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INTERSPECIFIC INTERACTIONS

Predators Without Preference: Grey Wolf Movement in Relation to Overlapping Barren-ground Caribou Herds

Robin Abernethy¹, Alicia Kelly², Abbey Wilson²

¹Environment and Climate Change,
Government of the Northwest Territories,
Yellowknife, Northwest Territories, Canada,

²Environment and Climate Change,
Government of the Northwest Territories

The significant decline of the migratory Bathurst barren-ground caribou herd in Northern Canada, and the need to understand how predators impact the herd and its recovery, have highlighted knowledge gaps surrounding Tundra grey wolf space use and movement patterns. In winter, Bathurst caribou have shown increased spatial overlap by the more populous Bluenose East and Beverly caribou herds since 2020. This study aimed to determine if grey wolf movement patterns showed selection for one herd over another during these times of winter caribou herd overlap. Concurrent barren-ground caribou (n = 308) and grey wolf (n = 30) GPS telemetry datasets were used from January through April of 2020 to 2023. Wolf movement and herd selection were examined using integrated step selection models incorporating herd-specific prey proximity metrics (distance to the ten closest satellite collared caribou from each of the Bluenose-East, Bathurst, and Beverly herds) and environmental covariates (elevation, slope, percent open habitat, distance to eskers, temperature, and snow depth). Overall, across the individual wolf models, no significant coefficients (positive or negative) were found for any of the explored covariates, prey-based or environmental. However, results should be

interpreted with care as the lack of significant correlation could indicate misalignment between the temporal and spatial scales at which predator selection occurs across the landscape. This work informs the adaptive strategies of wolf management programs in migratory systems by providing evidence that wolf movements and habitat selection cannot be used to affiliate wolves with particular caribou herds during times of overlap.

Fire History as a Driver of Muskox Habitat Selection in Boreal Forests: Implications for Coexistence With Caribou

Nick Luymes¹, Kevin Chan², Jan Adamczewski²,
Frances Stewart¹

¹Wilfrid Laurier University, ²Government of
Northwest Territories

Muskoxen are an ecologically and culturally significant species in Canada's North, but their ongoing southern range expansion in the Northwest Territories (NWT) has led to questions regarding their impact on other wildlife, especially boreal caribou. After severe depletion due to overexploitation, muskoxen have been recolonizing into the boreal forest, an area where research is scarce. To address community concerns of habitat overlap and indirect competition between muskox and boreal caribou I used data from GPS-collared muskoxen in the Sahtú Region to study seasonal resource selection and compare with that of boreal caribou. Using integrated step selection functions, I looked at the influence of topography, land cover, and fire history on movement decisions. Selection for burned areas was up to four times as likely as unburnt areas in the summer and, in the winter, forested uplands were twice as likely to be selected compared to open areas. These habitat associations suggest that muskoxen may be

occupying different niches in the boreal forest compared to caribou. This research will enhance our understanding of how habitat requirements differ across environmental gradients and inform multi-species conservation strategies as distributions change.

Assessing the Influence of Wolf Removal on Bathurst Barren-ground Caribou Population Dynamics in the Northwest Territories

Amelia Cox¹, Alicia Kelly², Brad Woodworth², Robin Abernethy², Chloe Beaupre³, Stephanie Behrens⁴, John Nishi⁵, Dean Cluff⁶, Abbey Wilson²

¹Environment and Climate Change/ Government of Northwest Territories | Yellowknife | NWT | Canada, ²Environment and Climate Change, Government of Northwest Territories, ³State University of New York, College of Environmental Science and Forestry, ⁴Tłıchǵ Government, ⁵EcoBorealis Consulting Inc, ⁶Wek'èezhii Renewable Resources Board

The migratory Bathurst barren-ground caribou herd in the Northwest Territories, Canada has declined since 1996, with rapid declines in recent years leading to co-management actions to conserve the herd. Though the causes of this decline are cumulative, wolf predation is a source of mortality for the Bathurst herd and reducing predation has been an effective method for caribou recovery in southern, non-migratory populations. The Government of Northwest Territories, Tłıchǵ Government, and the Wek'èezhii Renewable Resources Board implemented a wolf removal program on the winter range (January-May) of the Bathurst caribou herd from 2019 to 2024. Here we present a Bayesian Integrated Population Model for the Bathurst herd that integrates

abundance counts, age and sex composition, and individual-level seasonal survival with environmental and wolf removal metrics to evaluate the impacts of wolf removal on herd vital rates. However, if wolf removal increased wolf population growth through reproduction or immigration, we may not see positive impacts of wolf removal on the Bathurst survival. Alternatively, other environmental stressors may be more important drivers of population dynamics. Quantifying the impacts of wolf removal on Bathurst caribou will improve our understanding of wolf management as a tool for migratory barren-ground caribou recovery in the Northwest Territories and beyond.

Forest and Fire Drive Moose (Denié) Detections Near Their Northern Range Limit

Rosemary Hohnen^{1,2}, Nick W. Luymes¹, Eric Vander Wal³, Frances E.C. Stewart^{1,4}

¹ Department of Biology, Wilfrid Laurier University, ² Research Institute for the Environment and Livelihoods, ³ Department of Biology, Memorial University of Newfoundland, ⁴ School of Environmental Studies

Species distributions have been shifting dramatically in the past century amplified by the impacts of anthropogenic climate change. Moose (*Alces alces*) have been documented expanding their northern range onto the tundra, increasing potential for competition with tundra specialized species like barren-ground caribou (*Rangifer tarandus groenlandicus*). What drivers of this expansion remain unclear. We modelled moose detection rates from camera trapping data along the transition zone between the taiga boreal forest and tundra in Thaidene Nëné Indigenous Protected Area, NWT to quantify drivers of an edge population of moose, specifically looking

at landcover, fire characteristics, and co-occurrence of predators and competitors, including barren-ground caribou. In summer, the presence and age of fires were the best predictors of moose occurrence; with moose detected the most in habitat that had burned more than 20 years previously and the least in habitat that had not burned in the past 50 years. The best predictor of moose occurrence in the winter was landcover, with the moose detections highest in areas with mixed forest. Co-occurrence with barren-ground caribou and other competitors and predators had minimal impact on moose detections, contrasting with previous studies. Moose were detected at three locations on the tundra overlapping briefly in the fall with barren-ground caribou, with multiple sightings at one location. These results suggest that moose use different habitats on the edge of their range, and climate impacts may continue to cause changes in this species' distribution in the future.

Grizzly Bear and Wolf Activity During Caribou Calving Assessed With Broad-Scale Camera Trapping

Benjamin Larue¹, Amélie Roberto-Charron², Amanda Dumond³, Jan Adamczewski⁴, Robert Winter⁵, Erik Hedlin⁶, Megan Perra⁷, Celebrity Wright⁷, Anne Gunn⁸, Eliezer Gurarie⁷, Mark Hebblewhite⁹

¹Université Laval, Québec, Québec, Canada,

²Government of Nunavut, ³Kugluktuk Angoniatit Association, ⁴Wildlife Division, Government of Northwest Territories, ⁵Electrical and Computer Engineering Department, University of Alberta, ⁶Department of Biological Sciences, University of Alberta, ⁷Department of Environmental Biology, SUNY-ESF, ⁸CARMA, ⁹Wildlife Biology Program, University of Montana

Caribou (tuktu in Inuinnaqtun) from the Bathurst and Bluenose-East herds have experienced steep declines in recent decades, raising major concerns for communities who depend on these herds for food, cultural continuity, and wellbeing. In Kugluktuk, Inuit knowledge holders have described noticeable changes on the tundra, including more frequent encounters with grizzly bears, and have expressed concerns that these shifts may affect the survival of newborn calves. Responding to these observations, the Kugluktuk Angoniatit Association (KAA) partnered with the Governments of Nunavut and Northwest Territories to design and lead a community-based study focused on predator and caribou activity during the calving period. The program deployed 96 non-invasive camera traps across the Bathurst calving grounds, creating one of the largest camera-trap arrays in the Arctic. Analysis of more than 245,000 photos collected in 2023 revealed that grizzly bears were detected five times more often than wolves and showed strong spatiotemporal overlap with calving caribou. These findings point to the need for closer examination of predator movements and their potential influence on caribou recruitment. KAA is now extending this effort to the Bluenose-East calving grounds, establishing a multi-year, comparative monitoring program. This community-led scientific approach is generating the data needed to start evaluating predator impacts and support decision-making aimed at improving caribou recovery in the central Canadian Arctic.

Winter Distribution Overlap of Migratory Barren-ground Caribou Reduces Effectiveness of Wolf Management

Abbey Wilson¹, Robin Abernethy², Dean Cluff³, Stephanie Behrens⁴, John Nishi⁵, Nicola Love⁶, Robin Kite⁷, Jerrold Belant⁸

¹Wildlife Management Division, Government of the Northwest Territories | Yellowknife | NT | Canada, ²Government of the Northwest Territories, ³Wek'èezhii Renewable Resources Board, ⁴Tłı̨chǫ Government, ⁵EcoBorealis Consulting Inc, ⁶University of British Columbia, ⁷Caslys Consulting Ltd, ⁸Department of Fisheries and Wildlife, Michigan State University

The Bathurst and Bluenose East barren-ground caribou herds have declined since 1996 (99%) and 2010 (67%), respectively. The Wek'èezhii Renewable Resources Board, Government of Northwest Territories, and Tłı̨chǫ Government implemented a wolf removal program on the winter ranges of these herds in Northwest Territories, Canada during January-May 2019-2024 to facilitate recovery. We assessed if caribou herd mixing during winter influenced our ability to assign wolves to specific herds for targeted removal. We used wolf harvest, capture, and den-site locations and GPS collar data to estimate wolf movements and caribou herd distributions. Monthly spatial overlap of the Bathurst and Bluenose-East caribou with at least one other herd during wolf removal increased from >17% in 2019 to 91% in 2024. Using telemetry data from 31 wolves, five co-occurred at least 66% and two 100% of the time with an individual herd. Further, only 30% of wolves assigned to a caribou herd based on winter capture location denned on the same caribou herd range. In 2021, 47% of wolf harvest locations overlapped with monthly utilization distributions of a single herd. Using integrated step selection analysis, wolves did

not select for specific caribou herds. Techniques used to assign wolves to individual caribou herds were ineffective, with accuracy of herd assignments less than 50% across methods. We demonstrate the challenges of wolf removal to benefit migratory caribou herds exhibiting high spatial overlap and suggest that it may not be possible to conduct wolf removals relative to specific herds in this system during winter.

