2021 Annual Report

RICC | Regional Industry Caribou Collaboration

Photo credit: Cory DeStein

The Regional Industry Caribou Collaboration (RICC) is a group of energy and forestry companies working collaboratively across tenure and lease boundaries focused in the northeastern Alberta caribou ranges. These ranges overlap substantially with RICC members' oil sands and forest management operations in the area.

TABLE OF CONTENTS

Regional Industry Caribou Collaboration (RICC)

Caribou recovery is a shared government, public and private sector responsibility, with planning led by government [1]. Lease and tenure-specific mitigations undertaken by companies are important to minimize local impacts on individual animals, however population-level benefits stem from range-level actions that require collaboration beyond individual company boundaries.

MISSION

Enable the restoration of caribou habitat and recovery of caribou populations through collaborative, range-based efforts

GOAL

Participate in collaborative research and active, science-based adaptive management activities within the defined RICC area

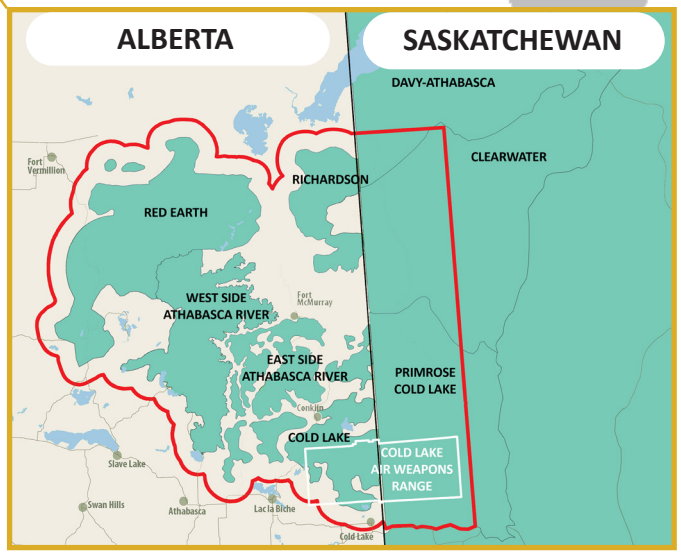
OBJECTIVES

- Coordinate industry restoration of disturbance in priority areas
- Support and lead scientific research on caribou ecology and caribou-predator-landscape relationships
- Support and lead investigative trials on restoration methods, effectiveness, and wildlife responses

1. Government of Alberta. 2011. A Woodland Caribou Policy for Alberta. Alberta Environment and Parks. Edmonton, AB.

RICC Study Area

The RICC study area encompasses the Cold Lake, East Side Athabasca River (ESAR), West Side Athabasca River (WSAR), Red Earth and Richardson boreal caribou ranges, and portions of adjacent boreal caribou ranges in Saskatchewan. RICC's primary focus is on supporting recovery within the Alberta caribou ranges, as this is where RICC industry partners have operations. The Saskatchewan boreal caribou ranges provide less disturbed reference areas for comparison. The study area also includes a 20-kilometer buffer around the caribou ranges, incorporating adjacent landscapes where habitat alteration effects may influence caribou within the ranges.



State of Boreal Woodland Caribou in Alberta

Boreal woodland caribou, a Threatened species in Canada, are declining over most of their range. Many complex and interconnected factors are contributing to the decline of boreal caribou, such as land use (agriculture, forestry, oil and gas, and municipal development), forest fires, and warming climate. This results in an increase in populations of other prey species such as white-tailed deer, as well as predator accessibility that results in increased loss of caribou.

To increase chances of achieving self-sustaining populations, the federal Recovery Strategy identifies a maximum disturbance level of 35% in each caribou range, with disturbance defined as human footprint plus a 500-meter buffer, and forest fires less than 40 years old. At present, all caribou ranges in the oil sands region are beyond this identified 35% disturbance threshold. The Government of Alberta has committed to decreasing the amount of disturbance to this level, as described in Section 11 agreement between the Government of Canada and Government of Alberta [2]. This includes managing for important areas for woodland caribou, biophysical habitat, and establishing an ongoing minimum of 65% of the range as undisturbed habitat.

