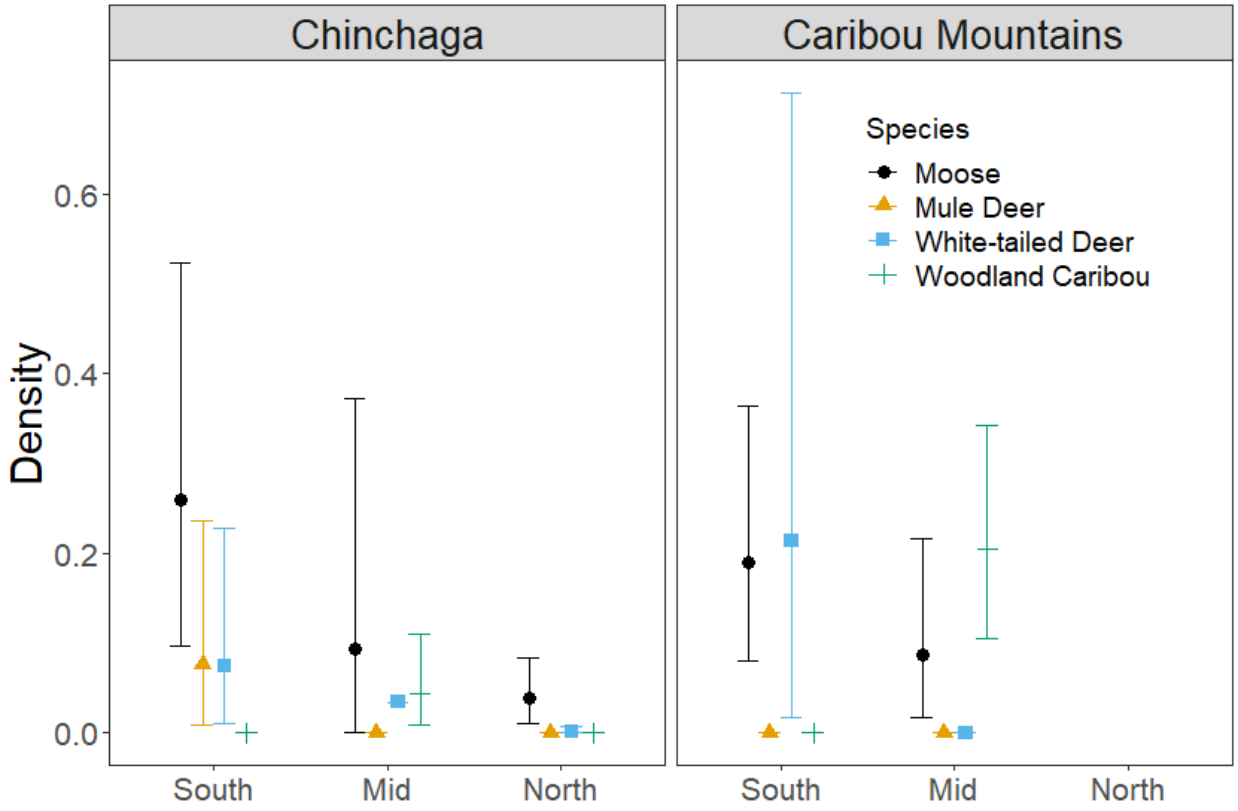

Figure 3. Density (# animals/km^2) with 90% confidence intervals of moose, white-tailed deer, and woodland caribou in the Chinchaga and Caribou Mountains caribou ranges. Densities are provided for each range, arranged from south to north.

Discussion

Woodland caribou were observed at very low densities in both the Chinchaga and Caribou Mountains caribou ranges; caribou were not observed in the South-Caribou Mountains, South-Chinchaga, or North-Chinchaga camera clusters. The mid-latitude clusters were the exception, where caribou densities were within the range observed in the Richardson caribou range (0.01–1.08 caribou/km^2), the northernmost monitored range in northeastern Alberta that uses the same methodology as employed here. Additional years of monitoring are needed to confirm these density estimates.