CONSERVATION & MANAGEMENT I

Beyond the 65% Threshold: Environmental and Human Factors Shape Boreal Caribou Survival and Population Trends in the NWT

Chloe Beaupre¹, James Hodson², Allicia Kelly², Kathy Unger², Robin Abernethy², Nick Wilson², Ashley McLaren², Michael Gast², Lisa Smith², Kathleen Groenewegen², Eric Nielsen³, Cheryl Johnson⁴, Eliezer Gurarie¹

¹State University of New York College of Environmental Science and Forestry,

²Environment and Climate Change, Government of Northwest Territories, ³Canadian Forest Service, Natural Resources Canada,

⁴Environment and Climate Change Canada, Science and Technology Branch

The boreal caribou national Recovery Strategy requires maintaining at least 65% undisturbed habitat within each range Canada wide, defining disturbance as the combined area of human disturbance (buffered by 500 meters) and wildfires up to 40 years old. However, previous work in the Northwest Territories (NWT) found that boreal caribou actually select recent (0-10 year) burns during summer but older unburned habitat by late winter, suggesting that measuring fire disturbance may better predict survival. Additionally, annual demographic fluctuations despite relatively stable levels of human disturbance over time implicate weather as a potential driver. We used survival and calf recruitment data from population monitoring programs across seven study areas in the southern NWT to compare the performance of various models to evaluate which factors best predicted individual adult

female survival. The area-based disturbance models from the national Recovery Strategy were compared against alternative models incorporating different metrics for human and wildfire disturbance, models including weather-related variables and finally, a similar set of disturbance-based models. Our analysis revealed that the relationship between disturbance and caribou demographics may be more nuanced than current Recovery Strategy framework suggests. Fire age appeared to play a different role than traditionally assumed, with younger age classes showing different relationships than predicted by the 40-year fire footprints. Weather variables emerged as important predictors alongside disturbance metrics, suggesting that population dynamics are driven by multiple interacting factors. These findings highlight the need to reconsider how we measure habitat disturbance and predict population viability for boreal caribou in their northern range.

Management Focus on Caribou Threats Provides Uneven Protection for Canada's Other Species at Risk

Rosemary Hohnen^{1,2}, Nick Luymes², Eric Vander Wal³, Frances Stewart²

¹Charles Darwin University, Darwin, Australia,

²Wilfrid Laurier University, ³Memorial University

In Canada, the number of species at risk is escalating rapidly, prompting conservation managers to consider how best to allocate funding to effectively address species loss and support ecological integrity. Considerable resources have been allocated to woodland caribou (*Rangifer tarandus caribou*, hereafter caribou) conservation, due to the species widespread range, cultural significance and population declines. However, these caribou-

focused conservation efforts may or may not benefit the other 649 Canadian species at risk. We use national datasets of spatial distributions and threat listings to examine the extent that caribou-focused conservation might benefit Canadian species at risk, quantified through geographic and threat overlap. We found that 23 % of species at risk overlap in range with caribou, and of those 13 % overlap in more than 20 % of their range. Of those sympatric species, range size, range overlap with caribou and taxonomic group best predicted threat overlap with caribou. Caribou share more threats with species at risk that have large ranges and overlap more in their distribution with caribou, including those from specific taxonomic groups including amphibians, reptiles and terrestrial molluscs. Management focus on caribou provides uneven protection for Canada's species at risk, particularly those with small ranges.

Disconnect Between Scientific Evidence and Policy Decisions Leads to Further Endangerment of Species at Risk: Upper Smoky Sub-regional Planning as a Case Study

Tara Russell¹, Pamela Narváez-Torres², Kirby Smith³

¹Canadian Parks and Wilderness Society Northern Alberta Chapter, ²Alberta Wilderness Association, ³Conservation Affairs Committee, Alberta Chapter of the Wildlife Society

Southern mountain caribou are a threatened species in Canada. Habitat loss, driven by industrial development, is the ultimate cause of their endangerment. The Government of Alberta completed the Upper Smoky Sub-regional Plan in 2025. The plan was meant to

recover the Redrock-Prairie Creek and Narraway southern mountain caribou populations, however commercial timber harvest and potential harvest for fire mitigation, will dramatically destroy caribou critical habitat. Using caribou location data from the Government of Alberta and spatial landscape information from the draft and final plans, we reviewed the overlap between proposed timber harvest areas, caribou critical winter habitat, and caribou occurrence on their winter range. We depicted the loss of biophysical and undisturbed critical habitat within each caribou winter range. Combined with a literature review, we explored the implications for population persistence given the forecasted loss of habitat in the plan. Our analyses show that the proposed harvest sequence would enable clearcutting across much of their winter ranges. Additional habitat loss from wildfire mitigation would further reduce the already limited amount of undisturbed critical habitat – already well below the minimum 65% threshold required for recovery – and reduce available biophysical critical habitat. Caribou habitat will not recover for over 100 years. These findings highlight a government-led planning and decision-making process that is not considerate of published findings regarding caribou conservation and site-specific data for the affected caribou populations. We will discuss the interface between research-based knowledge for this species at risk and government planning and policy processes.

Societal Drivers and Barriers for Caribou Conservation Measures: Integrating Governance, Local Knowledge, and Social Acceptance in the Dovre-Rondane Region, Norway

Marianne Singaas¹, Stine Rybråten², Vegard Gundersen²

¹Telemark Research Institute, Norway,

²Norwegian Institute for Nature Research

Norway holds an international responsibility to protect the last 24 relatively isolated populations of European wild reindeer, now red-listed and increasingly threatened by habitat fragmentation, climate warming, and emerging diseases. In response to escalating pressures, national authorities launched a white paper in 2024; completed quality-norm classifications for all ranges; and facilitated extensive local processes that generated 310 proposed conservation and management measures (CMM). These CMMs constitute an unprecedented governance initiative in Norway: Never before has such a cross-sectoral suite of conservation actions been mobilized simultaneously. At the same time, they offer an unparalleled scientific opportunity, as this is the first instance in which extensive before-after datasets on human activity, GPS-collared reindeer movement, and population performance exist for multiple concurrent interventions—creating a globally unique evidence base for assessing both social acceptance and ecological effectiveness. Taking departure in the newly funded project “Coexistence of wild reindeer and humans - reducing barriers in a social-ecological framework” (COEXISTENCE) supported by the Norwegian Research Council, this presentation investigates the societal drivers and barriers shaping support for CMM across scales. Drawing on a holistic socio-ecological

framework (Ostrom 2009, Collins 2011), we examine how local practices, values, and power relations influence perceptions of soft (informational) and hard (restrictive or physical) measures. Ethnographic fieldwork and semi-structured interviews conducted in spring 2026 will explore lived experiences of reindeer management, shedding light on how people navigate multiple, sometimes conflicting, expectations linked to conservation, land-use traditions, identity, and local autonomy. The preliminary results will highlight key drivers of support, sources of resistance, and the governance conditions required for legitimacy, compliance, and long-term conservation success (Decker 2016).

Wildlife as Research Partners: Connecting Land Relationships to Wildlife Data Governance

Erin Tattersall¹, Michael McPhee², Samuel Haché³, Warren Cardinal-McTeague¹, Cole Burton¹

¹University of British Columbia, ²Sambaa K'e First Nation, ³Canadian Wildlife Service

Scientific data are more than pieces of information to be analyzed to address a research question; they reflect the values and priorities that motivate scientific curiosity. Understanding these underlying perspectives is especially important in collaborations between Indigenous communities and Western scientists because they shape collaborative data governance. This study is a collaboration between Sambaa K'e First Nation and researchers in the Northwest Territories Biodiversity Monitoring Program (NWTBMP), an initiative to establish wildlife monitoring across remote NWT landscapes. We explored Sambaa K'e perspectives on land and wildlife stewardship, research, and monitoring, and identify how these guide the community's

visions for collection of wildlife data. In March 2025, we hosted community members in a workshop in Sambaa K'e to discuss wildlife, data, Indigenous data sovereignty, and land stewardship. Participants shared about their past and present relationships to land and how this connection frames the values that guides research priorities. We also discussed concerns about land governance, climate change, and research, and what participants envisioned for Indigenous-led monitoring, collaborative monitoring, and data governance moving forward. Participants identified caribou as a sensitive species and spoke of strong preferences for non-invasive data collection methods. They also expressed the desire for greater control of data throughout research, particularly when sharing data beyond individual collaborators. The results of this study will support Sambaa K'e in developing their own data governance frameworks, shape the terms of their collaboration with the NWTBMP, and inform the program's research on culturally significant species such as caribou throughout the territory.

actually protect caribou habitat - especially with new pressure to quadruple oil and gas development, introduce AI data centres and nuclear energy generation. The over allocation of forestry licenses in Alberta, as well as the companies public and active role in creating the plans meant to regulate development within caribou zones is also a unique part of the discussion. Finally, we would speak to how efforts in the South are comparable, but also somewhat distinct to what is being experienced by Northern populations.

Caribou Advocacy in an Alberta Sub Regional Planning Landscape from an Indigenous Perspective

Aseniwuche Winewak Nation

Plan to present a panel discussion moderated by Jaymie Campbell, with panelists from AWN (David MacPhee, President and Marc Doire (AWN Youth), Lawyer from JFK Law and potentially a CPAWS representative. The focus would be on the efforts undertaken by Indigenous communities to protect and conserve caribou and caribou habitat, including the voluntary pause on caribou harvesting in response to declining population numbers. In addition, we would speak to the failure of the subregional planning process in Alberta to address impacts to Indigenous rights, and to

HABITAT CHANGE & RESTORATION

Development of the Tłıchǵ Highway Caribou Habitat Offset Implementation Plan, A Collaborative Approach

Paula Bentham¹, Melanie R. Routh², Jack Yurko¹,
Mélanie Routh³, Benjamin Bey⁴, James
Hodson³, Lisa Smith³

¹WSP Canada, ²Department of Environment and Climate Change, GNWT, ³Department of Environment and Climate Change, Government of Northwest Territories, ⁴Department of Infrastructure, Government of Northwest Territories

The Tłıchǵ Highway is a 97-km all-season-road connecting Whatı to Highway 3. Construction of the Highway was completed by the Government of the Northwest Territories Department of Infrastructure (GNWT-INF) in 2021, with the route generally following a winter trail. Construction and operation of the Tłıchǵ Highway triggered concern over impacts to boreal caribou (tǵdzi) and uncertainty regarding effectiveness of mitigation measures by the Mackenzie Valley Environmental Impact Review Board (MVEIRB), which led to the requirement of a plan to offset any loss of effective tǵdzi habitat caused by building and operating the road. Following extensive engagement with the Tłıchǵ Government, Wek'èezhıı Renewable Resources Board, Yellowknives Dene First Nation, North Slave Métis Alliance and Environment and Climate Change Canada, a Caribou (tǵdzi) Draft Habitat Offset Plan was prepared in 2019 with a focus on habitat restoration, with a Final Habitat Offset Plan prepared prior to public use of the road. In 2024, the GNWT-INF initiated the preparation of the Caribou Habitat Offset

Implementation Plan (HOIP) for Tłıchǵ Highway within the Wek'èezhıı region. We will review the methods employed and criteria used in the development of the HOIP including; selection of features for restoration, an updated calculation of habitat offset area (ha), the collaborative approach used for engagement and local knowledge holder input into identifying restoration areas and actions, as well as preliminary restoration prescriptions following ground plot field investigation (2025) that consider the unique site limiting factors of northern ecosystems.