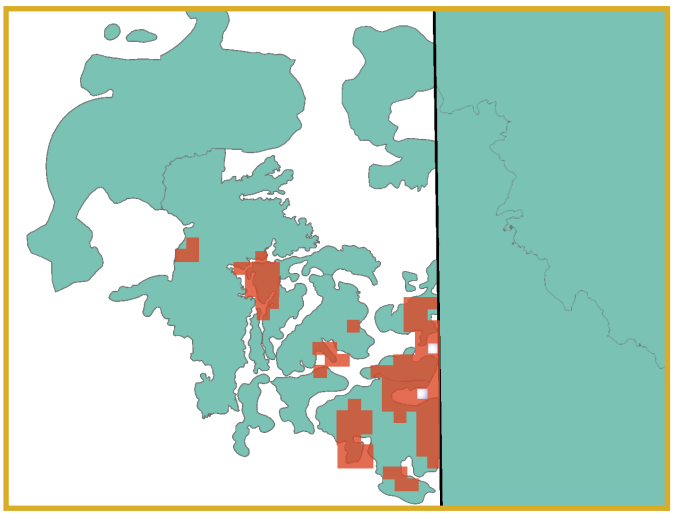
Geographic distribution of woodland caribou, boreal population in Canada

Regional Industry Caribou Collaboration study area

2. *Environment and Climate Change Canada and Alberta Environment and Parks. 2020. Agreement for the Conservation and Recovery of the Woodland Caribou in Alberta.*

Habitat Restoration

Linear features, including legacy seismic lines, have been implicated in caribou declines mostly through their facilitation of predator movement and increasing predator access to — and overlap with — caribou. Restoration of seismic lines has been identified as a key management tool to support caribou recovery in Alberta. Restoration treatments, such as planting and mounding, aim to return forest cover and reduce predator use of these features, ultimately reduce predation on caribou. Member companies recognize our role in habitat restoration, and have assessed or treated over 2,300 km of legacy seismic lines since the inception of RICC. In 2021, RICC member companies treated 254 km of seismic lines.



Restoration treatment townships

Using silvicultural tools like mounding, coarse woody material placement, and planting over 1 million seedlings, RICC companies have initiated habitat recovery across an area of approximately 1,050 km² in Cold Lake, 545 km² in ESAR and 20 km² in WSAR caribou ranges [3]. RICC also has an implementation-ready plan to address 268 km in ESAR.

Since RICC began, > 2,300 km of seismic lines have received treatments or were assessed as naturally regenerating

3. Based on the definition of disturbance as defined in the federal Recovery Strategy (2012).

Multiple lines of evidence for predator and prey responses to caribou habitat restoration

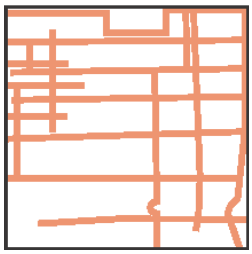
Habitat restoration is increasingly being implemented to recover caribou habitat. Given the extent of the disturbance and the cost to conduct restoration, evaluating the effectiveness of restoration treatments is needed for effective recovery of caribou populations. We used a multi-scale and multiple-lines-of-evidence approach to evaluate the response of wildlife to restoration treatments in a 378km^2 area, one of the largest studies of its kind.

The study evaluated how moose, caribou, bears, and wolves used two areas; one without habitat restoration ("business as usual", and one with extensive restoration treatments ("restored landscape"). They used both camera traps and GPS collars to monitor animals as they used seismic lines and the surrounding habitat within these two areas.

Methods:

Paired Design

Business as Usual Landscape



Restored Landscape

Multiple Data Types

Camera Traps

GPS Collars

Multiple Scales

Camera Site

Single Animal

Whole Study Area

Main Results:

All four species were less likely to be present at treatment sites, particularly those with higher intensity treatments, though effect sizes were small.

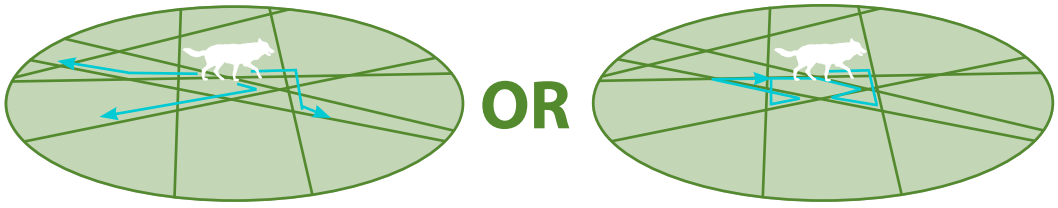
Moose, bears and wolves monitored with GPS collars also showed a decline in use of treated linear features, though the response was minimal.