A general trend that emerged from preliminary data exploration is higher densities of moose, white-tailed deer, and black bear in southern areas relative to more northern areas. This trend has

also been observed for white-tailed deer and black bear, but not moose, in the East Side Athabasca River, West Side Athabasca River, and Saskatchewan Boreal Plain caribou ranges (Dickie and Serrouya, 2020). This trend may result from areas farther south having increased habitat productivity, which increases food availability for herbivores and omnivores, and less severe winter conditions, which increases overwinter survival for many species (Dawe et al., 2014; Laurent et al., 2020).

Many studies of the relative influence of climate and human habitat-alteration are complicated by their confounding relationship with latitude: as you move from south to north, climate becomes more severe but habitat alteration concomitantly decreases (Alberta Biodiversity Monitoring Institute, 2018; Fisher and Burton, 2018; Laurent et al., 2020). However, in Chinchaga, human habitat alteration was high across all three camera clusters—areas with low habitat alteration are uncommon in the Chinchaga caribou range. Conversely, human habitat alteration was low in both the Caribou Mountains camera clusters. The difference between Chinchaga and Caribou Mountains reflects the province-wide trend of lower habitat alteration in the northern region of the province.

The latitudinal trend in moose, white-tailed deer, and black bear density within each caribou range observed in this study, despite no variation in habitat alteration, supports that these gradients result from climate and/or habitat productivity gradients rather than human habitat alteration. The northward expansion of white-tailed deer is expected to increase predation on caribou and the spread of chronic wasting disease (Arifin et al., 2020; Latham et al., 2011). Clarifying the role of climate and human habitat alteration is necessary for effective management of deer and thus caribou populations. Comparison between caribou ranges with similar climate and habitat productivity but vastly different amounts of human habitat alteration, will help to clarify this topic. For example, portions of the Red Earth caribou range would make excellent contrasts to the Chinchaga caribou range.

Camera cluster locations were selected to capture a range of wildfire that roughly represented each caribou range (Figure 1). The Mid-Chinchaga cluster fully overlapped the 1950 Chinchaga wildfire, which covers a large portion of the Chinchaga caribou range. The majority of the Mid-Caribou Mountains cluster patchily overlapped a 2003 wildfire, reflecting the high variability in age and distribution of fires in Caribou Mountains. The remaining clusters had relatively little burned habitat. Anecdotally, the two clusters with high proportions of burned habitat also had the highest density of woodland caribou. This preliminary finding is counter to expectations based on the known avoidance of burned areas by caribou (Dalerum et al., 2007; Johnson et al., 2020;

Silva et al., 2020), and will be an important finding to investigate as further camera data is collected.

The density of wolves was higher in Caribou Mountains than Chinchaga, with only 1 of 75 cameras detecting wolves in Chinchaga. These results suggest that predator reduction actions conducted by the Government of Alberta and neighboring Government of British Columbia within the Chinchaga caribou range have been effective at reducing wolf density. However, we cannot conclude this with any degree of certainty without baseline information from pre-wolf reduction actions. Comparing trends over time in Chinchaga to other ranges without predator reductions (e.g., over a 5-year period) may indicate if predator reductions result in reduced wolf density and a corresponding increase in caribou or other ungulate populations. Provincial monitoring of caribou populations using aerial surveys and collaring will clarify if caribou populations are responding to this management action. Camera data collected by this program may help support such data in the future. The consequences of species management strategies need to be understood to inform future management decisions (Myers et al., 2007), especially when these management strategies are socially polarizing (Doherty and Ritchie, 2017). Monitoring predator and prey populations as wolves are removed from the system is imperative to measure the success, and costs, of this management action.

Future Considerations

The northern cluster of cameras in Caribou Mountains was not successfully deployed in 2020. The addition of this cluster would confirm if the trend of low moose, white-tailed deer, and black bear densities occur in the most northern portion of the caribou range. If the cluster cannot be accessed, shifting the location of the cluster is possible. However, access constraints still exist in other northern regions of the range and care must be taken to avoid Wood Buffalo National Park, which introduces additional access constraints and possible confounding ecological factors. The addition of the North-Caribou Mountains cluster would also indicate if wolves are consistently higher in Caribou Mountains than Chinchaga, even with low prey densities. These added benefits should be carefully weighed against the cost of deployment in the difficult-to-access area, as well as the possibility of increasing trail presence in this otherwise low-disturbance area.