Advancing Indigenous-led Caribou Habitat Restoration through a Multifaceted Communications Approach

Kate Broadley¹, Katherine Wolfenden², Jesse Tigner³

¹Fuse Consulting Ltd., ²Fort Nelson First Nation Lands and Resources Department,
³SwampDonkey Solutions

Caribou habitat restoration is a critical conservation challenge that requires strong collaborations. Effective knowledge exchange and communication is needed to support innovation, share lessons learned, and engage local communities. We present the Fort Nelson First Nation's (FNN) caribou restoration program as a case study in effective communications and knowledge exchange. FNN has taken a multi-faceted approach to communication, using different materials to reach internal and external audiences, including newsletters, infographics, workshops, and documentary films. In doing so, FNN has been able to mobilize innovative approaches to restoration and share lessons learned with the broader restoration community, contributing to an engaged community of practice. These efforts have also been leveraged as strategic

opportunities for internal capacity-building for FNFN community members and youth education. Through effective communication about their work and the potential for Indigenous-led restoration, FNFN hopes to help shape the future of caribou habitat restoration across North America.

Evaluating Habitat Restoration to Meet Caribou Recovery Goals in Alberta

Melanie Dickie¹, Sarah Kristoff², Sara Barszczewski³, Cynthia Chand³

¹Wildlife Science Centre, Biodiversity Pathways,

²Alberta Biodiversity Monitoring Institute,

³Government of Alberta

Across Canada's boreal forest, habitat alteration has reshaped predator-prey dynamics in ways that continue to challenge the recovery of threatened species. For boreal woodland caribou, linear features such as seismic lines are a dominant focus of restoration because they increase predator access and hunting efficiency across large portions of the landscape. In Alberta, extensive linear disturbance has degraded caribou habitat, prompting the Government of Alberta to launch the Caribou Habitat Recovery Program in 2017. The program aims to treat and assess over 200,000 km of legacy seismic lines through treatments such as site preparation, tree planting, and line blocking. These interventions are designed to accelerate forest regeneration, reduce predator efficiency, and limit human access. In 2024, the Alberta Biodiversity Monitoring Institute (ABMI) established a long-term monitoring program to evaluate restoration effectiveness. The program tracks treatment condition, vegetation regeneration, and human and wildlife response using vegetation plots, remote cameras, and remote sensing. We will present early insights from the first phase of the program. Two years

post-treatment, many sites show high treatment persistence, high survival of planted trees, and limited human or wildlife use—indicators of early functional recovery. While long-term effectiveness cannot yet be assessed, these results are promising and highlight the value of early, multi-scale indicators. This monitoring framework provides the foundation for consistent, evidence-based evaluation of restoration across Alberta's caribou ranges and will support adaptive management decisions as treatments scale up in coming years.

Well, How's It Growin'? Wildlife Response to Wellsite Reclamation and Restoration in Caribou Ranges

Laura Finnegan¹, Courtney Burk², Leonie Brown², Tracy McKay³, Amanda Schoonmaker⁴, Solène Williams²

¹fRI Research, Hinton, Alberta, Canada, ²fRI Research, ³Parks Canada, ⁴NAIT

Caribou habitat restoration has largely focused on linear features; less is known about the role restored wellsites may serve in providing caribou functional habitat. To address this knowledge gap, we collected camera and vegetation data during 2022-23 within wellsites in west-central Alberta that had been issued reclamation certificates. A subset of these had been re-treated between 2006-09 in an effort to establish forested vegetation (treated wellsites) and these were compared with untreated wellsites, and intact forest. We assessed use by bears, coyotes, deer, moose, and elk. Model-building considered treatment type, current reclamation standards (stems/ha), and vegetation composition. Regardless of treatment, bears, white-tailed deer, and lynx used wellsites more than forest, while elk and mule deer used wellsites similarly to forest.

During winter, coyotes used treated wellsites similarly to forest, but moose used treated wellsites more than forest. For most species and seasons, reclamation standards did not influence response to wellsites. However, moose response to treated wellsites with ≥ 5000 stems/ha were species-dependent, differing from forest only when palatable woody stems dominated the wellsite. Therefore, although treatment increased short-term moose use, moose use of wellsites may decrease once treated wellsites have dense vegetation unpalatable to moose. Although only 14-16 years after restoration, our results suggesting restoration changes wellsite use by coyotes and moose are promising. Our research suggests that there is no 'one-size fits all' approach to caribou habitat restoration, and success may need to be defined based on impacts on a few focal species implicated in caribou declines.

The Effects of Mine Disturbance on Woodland Caribou (*Rangifer tarandus caribou*) Habitat Selection in Eastern Ontario

Brenna Mervyn¹, Brigitte Leblon¹, Brian McLaren¹, Megan Hazell², Armand LaRocque³, Michel Laforge¹

¹Faculty of Natural Resources Management, Lakehead University, ²Department of Biology, Queen's University, ³Faculty of Forestry and Environmental Management, University of New Brunswick

Despite intensified conservation efforts, 70% of woodland caribou ranges in Canada are not considered self-sustaining. Increased natural resource extraction has resulted in the fragmentation of critical caribou habitat. Mining is rapidly expanding across much of Ontario, with potential implications for caribou. Habitat fragmentation, sensory disturbance, and dust

accumulation have been suggested as mechanisms contributing to mine avoidance, however, the effects of cumulative mine disturbance on woodland caribou remain understudied in Ontario. We aimed to quantify the effect of mining disturbance on caribou habitat selection in the Kesagami-Detour range in Eastern Ontario to determine the effects of mining on habitat selection, the extent of avoidance around mine sites, and the extent of functional habitat loss.

We performed a land cover change analysis to quantify the variation in high-quality habitat availability over 20 years of mining (2005, 2015, and 2025). Using caribou telemetry data from 2010 to 2015, we generated resource selection functions to infer the influence of mining activity on habitat selection and compared active to inactive mine sites. To determine the geographical extent of disturbance, a zone of influence analysis quantified the amount of functionally unavailable habitat surrounding mine sites. This research contributes to our understanding of mining disturbance across multiple stages of the mining process and how it affects caribou habitat and behaviour in Northern Ontario. The results of this study provide context for boreal caribou recovery and conservation across Canada by evaluating the effect of mining disturbance across multiple phases of mining activity.

Bringing Back Boreal Caribou Habitat: Restoring the Landscape Across the Southern Northwest Territories

Mélanie Routh¹, Ashley McLaren¹, Michael Gast¹, Adrian Young¹, Lisa Smith¹, Kathleen Groenewegen¹, Tyler Rea¹, Tyanna Steinwand², Jocelyn Zoe², Claudia Azigwe³, Whitney Tsetso⁴, Shawn McKay⁵, Sam O'Reilly⁶, James Hodson¹, Alicia Kelly¹, Jurjen van der Sluijs¹

¹Department of Environment and Climate Change, Government of Northwest Territories, ²Tłı̨chǫ Government, ³Kátł'odeeche First Nation, ⁴Kı́ı́ıdlı́ı́ Kúé First Nation, ⁵Fort Resolution Métis Government, ⁶Deninu Kúé First Nation

Boreal caribou are a culturally and ecologically important species, and have shared the land with Indigenous peoples of the Northwest Territories, Canada, since time immemorial. Boreal caribou are threatened by human-caused linear disturbances such as seismic lines and roads that were created primarily by industrial activity. These linear disturbances do not always regenerate on their own and require human intervention. Since 2023, the Government of the Northwest Territories in collaboration with Indigenous governments and Indigenous organizations have been working together on addressing the functional and ecological restoration of linear disturbances within boreal caribou habitat in southern Northwest Territories. We are assessing the regeneration status of linear disturbances through acquisition of aerial imagery with co-collected airborne LiDAR and creating a detailed repository of interpreted vegetation attributes from fixed area plots of 100 m² at 500 m intervals along the entirety of linear disturbances. We are also investigating the use of linear disturbances by predators, boreal caribou, and alternate prey species through the deployment of wildlife cameras

and detailed vegetation surveys. We aim to improve our understanding of how linear disturbances impact boreal caribou and if habitat restoration is an effective tool for boreal caribou habitat recovery in the Northwest Territories. By continuing to develop this strategy and achieving on the ground restoration work, we anticipate developing specific thresholds and criteria for determining successful restoration of boreal caribou habitat in southern Northwest Territories.

COMBINING VALUES AND KNOWLEDGE SYSTEMS TO IMPROVE CARIBOU MANAGEMENT IN CANADA I

What Does a Peary Caribou See Here? Weaving Pictures, Participatory Mapping, Aerial Surveys, Bayesian Models, and More to Co-produce Habitat Distribution Maps

Carlos Alberto Arnillas¹, Estéban Hamel
Jomphe², Xin Wen¹, Alexandre Roy², George
Arhonditsis¹, Cheryl Ann Johnson³

¹Department of Physical and Environmental
Sciences, University of Toronto at Scarborough,
²Université du Québec à Trois-Rivières, ³Science
& Technology, Environment and Climate
Change Canada

Understanding the key processes affecting
northern Canada requires co-production of
knowledge, weaving Inuit Qaujimagatuqangit
(IQ, Inuit Knowledge) and Western Science
(WS). Climate change is strongly affecting the
Canadian Arctic Archipelago (CAA) landscape,
and Peary caribou is facing the compounding
effect of feeding ground disruptions and the
disappearance of the sea ice that connects the
islands that they inhabit. IQ and WS provide
different information on Peary caribou habitat
use. For instance, IQ and WS cover different
areas and time periods, and have different
epistemological approaches. To weave them,
we first evaluated the relationality among IQ

from different communities. For that, we
gathered habitat pictures from different sites
across the CAA and explored similarities and
differences in the perception of Knowledge
Holders on Peary caribou usage of different
habitats. Consistency in perspectives suggests
caribou behaviours are similar across the CAA.
The above results informed the creation of a
habitat distribution map. We adapted a
Bayesian framework to weave results from
participatory mapping, flight surveys and other
sources. IQ on the distribution of Peary caribou
were used as priors and WS data was added
later. We discuss lessons learnt developing our
robust approach meant to recognize the nature
of each knowledge system.

Ways of Knowing: A Dual Approach to Species at Risk Assessment in the Northwest Territories, Canada

Michele Grabke¹, Leon Andrew², Kristi Benson²,
Petter Jacobsen², Suzanne Carrière², Joslyn
Oosenbrug³

¹NWT Species at Risk Committee (SARC) / NWT
Species at Risk Secretariat (GNWT), ²NWT
Species at Risk Committee, ³NWT Species at
Risk Secretariat

To determine if a species is in danger of
disappearing, an assessment of its biological
status must take place. In the Northwest
Territories, the Species at Risk Committee
(SARC) uses the best available information from
Indigenous, community, and scientific sources
to assign species to a status category that
describes its level of extinction risk in the NWT.
All five caribou ecotypes in the NWT (Peary,
Dolphin and Union, barren-ground, northern
mountain, and boreal) have been assessed as
at-risk and are listed under NWT species at risk
legislation. In 2021, SARC developed a dual

approach to species assessment to consider information about the species in the way that is most appropriate to each kind of knowledge. Two separate sets of criteria are used for status assessments—one based in Indigenous knowledge and the other in science. This presentation will describe the context and motivation for the NWT's dual assessment process, including examples of how Indigenous knowledge can be used to determine species status alongside conventional scientific criteria. The presentation will:

- Increase awareness of how species are assessed in the NWT and why some species are considered at risk.
- Show how impacts to Indigenous ways of life and concerns expressed by knowledge holders can be used as indicators of species decline.
- Highlight information needs for species assessments to encourage research to address these needs.
- Demonstrate how the dual assessment process works in practice and how Indigenous, community and scientific knowledge can work together to provide a more complete picture of biological status.