The study found more evidence than not supporting the expectation that animals reduce use of the restoration sites. Reduced use by both predators and prey are expected to reduce encounter rates, and therefore predation rates of caribou. However, the study also highlights the complexity of monitoring and evaluating the success of habitat restoration. Continued monitoring of restoration effectiveness will be needed to understand how these species respond to restoration treatments in the long-term.

Supporting Science To Understand Caribou Declines And Caribou-Predator-Landscape Relationships

Resource Exploitation Collapses the Home Range of Wolves

Previous work suggests that restoration of linear features, such as seismic lines, pipelines, and roads, can reduce wolf hunting efficiency, but our results suggest that restoration can also reduce regional wolf density, especially in less productive areas favoured by caribou. Linear features enable wolves to travel more efficiently and provide easy access into woodland caribou habitat. It is hypothesized that these changes in wolf behaviour lead them to encounter caribou more frequently, increasing predation pressure on declining caribou. **However, the effect of increased hunting efficiency on wolf space-use at a larger scale is not well understood.**



Does easier travel lead wolves to search for prey over a wider area, which would push out other packs?

Does a more efficient search enable wolves to "make do" with less area and keep their journey close to home?

Methods:

We tested if wolves' home range size was influenced by how efficiently they could move around the lardscape, the density of prey, or the combination of the two.

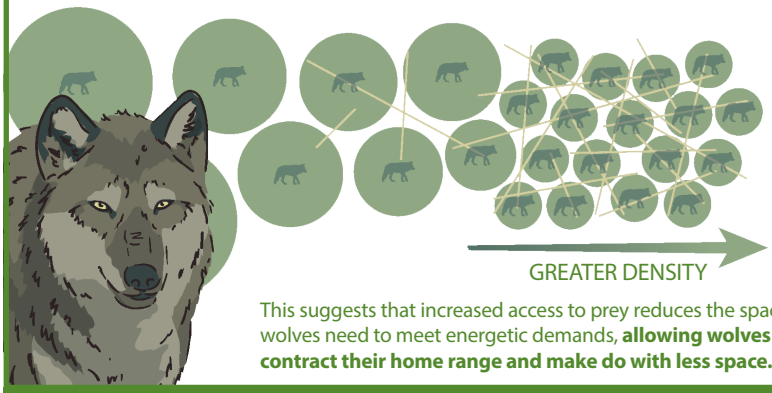
GPS DATA FROM 142 COLLARED WOLVES

DISTRIBUTED OVER >500,000 KM² ACROSS B.C., AB AND SK

PRIMARY PRODUCTIVITY = PROXY FOR MOOSE DENSITY

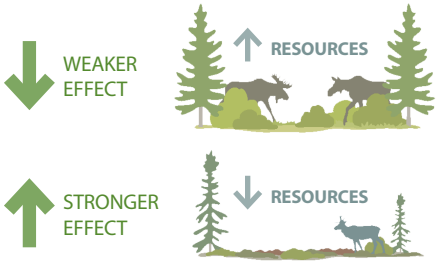
LINEAR FEATURES = PROXY FOR WOLF TRAVEL EFFICIENCY

We found that wolf home range size was influenced by not only prey density, but also how the landscape influenced access to those prey. **Home range size decreased as linear density increased.**



This suggests that increased access to prey reduces the space wolves need to meet energetic demands, **allowing wolves to contract their home range and make do with less space.**

Linear features had a more pronounced effect in less productive areas. i.e., areas with fewer moose, like those with vast peatlands.