Wildlife cameras and ARUs can provide a wealth of information, from images to sound recordings—however, information is only as useful as the questions that are asked of it. A well-designed study to answer specific questions is immensely important. The preliminary data

collected by NWSAR, in conjunction with the ABMI and the ATA, are well positioned to answer questions over the long term through continued data collection such as:

- What are the relative impacts of human habitat alteration and natural habitat variability, including climate, on mammal populations?
- How does the mammal community respond to wolf reductions as a caribou recovery action?
- How does the mammal community respond to habitat restoration as a caribou recovery action?
- What drives the expansion of white-tailed deer—an invasive species to northern Canada—over space and time?

Acknowledgements

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Literature Cited

Alberta Biodiversity Monitoring Institute, 2018. The Status of Human Footprint in Alberta. Edmonton, Alberta. https://abmi.ca/home/reports/2018/human-footprint

Arifin, M.I., Staskevicius, A., Shim, S.Y., Huang, Y.H., Fenton, H., McLoughlin, P.D., Mitchell, G., Cullingham, C.I., Gilch, S., 2020. Large-scale prion protein genotyping in Canadian caribou populations and potential impact on chronic wasting disease susceptibility. Mol. Ecol. 29, 3830–3840. https://doi.org/10.1111/mec.15602

Dalerum, F., Boutin, S., Dunford, J.S., 2007. Wildfire effects on home range size and fidelity of boreal caribou in Alberta, Canada. Can. J. Zool. 85, 26–32. https://doi.org/10.1139/Z06-186

Dawe, K.L., Bayne, E.M., Boutin, S., 2014. Influence of climate and human land use on the distribution of white-tailed deer (*Odocoileus virginianus*) in the western boreal forest. Can. J. Zool. 92, 353–363.

Dickie, M., Serrouya, R., 2020. Ecosystem Monitoring Camera Program Interim Report. Alberta Biodiversity Monitoring Institute. Edmonton, Alberta.

Doherty, T.S., Ritchie, E.G., 2017. Stop jumping the gun: A call for evidence-based invasive predator management. Conserv. Lett. 10, 15–22. https://doi.org/10.1111/conl.12251

Fisher, J.T., Burton, A.C., 2018. Wildlife winners and losers in an oil sands landscape. Frontiers (Boulder). 16, 323–328. https://doi.org/10.1002/fee.1807

Johnson, C.A., Sutherland, G.D., Neave, E., Leblond, M., Kirby, P., Superbie, C., McLoughlin, P.D., 2020. Science to inform policy: Linking population dynamics to habitat for a threatened species in Canada. J. Appl. Ecol. 57, 1314–1327. https://doi.org/10.1111/1365-2664.13637

Latham, A., Latham, M.C., McCutchen, N.A., Boutin, S., 2011. Invading white-tailed deer change wolf-caribou dynamics in northeastern Alberta. J. Wildl. Manage. 75, 204–212.

Laurent, M., Dickie, M., Becker, M., Serrouya, R., Boutin, S., 2020. Evaluating the mechanisms of landscape change on white-tailed deer populations. J. Wildl. Manage. 85, 340–353. https://doi.org/10.1002/jwmg.21979

Myers, R.A., Baum, J.K., Shepherd, T.D., Powers, S.P., Peterson, C.H., 2007. Cascading effects of the loss of apex predatory sharks from a coastal ocean. Science. 315, 1846–1850. https://doi.org/10.1126/science.1138657

Silva, J.A., Nielsen, S.E., McLoughlin, P.D., Rodgers, A.R., Hague, C., Boutin, S., 2020. Comparison of pre-fire and post-fire space use reveals varied responses by woodland caribou (*Rangifer tarandus caribou*) in the boreal shield. Can. J. Zool. 98, 751–760. https://doi.org/10.1139/cjz-2020-0139

Steenweg, R., Whittington, J., Hebblewhite, M., Forshner, A., Johnston, B., Petersen, D., Shepherd, B., Lukacs, P.M., 2016. Camera-based occupancy monitoring at large scales: Power to detect trends in grizzly bears across the Canadian Rockies. Biol. Conserv. 201, 192–200.