Endangered but Not Extirpated – A Case Study of the Kwun-Tse (Burnt Pine) Southern Mountain Caribou Herd

Mateen Hessami¹, Tania Solanas¹, Nathan Prince¹, Dale Seip²

¹McLeod Lake Indian Band, ²BC Government

In 2014, the Burnt Pine (Kwun-Tse) southern mountain caribou herd, located in east-central British Columbia, was declared extirpated by the provincial government. Since 2014, local First Nations and land-users have archived observations of caribou groups (<40 individuals) within the extirpated Burnt Pine range (Muir and Richart 2025). However, because these observations were not confirmed

by provincial aerial population surveys – the Burnt Pine herd maintained its extirpated status. In December of 2025, a British Columbia and McLeod Lake Indian Band co-organized aerial survey of the Burnt Pine range confirmed occupancy of 7 individuals. Here, we summarize the science and policy history of this unique herd of caribou and what future collaborative stewardship must entail to restore the Burnt Pine herd back to culturally meaningful abundance levels.

Ethical Pathways in the Co-Production of Knowledge for Species and People

Cheryl A. Johnson¹, Susie Memogana²

¹Science & Technology, Environment and Climate Change Canada, ²Olokhaktomiut Hunters & Trappers Committee

This opening talk explores how to ethically engage in the co-production of knowledge for species conservation with Indigenous Nations, communities and partners. Too often, academic and policy systems divide knowledge into silos, separating science from story, data from experience, and people from place. Indigenous knowledge systems challenge this fragmentation with a perspective that recognizes relationships, responsibilities, values, morals and reciprocity are inseparable from learning. Embracing this perspective to develop meaningful collaborations requires changing the way institutions work. Doing things differently requires proactive and dynamic planning that is responsive to the evolving needs of our partners. Plans need to not only be flexible and allow for effective two-way communication, they also need to focus on giving back, through education, creative methods, and inclusive collaboration. Research and policy need to understand and factor in the social, cultural, educational and economic

implications of our partnerships. This talk sets the stage for a series of presentations meant to illustrate how ethical engagement transforms both the process and the outcome of research. We invite reflection on how each of us might foster deeper, more meaningful collaboration with case studies on community-driven approaches to knowledge co-production, from participatory modeling to educational art and anti-racism work, to improve species at risk conservation in Canada.

Co-developing Arctic Research: Inclusive Partnerships, Youth Engagement, and Knowledge Sharing in the North

Emmelie Paquette¹, Josée-Anne Langlois², Brent Puqignak³, Elizabeth Aiyout⁴, Martha Paniloo⁴, Cheryl Ann Johnson⁵, Alexandre Langlois², Stephan Schott⁶

¹Geography and Environmental Studies, Carleton University, Ottawa, Ontario, Canada,

²Centre for Northern Studies - CEN, Applied geomatics department, Sherbrooke University,

³Gjoa Haven Hunters and Trappers Association, Gjoa Haven, Nunavut, Canada, ⁴Taloyoak Umarulirigut Association, Taloyoak, Nunavut,

⁵Landscape Science & Technology, Environment and Climate Change Canada, ⁶School of Public Policy, Carleton University, Ottawa, Ontario, Canada

In this session, we will highlight two co-developed research initiatives with northern partners that respond to community-identified priorities, and create inclusive knowledge sharing environments. The first focuses on a harvest bio-monitoring and fishery development project, where we worked with partnering Hunter and Trappers Organizations in Gjoa Haven, and Taloyoak to envision the real costs of harvesting, and the complex roles all

community members take-on in sustaining year-round food security. To holistically represent harvest ecologies, we used inReach devices to track harvesters on-the-land experiences, hosted inter-generational focus groups to understand what harvesters reported, and created inclusive learning events focussed on women's experiences with niqimariit (country-food/goods). The second initiative builds on collaborative fuzzy cognitive mapping (FCM) workshops exploring the impacts of snow conditions on Peary caribou. Interviews and workshops were conducted in Ikaahuk (Sachs harbour), Ulukhaktuk, Qausuittuq (Resolute Bay) and Ajuittuq (Grise Fjord) to characterize snow conditions in these regions and their effect on caribou in terms of access to forage, predation, and movement. We transformed the FCM findings into an illustrated English-Inuktitut comic book designed to engage and teach youth about snow and caribou. Schools in the participating communities have expressed enthusiasm for integrating the comic into their curricula. Together, these initiatives underscore the importance and potential diversity of inclusive research practices, creative knowledge-sharing strategies, and meaningful collaboration with Arctic research partners.

Addressing Misinformation, Disinformation and Racism in Caribou Recovery

Jean Polfus¹, Robin Steenweg², Lucy Reiss², Jenny Touchie², Emily Sunter², Mateen Hessami³, David Plamondon⁴, Jennifer Brunet-Rentchem³, Jahan Kariyeva²

¹Canadian Wildlife Service, Environment and Climate Change Canada, Kelowna, BC, Canada,

²Canadian Wildlife Service, Environment and Climate Change Canada, ³-, ⁴Pe Metawe Consulting

Science and policy decisions in conservation have implications beyond species recovery, they can also lead to real and targeted public backlash, often directed toward Indigenous communities. As science and policy practitioners, we have a responsibility to recognize these risks, address disinformation, uphold Indigenous rights, and communicate clearly about legal and moral responsibilities. As ECCC works toward posting the Southern Mountain Caribou Recovery Strategy amendment, Indigenous partners have raised urgent concerns about renewed misinformation, fear-based narratives, and misplaced blame. Drawing on recent workshops and community feedback, we are developing a proactive communications process that emphasizes early education, coordinated messaging, and shared responsibility. This work includes creating practical, creative tools such as rapid-response templates, messaging guides, media guidance, social media materials, community safety planning resources, and educational factsheets designed to “prebunk” false narratives, elevate Indigenous voices, and support quick, authoritative responses to racism. By preparing early and working collaboratively, we aim to help ensure that scientific and policy work contributes not only to caribou recovery, but also to building public understanding, reducing harm, and supporting respectful dialogue in caribou recovery.

CHANGING CLIMATE AND FIRE REGIMES

Strengthening Our Understanding of Wëdzey (Caribou) Climate Change Adaptation in Tr’ondëk Hwëch’in Traditional Territory

Aidan Burghardt¹, Alice McCulley², Hilary Cooke³, Crystal Fraser⁴, Fiona Schmiegelow⁵

¹PhD Candidate, University of Alberta & Yukon University, ²Tr’ondëk Hwëch’in First Nation, ³Wildlife Conservation Society Canada, ⁴University of Alberta, ⁵University of Alberta & Yukon University

Tr’ondëk Hwëch’in Traditional Territory (west-central Yukon, Canada) lies at the intersection of a diverse mosaic of landscapes supporting northern mountain and migratory Wëdzey (caribou; *Rangifer tarandus*) populations, including the Fortymile, Porcupine, Hart River, and Clear Creek herds. Wëdzey and Dënezhu (People of this Land) have persisted through centuries of environmental change, grounded in the strength and resilience of their sacred ancestral relationship. However, the accelerating pace and magnitude of anthropogenic climate change represent a significant challenge to the health and long-term persistence of Wëdzey and their relationship with Dënezhu. Thus, identifying drivers of change affecting Wëdzey and their habitat, understanding the underlying ecological mechanisms, and anticipating future responses have become leading research priorities in community. This collaborative project responds to these priorities and is grounded in Dënezhu Law as a methodological framework that guides us towards working together in a good way and upholding Tr’ondëk

Hwëch'in sovereignty in our research. Together, we draw on Dënezhu worldview, lived experience and oral history, alongside Western science, to determine how Wëdzey and their habitat are responding to climate change and to consider how these changes may reshape relationships among Wëdzey and Dënezhu. This research supports the continued ancestral stewardship of Wëdzey and their habitat in addition to informing broader caribou conservation efforts under the Tr'ondëk Hwëch'in and Umbrella Final Agreements.

Recovery of Southern Mountain Caribou Habitat Following Wildfire in Ulkatcho Territory, British Columbia, Canada

Olivier Jumeau¹, Jill Harvey¹

¹Thompson Rivers University

The Ulkatcho people of west-central British Columbia, Canada, have co-existed with caribou since time immemorial, relying on caribou for meat, clothing, tools and oral history. All four caribou herds in Ulkatcho territory are Threatened and the availability of winter habitat is considered a limiting factor in their recovery. We combined traditional ecological knowledge from Ulkatcho Elders with lichen and stand structure measurements at five stand-replacing wildfires to assess the 90-year recovery of winter caribou habitat. 'Think like a caribou' methods were designed to capture the recovery of high-quality forage sites. Bayesian hurdle models were fitted by 308 lichen plots and found earliest stand-level terrestrial caribou lichen recovery at 59 years after fire. The earliest recovery of high-quality forage sites occurred later at 74 years after fire. Stems per hectare of lodgepole pine failed to reach suitable openness for caribou within 90 years post-fire. Stands were up to eight times denser than forest structure of known caribou

habitat at the earliest point of terrestrial lichen recovery. Our findings suggest it takes substantially longer for post-burn forests to reach suitable winter habitat than the general benchmark of 40 years. We posit that the prolonged self-thinning of lodgepole pine after wildfire may be a greater limiting factor than lichen abundance for habitat recovery in lodgepole pine caribou habitat. Our results demonstrate the importance of adopting a holistic approach towards habitat, one that includes both stand structure and lichen abundance alongside Indigenous ecological knowledge.