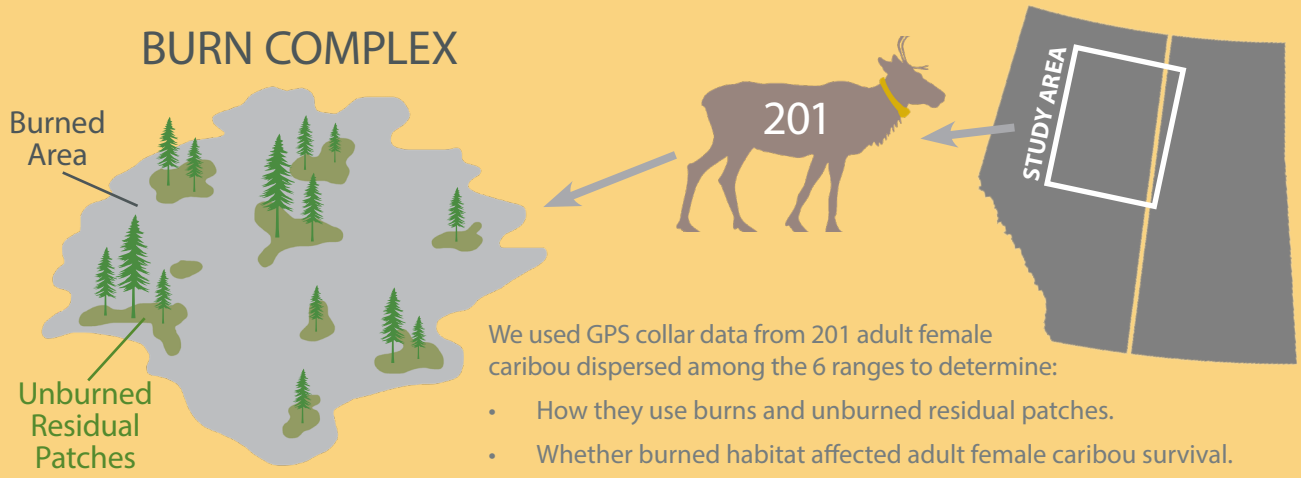
All else being equal, **smaller home ranges mean that more wolves can "pack" into an area**—increasing regional density.

This study demonstrates how an understanding of animal movement and space use can assist conservation. Linear features not only facilitate wolf travel, but can shrink the area wolves need to survive, especially where resources are scarce. **This could mean that areas with more linear features have higher wolf density, which may also increase predation on caribou.**

A Burning Question: What are the Implications of Wildfire for Woodland Caribou?

Wildfire is the dominant natural disturbance in the boreal forest and can influence food availability and disrupt predator-prey relationships for species like boreal woodland caribou. Understanding how caribou use burned habitat is important for informing caribou conservation and recovery. Land use and economic decisions depend on appropriately defining and managing critical habitat. Because fire is currently considered a disturbance to caribou habitat, understanding how caribou respond to these disturbances is necessary.

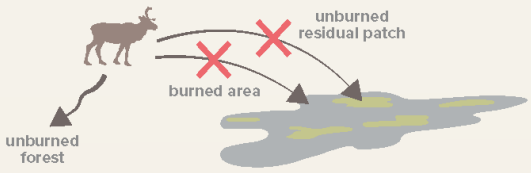
There is uncertainty around whether unburned residual patches should be included in disturbed habitat. To better understand the implications of wildfire on caribou ecology, we mapped residual patches within fires occurring on 6 boreal woodland caribou ranges in northeastern Alberta.



We used GPS collar data from 201 adult female caribou dispersed among the 6 ranges to determine:

- How they use burns and unburned residual patches.
- Whether burned habitat affected adult female caribou survival.

What we found:



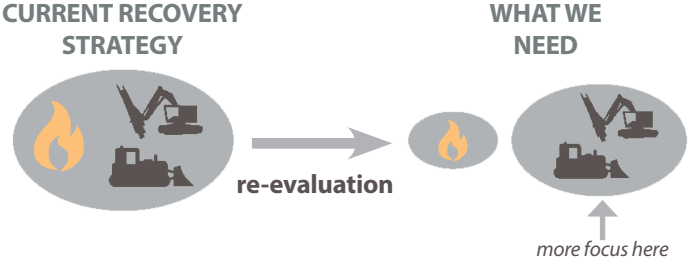
Caribou avoided both burned areas and unburned residual patches, suggesting they perceive burned areas as one continuous disturbance.

However, burned habitat did not affect adult female survival, suggesting that wildfire is unlikely to be the primary cause of caribou declines.

If populations are declined by 30%, but habitat is not limiting, it is predators that are likely the cause.

Management Implications

- We found no support for considering unburned residual patches sseparately from the larger burn area when assessing disturbance thresholds under recovery strategy guidelines.
- Instead of focusing on managing the effect of wildfires on caribou, recovery efforts should focus on reducing the effect of human-caused habitat alteration.
- This research highlights the need to differentiate fire disturbance and human-caused habitat alteration when assessing critical habitat.



Trophic Consequences of Terrestrial Eutrophication for a Threatened Ungulate

Climate change and landscape transformation are having a combined, enriching effect on ecosystems through "terrestrial eutrophication"; i.e. an increase in habitat productivity. For example, forest cutting leads to an increase in the production of early seral vegetation. How changes in productivity influence food webs is unclear, because these changes can result in positive outcomes for some species, and negative outcomes for others. Understanding the response of different species to this habitat alteration is crucial to inform caribou recovery management decisions.

We contrasted the support of several hypotheses linking habitat alteration to caribou declines:

i. Resource extraction limits forage for caribou, leading to lower population growth rates.

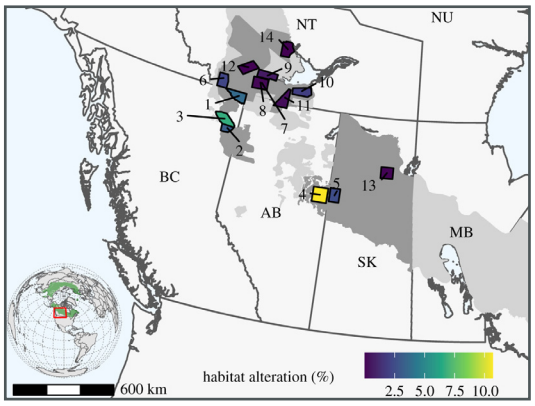
ii. Linear forest clearings (seismic lines, pipelines, roads, etc.) allow for easier predator movements, leading to increased predation of caribou by wolves.

iii. Moose out-compete for forage, resulting in less food for caribou and thereby, lower population growth.

iv. Increased young vegetation from habitat alteration supports more moose, which in turn support more wolves, resulting in higher predation of caribou by wolves (termed "apparent competition").

v. Moose and caribou both benefit from increased forage due to resource extraction.

To contrast these hypotheses, we combined satellite-derived estimates of primary productivity, estimates of moose abundance, wolf abundance, and caribou population growth rates.

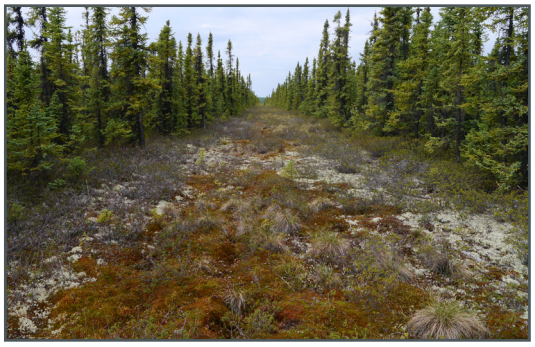


Wolf survey units (WSU) used to evaluate the relationship between productivity, moose density, wolf density and caribou population growth rates in the boreal forest of western Canada. The colour gradient represent the per cent anthropogenic habitat alteration. Light grey shading is boreal caribou range, and dark grey shading represents focal areas where caribou demographic data were collected. Numbers for each WSU correspond to the raw data labels in GitHub.

Wolf on a seismic line. Photo credit: Chris Gale

Results:

Hypothesis iv above ("apparent competition") was most supported by the data, suggesting that increased forage from habitat alteration resulting from resource extraction increases the density of moose, and thereby wolves, which incidentally prey on caribou. Caribou recovery will therefore likely require management actions that operate across these various trophic levels (predator reductions, prey reductions and habitat restoration). This work provides insight into the cascading effects of forest harvest, shining light on how altering habitat can influence natural predator-prey dynamics.



Peat seismic. Photo credit: Craig De Mars

Ecosystem Monitoring Camera Program

RICC continued monitoring existing camera arrays in Cold Lake, ESAR, WSAR and Saskatchewan boreal plains caribou ranges and deployed new wildlife cameras in Richardson.

Partners: Caribou Monitoring Unit (CMU), Government of Alberta, Cold Lake First Nation, University of Alberta.