The Role of Top-Down and Bottom-up Controls on Fire Refugia in Northern Boreal Ecosystems: Implications for Caribou Management

Christine Kuntzemann¹, Brad Woodworth², Ellen Whitman¹, Sebastien Rodrigue¹, Robin Abernethy², Diana Stralberg¹

¹Canadian Forest Service, Northern Forestry Centre, ²Government of the Northwest Territories, Department of Environment and Climate Change

Increasing wildfire activity, particularly fire frequency and severity, poses a growing uncertainty for boreal caribou habitat and ongoing conservation efforts. Fire refugia (areas within fire perimeters that remain unburned due to resistant ecological or physical conditions) can help preserve critical habitat and prevent potential vegetation shifts. We assessed how hydrological, ecological, and topographic heterogeneity, along with climate and daily fire weather conditions, influence the occurrence of fire refugia across the Northwest Territories (NWT), Yukon, and northern parts of Alberta, British Columbia, Saskatchewan, and

Manitoba from 2002 to 2021. Based on remotely sensed fire severity data, we identified unburned patches within fire perimeters and applied machine learning to model fire refugia probability based on both biotic (e.g., vegetation, wetlands) and abiotic (e.g., weather, climate) factors. We then overlaid refugia predictions with boreal caribou range planning regions and seasonal resource selection function outputs to evaluate overlap between selected habitat and persistent (long-term) fire refugia. We found that the Wek'èezhìi and southern NWT range planning regions contained the highest percent area of fire refugia of the five boreal caribou range planning regions within the NWT, and that habitat conditions that were strongly selected for during mid/late winter and calving season were the most likely to become refugia in the event of a fire. These findings offer practical guidance for integrating fire-resilient areas into caribou range planning and broader conservation strategies across northern ecosystems.

Woodland Caribou Use of Burned Areas in Northeastern Alberta

Laureen Echiverri¹, [Eric Neilson](#)¹, Emily Herdman², Cole Burton³

¹Natural Resources Canada, Canadian Forest Service, ²Innotech Alberta, ³University of British Columbia

Wildfire activity is increasing in rate, intensity, and scale, adding new complexity to landscape management and the conservation of species at risk, such as woodland caribou (*Rangifer tarandus caribou*). Wildfire can reduce critical winter forage (lichen) for caribou and increase early-seral vegetation that attract moose and deer, which in turn increases predator presence. However, wildlife responses to burns vary by region, productivity, season, and scale. Recent

research in Alberta shows that caribou strongly avoid burns in late winter but may use them in late summer. In addition, moose and predator response to burns may differ depending on habitat productivity. To build on these studies, we explore the effect of fire on habitat use by woodland caribou, moose (*Alces alces*), white-tailed deer (*Odocoileus virgianus*), gray wolf (*Canis lupus*) and black bears (*Ursus americanus*) in northeastern Alberta. From 2019 to 2024, wildlife cameras were deployed in burned and unburned areas in the Richardson range, which burned in May 2011. Our preliminary results align with previous findings that wildlife use of burned areas varies by season. The results of this study can inform post-fire habitat management.

Climate Change Mitigation Through Woodland Caribou (*Rangifer tarandus*) Habitat Restoration in British Columbia

[Gregory Rickbeil](#)¹, James Maltman², Nicholas Coops², Txomin Hermosilla³, Cole Burton²

¹WSP Canada, Rossland, BC, Canada, ²UBC Forestry, ³Natural Resources Canada

Climate change poses a significant global threat, requiring rapid and effective mitigation strategies to limit future warming and there is potential for the objectives of caribou conservation and carbon sequestration to be co-beneficial. We examine this opportunity by estimating the carbon sequestration impacts of tree planting in woodland caribou (*Rangifer tarandus*) range in British Columbia (BC), Canada. To do so, we couple Landsat-derived datasets with process-based models of forest growth. We compare the sequestration impacts of planting informed by woodland caribou habitat needs to planting for maximum carbon sequestration under multiple future climate

scenarios including shared socio-economic pathways (SSP) 2, representing $\sim 2.7^\circ\text{C}$ warming, and SSP5, representing $\sim 4.4^\circ\text{C}$ warming. Province-wide by 2100, planting for maximum-carbon sequestration averaged $1062 \text{ Mg CO}_2 \cdot \text{ha}^{-1}$ planted, while planting for caribou habitat resulted in an average of $930 \text{ Mg CO}_2 \cdot \text{ha}^{-1}$ planted, a reduction of 12%. We found that relative sequestration between herds remained similar across warming scenarios and that, for most ecotypes, sequestration increased from 5% to 7% between the coldest ($\sim 2.7^\circ\text{C}$ warming) and warmest ($\sim 4.4^\circ\text{C}$ warming) scenario. Variability in the relative sequestration impacts of planting strategies was observed between herds, highlighting the importance of spatially-explicit, herd-level analysis of future forest growth when planning restoration activities. Our findings indicate a large potential for co-benefits between carbon sequestration and woodland caribou habitat restoration across BC. They also underscore the value of process-based forest growth models in evaluating the carbon implications of habitat restoration across large areas under a changing climate.

Cutting Through the Noise: What Can Habitat Selection Models Tell Us About Caribou-Fire Space Use Dynamics?

Geneviève Degré-Timmons¹

¹Université Laval

Wildfire is the dominant natural stand-replacing disturbance across the boreal forest biome. Woodland caribou (*Rangifer tarandus caribou*) have historically persisted on such landscapes, but are generally associated with old-growth and mature conifer forest. In contrast, barren-ground caribou (*R. t. groenlandicus* and *R. t. granti*) have had less exposure to wildfire, with this disturbance agent primarily affecting

forested areas in their winter range. Wildfire has long been considered a disturbance negatively impacting caribou habitat quality, leading to management strategies that consider burned areas as 'disturbed habitat' up until 40 years post-fire. However, habitat selection studies reveal variable responses to fire depending on subspecies/ecotypes, season, forest type and region. While many caribou habitat-related analyses rely on this 40-year management threshold, its reliability across contexts and populations remains less well understood. We conducted a review of peer-reviewed and grey literature to examine these patterns, accounting for seasonality, forest type, and location (i.e., ecoregion and jurisdiction) for barren-ground and woodland caribou, represented by both the boreal and mountain ecotypes. We reviewed the published and unpublished literature ($N = 5002$) and found 50 relevant habitat selection studies published between 2000-2024. From these studies, we evaluated a suite of characteristics, such as sampling and methodological approach, and present post-fire habitat selection trends. Our review revealed substantial methodological discrepancies undermining cross-model results comparison if left unaddressed. In order to improve comparability, we recommend researchers evaluating habitat selection carefully adjust their selection coefficients to account for differences in sampling ratios, reference categories and data centering. Our results suggest that caribou subspecies/ecotypes exhibited different behavioral trends at both orders of selection. Barren-ground caribou generally preferred older post-fire habitats (> 55 years) or habitats with no known recent fire history, whereas boreal and mountain caribou showed highly variable responses across post-fire successional stages. The greatest variability occurred in response to early (0-20 years) to intermediate (21-32 years) post-fire habitats at both the population (within home range) and individual (within individual home range) scales. Boreal caribou responses further varied by region and

dominant stand type, with seasonality exerting a relatively modest influence on space use patterns. Our synthesis highlights substantial variation in caribou responses to fire, emphasizing the value of regionally tailored habitat management.

HEALTH & DISEASE

A Decade of Community-Based Caribou Health Surveillance in the Central Canadian Arctic

Olivia Hee¹, Fabien Mavrot², Lisa-Marie Leclerc³, Naima Jutha⁴, Susan Kutz²

¹University of Calgary Faculty of Veterinary Medicine | Calgary | Alberta | Canada,

²University of Calgary Faculty of Veterinary Medicine, ³Government of Nunavut,

⁴Government of the Northwest Territories

Healthy caribou are critical for Arctic ecosystems and communities. Several caribou populations are in decline and increasingly threatened by climate and anthropogenic change. To better understand these threats and meet community priorities, we have operated a community-based wildlife health surveillance program since 2015 in three communities of the central Canadian Arctic: Ulukhaktok, NT, and Ekaluktutiak and Kugluktuk, NU. The program is a collaboration between community hunters and trappers organizations, academic research partners, government agencies, and the guided hunting industry. Our goal is to capture information on caribou health and ecology to inform decision-making partners and support food safety and sovereignty. Since starting the program, we have collected sample kits from 199 Bluenose East and 302 Dolphin and Union caribou, and documented Traditional Knowledge from all three communities. Analyses of harvester-collected samples and data have revealed herd differences in prevalence of zoonotic and other infectious diseases, trace element deficiencies, and stress. The information collected through this program has been imperative in identifying potential drivers of population declines and in providing co-management and public health partners with actionable research results.

Additionally, the training and outreach done through this program has provided community members and harvesters with transferable knowledge and skills, and tools to enhance their confidence in country foods. The program success is largely a result of longterm commitment and trust-building among multiple partners and highlights the importance of sustained funding and human resources to support Indigenous food and land sovereignty.

Meningeal Worm in Northeast Alberta Boreal Caribou: Observations From the Field

Troy Hegel¹, Steven Andriashek¹, Owen Slater²,
³, Elena Price¹, Kelsey Freitag¹

¹Fish and Wildlife Stewardship Branch, Alberta Environment and Protected Areas, ²Faculty of Veterinary Medicine, University of Calgary, ³Canadian Wildlife Health Cooperative

In June 2024 a boreal woodland caribou (*Rangifer tarandus caribou*) in northeast Alberta was observed displaying abnormal neurological symptoms. It was subsequently diagnosed as infected with meningeal worm (*Parelaphostrongylus tenuis*); the first detected case of *P. tenuis* in Alberta. Since then, ten additional cases of *P. tenuis* infected caribou were detected in the region. Using maps, photos, and videos, we describe field observations of these cases highlighting movements of radio-collared animals prior to death, observations of infected live animals, characteristics of mortality sites, and field sampling protocols. Meningeal worm represents a significant conservation threat to caribou as it is fatal. Alberta is currently investigating the occurrence the distribution of *P. tenuis* to identify in which ranges it is present. Recognizing certain signs may increase the ability to accurately diagnose if an animal is, or is not, infected with *P. tenuis*.

Community-Based Monitoring of Caribou Health: Integrating Local Knowledge and Body Condition Indicators

Caylee Falvo¹, Eleanor Dickinson¹, Benjamin Padilla², Fabien Mavrot¹, Lisa Marie LeClerc³, Susan Kutz¹

¹University of Calgary, ²University of Texas at El Paso, ³Government of Nunavut

Wildlife monitoring and management requires collaboration among various stake and rightsholders who share commitment to long-term sustainability. Community-based approaches recognize that local rightsholders and resource users hold valuable knowledge (Indigenous knowledge IK; local ecological knowledge LEK; Inuit Qaujimagatuqangit IQ) and access to wildlife samples that cannot be obtained through traditional science-based monitoring alone. Bringing together these local and scientific knowledge systems is particularly critical for caribou conservation in the Arctic. Community-based health indicators offer potential to support proactive co-management by identifying factors that influence population health and incorporating them into status assessment frameworks. Body condition represents a key health indicator that reflects fat reserves, nutritional status, and ultimately influences survival and reproduction. Body condition data can be collected by harvesters and integrated into assessment frameworks alongside other health metrics. We explored the potential for samples and data collected through a community-based wildlife health surveillance program on body condition to inform caribou population health assessment by examining changes in body condition indicators over time and by comparing populations known through IK/LEK/IQ to be in good versus poor health. By making efficient use of limited monitoring resources, this

approach supports collaborative wildlife management that incorporates both Indigenous knowledge and traditional scientific methodologies.

Diagnosis of Meningeal Worm (*Parelaphostrongylus tenuis*) in Northeast Alberta Boreal Caribou

Owen Slater¹, Steven Andriashek², Dayna Goldsmith², Richard Gerhold², Troy Hegel²

¹Canadian Wildlife Health Cooperative; University of Calgary Faculty of Veterinary Medicine, ²-

Caribou are known to be highly susceptible to *Parelaphostrongylus tenuis* infection, resulting in death caused by the nematode migrating through the brain and spinal cord. Western expansion of this parasite has been occurring over the past several decades with expanding white-tailed deer populations, with growing concerns about the potential impact on western boreal caribou. Until recently, *P. tenuis* was thought to be confined to Saskatchewan with reports in white-tailed deer and the occasional moose near the Alberta, Saskatchewan border just south of the boreal forest. Between June 2024 and April 2025, five boreal caribou in northeastern Alberta between Fort McMurray and Cold Lake had symptoms and lesions suggestive of *P. tenuis* infection. Two animals were initially found alive in severely compromised condition with neurological symptoms. Three additional caribou were found dead. Mortality site investigations, necropsy and histopathology were consistent with neurological disease in all cases. All five animals had microscopic lesions in the central nervous system suggestive of nematode parasite migration tracts and associated inflammation. Follow up testing via PCR and sequencing identified DNA of *Parelaphostrongylus* species. Additional molecular testing to differentiate

between closely related *P. tenuis* and *P. andersoni* confirmed *P. tenuis* as the causative agent. We will describe the clinical condition of the caribou found alive, the diagnostic testing conducted and the lab results that ultimately lead to confirming *P. tenuis* infection in Alberta boreal caribou. These cases represent the first known occurrence of *P. tenuis* in Alberta, and the presence of this parasite represents a major threat to boreal caribou persistence in northeastern Alberta.

Health Survey of Caribou Ecotypes and Muskox in Québec and Labrador, Canada

Joëlle Taillon¹, Laura Van Driessche², Benjamin Jakobek³, Vincent Brodeur³, Sabrina Plante³, Sara McCarthy⁴, Rachel Guindon⁵, Susan Pyakurel⁶, Angela Schneider⁷, Susan Kutz⁷, Gabriela Mastromonaco⁸, Gereon Schares⁹, Falk Melzer⁹, Kerstin Wernike⁹, Patricia König⁹, Steeve Côté¹⁰, Stéphane Lair²

¹Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, Québec, Québec, Canada,

²Canadian Wildlife Health Cooperative / Centre québécois sur la santé des animaux sauvages, Université de Montréal, ³Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, ⁴Wildlife Division, Forestry, Agriculture and Lands, ⁵Department of Environment, Wildlife, and Research, Makivvik, ⁶Nunavik Research Centre, Makivvik, ⁷University of Calgary, ⁸Department of Wildlife Science, Toronto Zoo, ⁹Friedrich-Loeffler-Institute, Federal Research Institute for Animal Health, ¹⁰Caribou Ungava, Université Laval

Caribou (*Rangifer tarandus*) populations, of the boreal and migratory ecotypes, are the focus of major conservation efforts, as most populations

have declined over the last decades. In northern ecosystems, muskox (*Ovibos moschatus*) populations are either sympatric with or have been introduced into caribou ranges, such as in northern Québec. Health monitoring is essential to better understand the dynamics of these overlapping species, ecotypes and populations, facing common challenges related to environmental change. From 2017 to 2024, 225 boreal caribou, 134 migratory caribou and 179 muskoxen were captured and sampled across northern Québec and Labrador, Eastern Canada. Assessments included hematology, biochemistry, coprological screening of endoparasites, serology, serum trace elements analysis, and hair cortisol measurements. All animals tested seronegative for SARS-CoV-2, *Brucella* spp., *Coxiella burnetii* and *Neospora caninum*. Seroprevalences for *Besnoitia tarandi* and *Erysipelothrix rhusiopathiae* were 9.5% and 41.6%, respectively in boreal caribou; 66.4% and 19.4%, respectively in migratory caribou; and high ($\geq 50\%$) for both pathogens in muskox populations. The individual and population-level health impacts of exposure to *B. tarandi* and *E. rhusiopathiae* remain unknown but are of concern in the light of recent outbreaks reported in other populations. Fecal parasitology results were largely species-specific with variations among populations, with low intensity of infection in caribou and higher burdens for *Fascioloides magna* and *Varestrongylus eleguneniensis* in muskoxen. This study provides health indicator baselines for boreal and migratory caribou and muskox. A holistic approach of health parameters is key to effective management and conservation of northern species and ecosystems during periods of environmental change.

Harvesters Uncover a Climate-Linked Emerging Disease in Barrenground Caribou (*Rangifer tarandus*)

Rachele Vada¹, Russell Akeeagok², Fabien Mavrot³, Paul McDonald², Dayna Goldsmith³, Hadjira Hamou⁴, Aparna Thomas³, Lisa-Marie Leclerc², Terry Milton², KAA Kugluktuk Angoniatit Association⁵, John Soghigian³, Amanda Melin^{4,6,7}, Matthew Kulpa⁸, Guilherme Verocai⁸, Susan Kutz³

¹Faculty of Veterinary Medicine, University of Calgary, Calgary, Alberta, Canada, ²Department of Environment, Government of Nunavut, ³Faculty of Veterinary Medicine, University of Calgary, ⁴Department of Anthropology and Archaeology, University of Calgary, ⁵Kugluktuk Angoniatit Association, ⁶Department of Medical Genetics, ⁷Alberta Children's Hospital Research Institute, ⁸Department of Veterinary Pathobiology, College of Veterinary Medicine and Biomedical Sciences, Texas A&M University

Climate change is driving the emergence of vector-borne diseases in the Arctic. Rising temperatures extend insect activity seasons, increase vector abundance, and accelerate parasite development. These shifts threaten the conservation of barrenground caribou (*Rangifer tarandus groenlandicus*) and, given the key role of this species, the food security and well-being of Indigenous communities. In 2023, harvesters near Kugluktuk, Nunavut, reported new disease syndromes associated with filarioid nematodes in 11 barrenground caribou. Lesions included yellow discoloration of the tissues or yellow-green fluid in the thoracic and abdominal cavities, often with strands of fibrin, as well as subcutaneous oedema and tissue discoloration near joints. Using parasite DNA detection through droplet digital PCR, visceral lesions were attributed to *Setaria yehi* and tissue abnormalities to *Onchocerca* sp. Subsequent

reports across the Kitikmeot and Kivalliq regions of Nunavut and the North Slave region of the Northwest Territories underscored the parasites' spread and increasing impact on caribou health. Initially, concerns over meat safety led harvesters to leave carcasses on the land. In Kugluktuk, the good collaboration and trust between conservation officers, biologists, researchers, and the community led to an effective information campaign which helped restore confidence in country food safety, reduce meat wastage, and support food security. The research on filarioid nematodes falls under the scope of a larger initiative encompassing community-partnered proactive caribou health surveillance, establishing sensitive diagnostic approaches to define filarioid diversity, and understanding the impacts of filarioids on caribou health and the factors driving the emergence of those parasites.

POPULATION ESTIMATION & MONITORING

Confronting the Challenge of Movement Between Caribou Herds

John Boulanger¹, Joe Thorley², Allicia Kelly³,
Jan Adamczewski³, Mitch Campbell⁴

¹Integrated Ecological Research | Nelson, BC | Canada, ²Poisson Consulting Limited, ³Dept of Environment and Climate Change, Govt of NWT, ⁴Dept of Environment, Nunavut Wildlife Research Division, Govt of Nunavut

In Canada caribou herds have been managed based on herd units as defined by calving ground areas visited each June in the high arctic. Using this approach provides tangible units for setting harvest limits, evaluation of management strategies, and assessment of overall herd trends. One complicating factor has been the movement of caribou between herd units which recently has increased among the Bluenose-East, Bathurst and Beverly herds, concurrent with higher overlap on winter range areas. In this case, change in herd size becomes a function of both demographic factors as well as movement between herds therefore complicating assessment of trends and evaluation of management strategies. We discuss in this talk the use of multi-strata models and Integrated Population Models (IPMs) to confront this challenge. We apply these models to the Beverly, Bathurst, and Bluenose-East herds. The Bathurst herd was once estimated at 470,000 in 1986 but had declined nearly 99% to about 6,200 in 2021, the Bluenose-East herd had fallen from about 120,000 in 2018 to about 23,000 in 2021 with recovery suggested in 2023 while the Beverly herd was still relatively

abundant and estimated at about 152,000 in 2023. We illustrate how IPM's can be used to estimate demographic versus observed trend and provide refined estimates of demographic parameters as well as abundance estimates. Further, by sharing demographic, movement, and trend information between herds inference can be made on interactions between herds that may not be detected by limited sample sizes of collared caribou.

Estimating Cow:Calf Ratios Using a Minimally Invasive Trail Camera Network Along the Hudson Bay Coast

Kimberly Lebel¹, Julie Colpitts², Douglas Clark², Russell Turner³, Ryan Brook²

¹Department of Animal and Poultry Science, College of Agriculture and Bioresources, University of Saskatchewan, ²University of Saskatchewan, ³Parks Canada

Caribou vital rates are among the most important data needed to inform conservation and wildlife management, yet obtaining accurate cost-effective long-term data remains challenging and expensive. The Endangered Eastern Migratory Cape Churchill caribou living entirely within northeastern Manitoba is notably lacking in research and monitoring efforts and relatively little is known about their ecology and demography. We deployed 92 Reconyx trail cameras in a stratified random distribution in the summer range of the population starting in September 2021. Cameras were placed within beach ridge and fen habitats. In order to quantify reproductive rates and estimate adult:calf ratios on summer range through the snow-free period. All photos were manually coded by animal species to identify all caribou detected and metadata were included from the cameras including date, time, and temperature.

All caribou images were identified to age and sex using antlers, vulva patch, penis sheath, and relative size. In the first two full years of the study we obtained 59,576 caribou photos and of these 13,914 (23%) photos contained at least one caribou calf of the year. Of the 92 cameras, 8 (9% of the total) did not detect any calves during the first two years and 4 (4% of the total) cameras only detected 1 calf, while one camera had 2,817 photos that included caribou calves. Just over half (51%) of all calves were detected in June. We hope to continue this over the long-term and compare adult: calf ratios to our late summer aerial survey data.