Influence of caribou management actions on prey and predator densities over time

Predator reductions, which are conducted by the Government of Alberta, and habitat restoration are two of the main management activities being used to recover caribou and their habitat in Alberta. Understanding how the mammalian community responds to caribou recovery actions, and how these various conservation levers combine to influence populations at the range-scale, is necessary. Preliminary results to date suggest the density of moose, deer, and, black bears have not increased over time in the wolf reduction only area relative to the reference area. In 2020, there was a significant increase in caribou densities in ranges with wolf reductions only and with wolf reductions and habitat restoration. Additional years of data are needed to confirm this trend.

Relative influence of human habitat alteration on deer densities

Increased deer presence and abundance within caribou range is linked to increased predation on caribou populations by supporting high predator densities. Therefore, understanding the factors that influence deer abundance and distribution has important implications for management. Human habitat alteration has been implicated in deer expansion by increasing forage. Additionally, over-winter survivorship of deer has increased due to less severe winters resulting from climate change. Because human habitat alteration decreases as we move northward but climate also becomes harsher, these two factors are confounded across Alberta's caribou ranges, making their relative effects on deer populations difficult to disentangle. Contrasting Alberta to Saskatchewan landscapes provides a unique opportunity to compare deer densities in similar climates, but with varying levels of human habitat alteration. Preliminary results found that when accounting for local habitat productivity, deer densities were better explained by winter severity than human habitat alteration: there were fewer deer in areas with longer, colder, snowier winters. Additional data are being collected to continue exploring the interaction between human habitat alteration and climate.

Relative influence of human habitat alteration and fire disturbance

Habitat disturbance from fire and human habitat alteration have been linked to caribou declines. The frequency and intensity of fires within Canada's boreal forests are changing, making it important to understand the relative impacts of these two causes of habitat disturbance. In 2021 the Ecosystem Monitoring Camera program continued to monitor three areas within the Richardson caribou range to help disentangle the relative effects of fire and human habitat alteration on mammal densities. Preliminary density estimates showed low densities of most ungulates and carnivores. An additional year of data will be collected to continue to evaluate these densities.

Exploring the drivers behind white-tailed deer density in Canada's northern boreal forests will help to understand the mechanisms behind increased predation on woodland caribou. Acknowledging that multiple management actions are needed to recover some caribou populations in the short term, we expect this work to help inform which management actions may combine to best support caribou recovery.

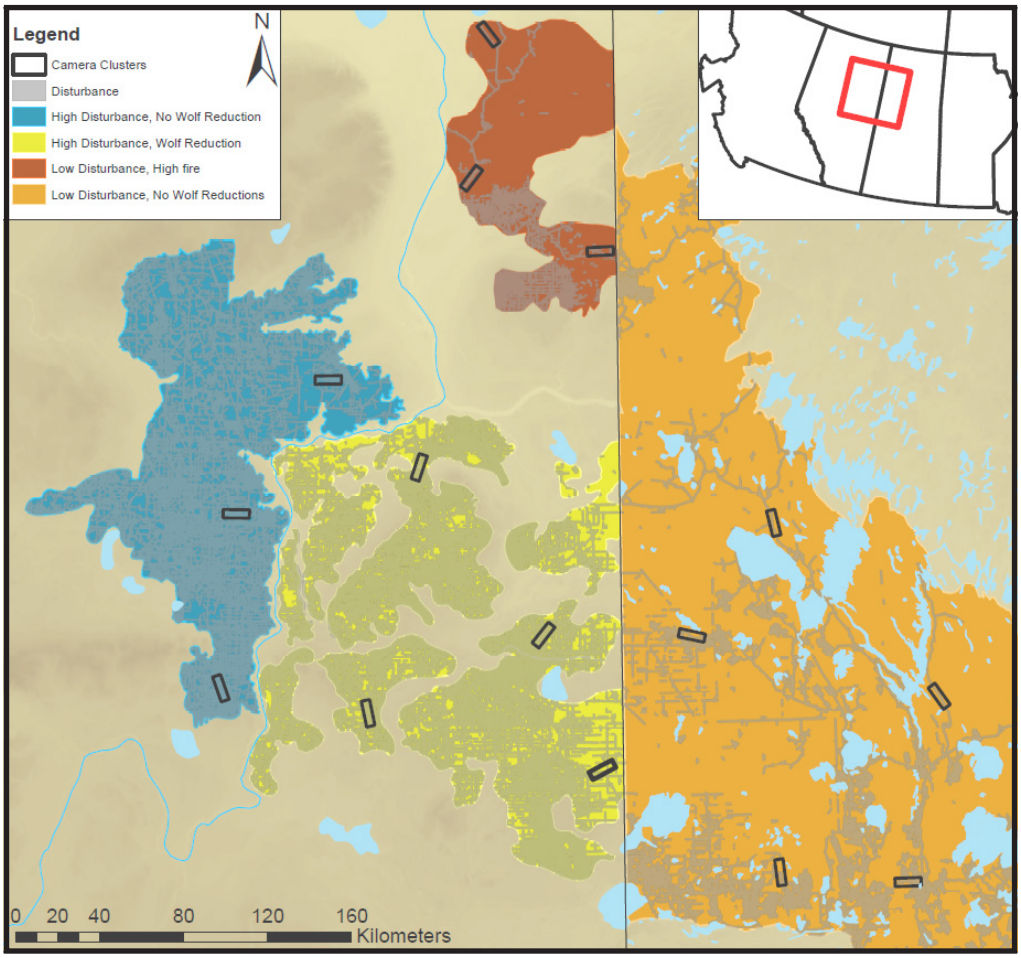
Photos captured by remote cameras

Program Objectives

1. **Monitor deer at their northern range limit and evaluate the relative influence fire disturbance on mammalian densities**

2. **Evaluate mammal population response to caribou management actions being implemented in different caribou ranges over time:**
   - Predator reductions only (ESAR)
   - Predator reductions and large-scale habitat restoration (Cold Lake)
   - Neither predator reduction nor large-scale habitat restoration (WSAR)
   - Reference areas with low levels of human land-use (Saskatchewan caribou ranges)

3. **Evaluate the relative influences of human habitat alteration and climate on white-tailed deer populations**



High Alteration **Low Alteration**

Work in Progress:

Synthesizing Mechanisms of Caribou Declines

Population declines of boreal caribou have been ultimately attributed to direct and indirect effects of landscape disturbance and climate change. The potential mechanisms linking these ultimate causes to caribou declines are varied, yet understanding these mechanisms and their relative importance is critical for developing effective conservation strategies for caribou. The primary objectives of this project are to:

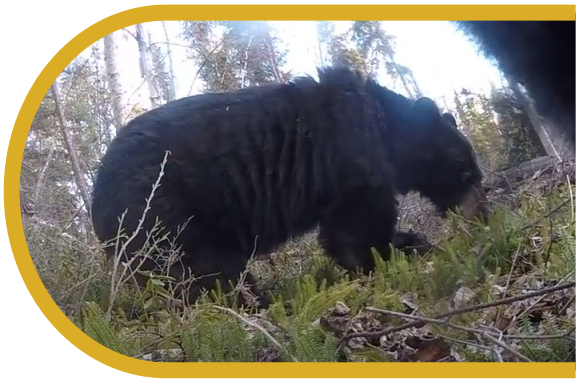
1. **Comprehensively review the existing literature to identify current hypothesized mechanisms for explaining caribou declines; and,**
2. **For each mechanism, determine whether demographic effects (e.g., lowered adult survival or juvenile recruitment) have been reported and whether such effects have been explicitly linked to population growth rates of caribou.**

From a management perspective, understanding the relative roles of natural disturbances (e.g., fire), climate effects, and human-caused disturbance will inform future effectiveness of efforts to recover human-caused habitat disturbance. This work therefore has the potential to influence future decisions regarding habitat restoration and activating other population management levers.

Estimating Black Bear Kill Rates on Caribou Neonates

Low calf survival is a key factor contributing to population declines of boreal caribou. Predation is the primary cause of calf mortality, and calf predation is particularly high during their first six weeks of life (i.e., the neonatal period). Evidence from eastern Canada suggests that black bears are a dominant predator of neonate calves, but it is unclear whether this holds true in western ranges of caribou. This project seeks to understand the influence of black bear predation on caribou calf survival by deploying video camera-equipped radio-collars on a sample of black bears occurring within and adjacent to the ESAR and Cold Lake caribou ranges.

This technology will allow for an estimate of kill rates of ungulate calves by black bears as well as fine-scale analyses of habitat use and selection by black bears during the calving season. These analyses will further incorporate estimates of bear density, which were derived from existing RICC remote camera program, to estimate the number of calves killed annually by bears and infer the demographic impact of calf predation by black bears on caribou populations. If black bears substantially contribute to high calf mortality, the implementation of a maternal pen or predator enclosure may be supported to protect caribou from this predator.