Fitness on the Line: How Disturbance Shapes Survival and Reproduction in a Northern Boreal Caribou Population

Philip D. McLoughlin¹, Ian Best¹, Clara Superbie¹, Branden Neufeld¹

¹University of Saskatchewan

Anthropogenic linear features like roads, seismic lines, trails, and transmission corridors are reshaping predator-prey dynamics across the boreal forest. For boreal caribou, these features facilitate wolf movement and elevate predation risk. Although many studies document associations between linear features and risk, few directly link the habitat conditions experienced by individual females to measurable fitness outcomes. We addressed this gap in northern Saskatchewan, Canada, across a ~130,000-km² region with relatively low human disturbance where caribou populations remained stable during the study period. This landscape spans a broad disturbance gradient, supporting individuals with little to no anthropogenic impact as well as others exposed to substantial line densities and recent wildfire. Using data from 152 GPS-

collared adult females monitored from 2013-2018, we tested how line density, vegetation composition, and fire influenced annual survival and calf recruitment using Cox proportional hazards models and generalized linear mixed models. Higher line density increased adult female mortality risk, confirming expectations of predator-mediated effects. In contrast, calf recruitment was positively associated with recently burned areas and rare patches of mixed coniferous-deciduous forest. These patterns suggest that post-fire residuals and more productive vegetation in the north may enhance nutrition or provide localized refugia for neonates. Our results show that even in relatively intact northern landscapes, anthropogenic disturbance can undermine adult female survival, while natural disturbances and productive habitats may bolster reproduction. By integrating survival and recruitment across a full disturbance gradient, this study highlights the importance of fitness-based habitat assessments for conserving caribou and other species sensitive to landscape change.

Inferring Caribou Population Trends From Hierarchical Habitat Selection

Julie Turner¹, Samuel Hache², James Hodson³, Philip McLoughlin⁴, Tatiane Micheletti⁵, Michael Peers¹, Agnes Pelletier⁶, Eliot McIntire⁷

¹University of Alberta, ²Environment and Climate Change Canada, ³Government of the Northwest Territories, ⁴University of Saskatchewan, ⁵TU Dresden, ⁶Government of British Columbia, ⁷Natural Resources Canada

Estimating population status (increasing, decreasing, stable) is central to managing declining species, yet direct estimation is often challenging due to cryptic life histories, broad distributions, and limited demographic data.

We present a novel approach to infer population status using hierarchical habitat selection models, offering spatial specificity that enhances conservation decision-making. With boreal caribou (*Rangifer tarandus caribou*) in Canada, we applied Integrated Step Selection Analysis across two scales: a global model encompassing all individuals, and four jurisdictional models representing regional subsets. These models generated pixel-level habitat selection intensities for both "global" and "regional" individuals. We compared these intensities and evaluated their relationship with independently measured jurisdictional population status. Our results reveal that variation in habitat selection—particularly deviations from optimal selection due to habitat loss—can be predictive of population performance. Furthermore, the global model had better predictive performance than the jurisdictional models, i.e., there was important value gained from using larger datasets, even when predictions were for smaller areas. This method provides a scalable framework for estimating population status in data-deficient contexts. In the case of managed species that cross jurisdictional boundaries, this study also provides evidence for improved predictions when data outside jurisdictions are used together.

Ekwo̓ Nàxoèhdee K'è: Being Caribou Guardians With 'Boots on the Ground'

Jocelyn Zoe¹, Janelle Nitsiza¹, Petter Jacobsen¹

¹Tl'cho Government

The Tl'cho̓ people has relied on Kokèti ekwo̓ (Bathurst caribou) since time immemorial, but a harvest ban since 2015 reduced peoples' interaction with the caribou and the land. To advance traditional knowledge research, Tl'cho̓ Government developed the Ekwo̓ Nàxoèhdee

K'è (Boots on the Ground) guardian program to monitor the Kokètì ekwò; a herd experiencing the most dramatic decline. Using traditional ways of traveling the land, by boat and on foot, to key geographical features known as ekwò noṛokè (water crossings) and what'àà (eskers), where elders anticipate ekwò herds' arrival, the guardian team sit in position, as traditional hunters did, waiting, and watching ekwò. The Tłıcho created the guardian program based on the concept of "We Watch Everything", a Tlıcho concept, focused on monitoring key indicators: health of caribou and the land; predators, climate change and industrial disturbance; and based on using traditional hunting methods as wildlife monitoring methods, and traditional hunting areas as monitoring locations. The program has operated since 2016 and expanded to three barrenland camps for summer caribou monitoring and one mobile camp during winter. Since inception of the program in 2016, we observed cumulative effects of climate change and human pressures impacting caribou. Being caribou guardians with our boots on the ground, Tłıcho are traveling back to ancestral harvesting locations and reconnecting to our cultural places and ekwò. Thus, being caribou guardians allows Tłıcho to "go back to the original source to remember" the stories, language, knowledge, and cultural ways of life that connects us to ekwò.

Documenting Inuit Qaujimajatuqangit (IQ) and Observations of the Southampton Island Barren-Ground Caribou (*Rangifer tarandus*) Herd

The Southampton Island barren-ground caribou (*Rangifer tarandus groenlandicus*) are an ecologically and culturally significant sub-population in Nunavut that has experienced

dramatic fluctuations since their reintroduction in 1967 following extirpation in the 1950s. After nearly three decades of rapid population growth and commercial harvesting, the herd declined sharply through the 2000s and early 2010s due to brucellosis outbreaks, severe winter icing events, and harvest pressure. Recent surveys and Inuit Qaujimajatuqangit (IQ) observations suggest the herd has stabilized and may be recovering.

This study gathered Inuit knowledge, values, and perspectives on caribou abundance, health, distribution, and management through semi-structured interviews with Elders, subsistence harvesters, and members of the Aiviit Hunters and Trappers Organization (HTO) in Coral Harbour, Nunavut. Fifteen interviews were conducted in May 2025, including a group discussion with the HTO board and individual interviews with key knowledge holders.

Participants consistently reported increasing caribou abundance since the 2010s, noting more animals near Coral Harbour, improved body condition across seasons, and numerous healthy calves. While disease prevalence was perceived to have declined, participants raised emerging concerns about increasing wolf and wolverine numbers and the effects of winter freezing rain and ice layers that limit forage access and affect calf survival.

Participants emphasized Inuit stewardship practices and the importance of community-based management guided by IQ. Findings highlight the value of weaving Inuit knowledge with scientific monitoring to inform adaptive, co-management approaches under the Nunavut Agreement and support the long-term sustainability of the Southampton Island caribou herd.

BEHAVIOUR

Anti-Predator Behaviors of Captive Boreal Caribou Exposed to Predator Cues

Gabrielle Brochu¹, Michaël Bonin², Julien Hénault-Richard³, Caroline Hins², Steeve Côté³

¹Université Laval, Centre d'études Nordiques,

²Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, ³Université Laval, Centre d'études nordiques

Without exposure to predators, captive animals are deprived of the learning opportunities necessary to develop and maintain effective anti-predator behaviors, compromising their ability to recognize and avoid predators once released into the wild. Since winter 2022, the threatened boreal caribou (*Rangifer tarandus*) population of Charlevoix (Québec, Canada) has been managed in captivity to promote breeding and survival. This conservation strategy may alter the behavioral responses of caribou toward their main predator, the gray wolf (*Canis lupus*). We assessed the effect of captivity on the ability of caribou to recognize predator cues and express anti-predator behaviors using predator recognition tests. We compared the behaviors of an experimental group, exposed to wolf cues, and a control group exposed to cues of non-predatory species. During summer 2024, we tested four cues stimulating different sensory systems: auditory (vocalizations), olfactory (urine), visual (model), and multisensory (live dog). We then measured their effects on caribou activity budgets, flight initiation distances, and time to return to the exposure site after treatment. Caribou showed strong responses to auditory and multisensory cues associated with wolves, while their reaction to olfactory and visual cues remained weak. Our results suggest that

caribou have retained some anti-predator behaviors, but captivity may have altered predator recognition through olfactory and visual cues. As conservation breeding becomes an increasingly used management action for caribou conservation across North America, our work highlights the need to assess how captivity alters these behaviors to recommend the most effective anti-predator training that could promote post-release survival.

Sex Matters: Multi-Population Analysis Reveals Consistent Sex Differences in the Behaviour and Spatial Ecology of Caribou

Margaret M. Hughes¹, Charlotte Bourbon², Jasmine Veitch², Samantha Barrette², Sangwook Ahn², Agnès Pelletier³, Pietro Milanese⁴, Charlotte Vanderlocht⁴, Duncan Blagdon⁵, Helen Schwantje⁶, Caeley Thacker⁶, Jesse Tigner⁷, Katherine Wolfenden⁸, Jean Polfus⁹, Peter Neuhaus¹⁰, Kathreen Ruckstuhl¹⁰, Jocelyn Poissant², Marco Musiani¹¹

¹Biological Sciences, University of Calgary, Calgary, AB, Canada., ²Faculty of Veterinary Medicine, University of Calgary, ³British Columbia Ministry of Water, Land, and Resource Stewardship, Terrestrial Species Recovery Branch, ⁴Department of Biological, Geological, and Environmental Sciences (BiGeA), University of Bologna, ⁵British Columbia Ministry of Land Water and Resource Stewardship, Terrestrial Species Recovery Branch, ⁶British Columbia Ministry of Water, Land, and Resource Stewardship, Wildlife Branch, ⁷SwampDonkey, ⁸Fort Nelson First Nation, ⁹Canadian Wildlife Service- Pacific Region, Environment and Climate Change Canada, ¹⁰Biological Sciences, University of Calgary, ¹¹Department of Biological, Geological, and Environmental

Sciences (BiGeA), University of Bologna & Biological Sciences, University of Calgary

Understanding sex-specific differences in spatial behaviour is critical for conserving species that exhibit sexual segregation, a pattern common among ungulates. In caribou (*Rangifer tarandus*) across western Canada, monitoring has traditionally focused on females, leaving male behaviour, and its implications for connectivity relatively understudied. Using a broad-scale GPS telemetry dataset from 13 populations in British Columbia, we quantified sex differences in seasonal movement patterns and habitat selection. We evaluated behaviours representing three ecological processes: timing of seasonal movements, spatial segregation, and seasonal resource selection. We found clear sex-specific differences in movement timing, with females migrating approximately 39 days earlier in spring and 10 days later in fall and used larger winter home ranges compared to males. Between-sex pairwise distances were significantly greater than within-sex pairwise distances in the summer, with males and females seemingly occupying distinct portions of the landscape. Seasonal habitat selection also differed consistently between sexes, with the strongest divergence in the selection of water features, which females selected more strongly across seasons. These patterns likely reflect differing ecological strategies shaped by reproductive roles and energetic demands. Since male dispersal is the primary driver of gene flow in caribou and many other ungulates, overlooking male spatial requirements may lead to conservation actions that inadvertently limit connectivity and long-term population viability. Our findings highlight the need for demographically unbiased monitoring to account for sex-specific behavioural variation in conservation planning for caribou to support effective, landscape-scale management.