Camera-equipped GPS radio collars were deployed on bears in 2019 (n = 5 bears) and 2021 (n = 20 bears). Collars were deployed in May and recorded data to mid-July, an interval that spans the neonatal period for caribou. Preliminary results suggest that the rate of calf kills per bear is low (e.g., <1 in 10 bears kills a calf), indicating that bears are opportunistic when predating calves and demographic impacts to caribou are likely dictated by bear densities. More comprehensive analyses are ongoing.

Caribou Ecology and Recovery Webinar Series

COVID-19 resulted in the cancellation of numerous conferences since 2020, including the Alberta Chapter of the Wildlife Society and the North American Caribou Workshop. To facilitate sharing information and maintaining communication between academics, government and industry, RICC sponsored the Caribou Ecology and Recovery Webinar Series, hosted by the Caribou Monitoring Unit and the National Boreal Caribou Knowledge Consortium.

Within the webinar series, Melanie Dickie, supported by RICC, presented preliminary research disentangling the influence of climate, habitat productivity and human footprint on white-tailed deer densities using data from the Ecosystem Monitoring Camera Program. The series has successfully engaged the community, with local and international participants frequently attending webinars. Because of its success in 2020 and 2021, the webinar series is continuing into the spring of 2022 with over 300 participants registered for the series.

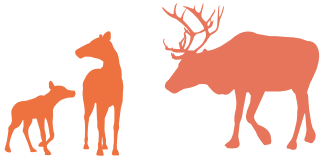
Presentations and Publications:

- Dickie, M., McNay, R.S., Sutherland, G.D., Sherman, G.G., Cody, M., 2021. Multiple lines of evidence for predator and prey responses to caribou habitat restoration. Biol. Conserv. 256, 109032. https://doi.org/10.1016/j.biocon.2021.109032
- Konkolics, S., Dickie, M., Serrouya, R., Hervieux, D., Boutin, S., 2021. A burning question: What are the implications of forest fres for woodland caribou? J. Wildl. Manage. https://doi.org/10.1002/jwmg.22111
- Serrouya, R., Dickie, M., Lamb, C., Van Oort, H., Kelly, A.P., Demars, C., McLoughlin, P.D., Larter, N.C., Hervieux, D., Ford, A.T., Boutin, S., 2021. Trophic consequences of terrestrial eutrophication for a threatened ungulate. Proc. R. Soc. B Biol. Sci. 288. https://doi.org/10.1098/rspb.2020.2811
- Dickie M., In press. Resource exploitation efficiency collapses the home range of an apex predator. Ecology. https://doi.org/10.1002/ecy.3642
- Dickie, M., 2021. Disentangling the influence of anthropogenic habitat alteration from climate on expanding white-tailed deer populations in western Canada. Caribou Ecology and Webinar Series.

Awards:

Two RICC-funded peer-reviewed manuscripts received Top Cited Article Awards in 2020-2021. These awards reflect the highly relevant work being conducted by the RICC program and partners:

- Dickie, M., McNay, S.R., Sutherland, G.D., Cody, M., Avgar, T., 2020. Corridors or risk? Movement along, and use of, linear features varies predictably among large mammal predator and prey species. J. Anim. Ecol. 89, 623–634. https://doi.org/10.1111/1365-2656.13130
- 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



Partner with us

Current RICC members include Canadian Natural, Alberta-Pacific Forest Industries Inc., Athabasca Oil Corporation, Cenovus Energy Inc., CNOOC, Imperial, MEG Energy and Suncor, but is open to any interested industry parties. We work with academia, the Government of Alberta, the Alberta Biodiversity Monitoring Institute (ABMI) Caribou Monitoring Unit and other organizations to meet our objectives. RICC officially became a Canada's Oil Sands Industry Alliance (COSIA) Joint Industry Project in 2014.

Learn more about our collaboration and how to become a member at:
www.cosia.ca/initiatives/land/regional-industry-caribou-collaboration

@RICCCaribou

cariboucollaboration@gmail.com

RICC | Regional Industry Caribou Collaboration

RICC | Regional Industry Caribou Collaboration