Listening to Barren-Ground Caribou (Ekwò, Tuktu): Using Animal-Borne Audio to Monitor Fine Scale Behavior

Megan Perra¹, Alicia Kelly², Simon Chamaillé-Jammes³, Eliezer Gurarie¹

¹SUNY College of Environmental Science and Forestry, ²Government of the Northwest Territories - ECC, ³Centre d'Ecologie Fonctionnelle et Evolutive

Barren-ground caribou (ekwò, tuktu) have been monitored with VHF and GPS collars for the past several decades. While these collars have enduring value, they remain limited in their ability to detail important aspects of caribou ecology - including energetics, calving, social interactions, immediate response to harassment. We present audiloggers – miniature audio and activity recorders – as a tractable method that can be used alongside GPS collars to monitor fine-scale caribou behavior. Starting in 2023, we began ground truthing these devices on captive reindeer at the Large Animal Research Station in Fairbanks, Alaska, USA, for the purposes of gathering and labeling behavioral data for model training. In March, 2025, we deployed 30 audiloggers on caribou from the Bluenose East and Beverly herds in the Northwest Territories and Nunavut, Canada. 10 of these were collected at the end of April, and the remainder were collected mid-August. Our loggers demonstrate, for the first time in barren-ground caribou, how animal-borne audio can be used to identify activities related to foraging, rumination and parasitism. The continuous nature of the data—logging audio and inertial information for weeks at a time—affords us with the opportunity to build detailed activity budgets and evaluate sound disturbance responses in real time.

Mosquito and Oestrid Fly Harassment of Barren-Ground Caribou: Environmental Predictors and Caribou Responses

Michael J. Sutor¹, Will Hein², Murray Humphries², Heather Johnson³, Gabrielle Coulombe³, Michael Sutor¹

¹Department of Environment, Government of Yukon, ²McGill University, ³USGS Alaska Science Center

Mosquito and oestrid fly harassment are important drivers of barren-ground caribou summer behavior. While insect harassment is strongly influenced by climate conditions, we have little understanding of how climate change in the Arctic is altering the duration or severity of harassment, and the relative effects of these different insects on caribou behaviors. To address these uncertainties, we used field sampling of insects, GPS locations and video camera data from caribou (2018-2023) to investigate mosquito and oestrid fly harassment of the Porcupine caribou herd, spanning the Alaska-Yukon border. We developed predictive mosquito and oestrid fly harassment models using environmental variables, and then hindcast harassment from 1950-2024 to assess long-term changes in severity and phenology. We then used predictions of mosquito and oestrid fly harassment to determine their relative influence on caribou movement, habitat selection and foraging. We found that mosquito harassment was best predicted by wind speed, temperature, snowmelt date, precipitation, topography, and soil moisture, while oestrid fly harassment was predicted by temperature, cumulative growing degree days, and time of day. Hindcasting indicated harassment for both insects has intensified and advanced over time. In response to mosquitos, caribou increased their movements, but continued to forage and

select for foraging habitat. Conversely, in response to oestrid flies, caribou foraged less, reduced selection for foraging habitat, and increased fine-scale avoidance behaviors. Our results highlight likely long-term changes in insect harassment, and the differential effects of mosquitos and oestrid flies on caribou behavior, which have important implications for their energetics and demography.

Considering Sociality When Estimating Caribou Distribution and Abundance

Quinn Webber¹, Jack Hendrix², Jillian Kusch², Alec Robitaille², Kristy Ferraro³, Eric Vander Wal²

¹University of Guelph, ²Memorial University of Newfoundland, ³University of Michigan

Among the most important tenets of wildlife conservation are animal distribution and abundance. Movement and habitat selection relate directly to distribution and density dependence as it relates to abundance. Given that caribou are among the most gregarious species of ungulates, sociality will link between estimates of distribution and abundance. Sociality, even in caribou, arises because the benefits outweigh the costs. Thus, we expect that caribou groups move and select habitat together, while they also form groups to maximize survival and reproductive success, the cornerstones for population viability models. The overarching objective of our research is to model animal distribution and abundance through the lens of sociobiology. Here, we will present results from multiple studies that address this broad objective. First, we synthesize our research demonstrating the covariance between social and spatial behaviours and space use. Second, we demonstrate social behaviours and their correlated spatial behaviours influence annual reproductive success. Finally, we demonstrate

how variation in social and spatial traits vary as a function of changes in population density and these relationships are likely to influence population dynamics and viability. Our research represents a caribou-specific case study that bridges multiple ecological disciplines to inform estimates of population distribution and abundance. We conclude by proposing that knowledge of caribou sociality within the context of estimating distribution and abundance has the potential to improve management planning by integrating information about social connections that are implicit to habitat selection and population viability analyses, particularly given the potential for Allee effects in small caribou populations.

COMBINING VALUES AND KNOWLEDGE SYSTEMS TO IMPROVE CARIBOU MANAGEMENT IN CANADA II

From Averting Extirpation To Recovering the Landscape and Treaty Rights

Tamara Dokkie¹, Naomi Owens-Beek¹, Roland Willson¹

¹Nikanêse Wah tzee Stewardship Society

Since 2013 Saluteau First Nations and West Moberly First Nations have worked together to successfully reverse the decline of the Klinse-Za caribou, using traditional knowledge and western science. The herd has now recovered from a low of 36 animals to almost 200. Yet these animals cannot be considered self-sustaining, since they are still unlikely to persist if interventions such as maternity penning and/or predator control were removed. Further, restoration of treaty rights will require many more caribou, occupying a landscape that is restored to a state that can once again sustain full seasonal rounds of food and medicine provision. How did we get here, where are we now, and where are we going? What will be required from partners, including governments?

LEVERAGING GENETIC DATA TO ASSESS POPULATION DEMOGRAPHICS AND CONSERVATION PRIORITIES

Case Studies in Estimating Population Size and Trends Using Capture-Recapture Analyses Applied to Non-invasive Genetic Sampling Data, With Recommendations for Optimal Outcomes

Arni Neil Arnason¹, Micheline Manseau²

¹Department of Computer Science, University of Manitoba, Winnipeg, MB, ²Landscape Science and Technology Division, Science and Technology Branch, Environment and Climate Change Canada (ECCC)

Estimating abundance is essential for understanding population dynamics, managing wildlife populations, and supporting recovery efforts. A commonly used approach involves non-invasive capture-recapture methods, where two or three surveys are conducted within a winter season, each followed by fecal pellet sampling at foraging sites. DNA is extracted from the pellets, and microsatellite genotyping is used for individual identification, enabling the construction of capture histories that permit estimation of demographic structure, population size, and trends. In this presentation, we discuss survey design considerations and analytical methods that contribute to accurate and precise abundance estimates. We define

and quantitatively assess population closure, presenting case studies that include both within-year closed populations—where abundance estimation is the primary objective—and multi-year open-population Robust Design surveys, which allow for the estimation of population trends and a wider range of demographic parameters. We also highlight a recent case in which a within-year study showed evidence of non-closure; however, POPAN analyses demonstrated that closed-population (Huggins) estimates could still provide meaningful estimates of a super-population. Finally, we discuss survey design and demographic requirements for obtaining reliable outcomes, emphasizing that populations lacking closure—such as some caribou herds—may not be suitable for these methods. Nonetheless, when surveys follow best practices that ensure adequate recapture rates for both males and females across time periods and allow for clear model selection, precise population size estimates can be achieved.

Mapping Boreal Caribou Density and Critical Habitat Using Spatially Explicit Capture Recapture Models

Jayna Bergman¹, Micheline Manseau¹, Darren Pouliot¹, Gigi Pittoello², Paul Wilson³

¹Environment and Climate Change Canada, ²Government of Saskatchewan, ³Trent University

Spatially explicit capture-recapture (SECR) models are a key tool for estimating density and abundance of wildlife populations from non-invasive genetic samples. They can also be used to assess how landscape features influence spatial variation in density. SECR models require individual identifications and precise detection locations, and their accuracy depends on

sample sizes, spatial coverage, and the use of relevant landscape features. Our aim was to test how data that varies spatially and temporally influences SECR density estimates and to identify which landscape features have the greatest impact on density. We present results for the Boreal Plain ecozone of Saskatchewan where boreal caribou (*Rangifer tarandus*) exhibit relatively small-scale movements, occupy a fragmented landscape, and are experiencing population declines. We used capture-recapture data from four study areas within the range, each of these areas were systematically sampled twice during the winter over a time frame ranging from one to four years. Our results support that multi-year data improves the precision of density estimates and that densities greatly vary across the range, being strongly influenced by cover types and anthropogenic features such proximity to roads and other linear disturbances. We also demonstrate data that varies spatially and temporally can be combined to generate realistic, large-scale density surfaces. However, models based on low capture and recapture rates tend to be overfit, resulting in unrealistic density estimates. This highlights the importance of balancing statistical performance with biological realism when selecting which model is used to inform conservation and management decisions.

Unraveling the Genetics Behind Boreal and Eastern Migratory Caribou in Ontario and Quebec

M. Lisette Delgado¹, Micheline Manseau², Cory Fournier², Daria Martchenko¹, Rebecca Taylor², Kirsten Solmundson³, Arthur Rodgers⁴, Janet Jackson⁴, Vicki Trim³, Joanie Kennah³, Paul Wilson¹

¹Trent University, ²Environment and Climate Change Canada, ³Government of Manitoba, ⁴Ontario Ministry of Natural Resources

Identifying the genetic differences between ecotypes can be key to defining their distinctness and evolutionary significance. Yet achieving this can be challenging for ecotypes which differences are rooted in their behavior and that exhibit high gene flow. This is the case of eastern migratory and boreal caribou in Ontario and Quebec. These ecotypes are morphologically similar, have an overlapping distribution in winter, and are distinguished mainly by their calving strategies. While eastern migratory caribou move to the tundra for calving, boreal caribou have a more sedentary behavior, remaining in the forest year-round. Here, we aimed to detect fine-scale genetic differences between these ecotypes by using a large genomic dataset (i.e., 109 high-coverage and 222 low-coverage genomes). Genomic analysis revealed that caribou were more genetically similar to geographically close individuals than to caribou from the same ecotype. However, admixture analysis detected two ancestral components that related to the ecotypes, and association analysis identified multiple small regions that significantly distinguished them. Notably, these variants were different in each province, and there was an absence of large genomic regions also referred to as “supergenes”. In Ontario, high levels of interbreeding between ecotypes were detected, which suggests that the area of geographical overlap is larger than what the current distribution reflects. Overall, our findings indicate a recent and repeated evolution of eastern migratory caribou in each province and suggest that tailored management strategies for each province might be recommended.

Following Trails of the Mountain Caribou: Conservation Guided by Indigenous Knowledge and Genetic Sampling

Cory Fournier¹, Leon Andrew², Manisha Singh²,
Micheline Manseau³

¹ʔehdzo Got'İne Gots'ę Nákedı (Sahtú Renewable Resources Board) | Tulita | NWT | Canada, ²ʔehdzo Got'İne Gots'ę Nákedı (Sahtú Renewable Resources Board), ³Environment and Climate Change Canada

Following Trails of the Mountain Caribou is a collaborative, community-led research initiative developed to address Shúhta ot'İne (Mountain Dene) and Métis priorities for understanding and sustaining shúhta goᑭepę́ (mountain caribou) in the Mackenzie Mountains. Centered in Nío Nę P'ęné - a place of deep biocultural significance where people and caribou have shared the land for millennia - this work follows Dene Ɂᑭᑭᑭ (laws) of respect and reciprocity that guide how wildlife should be studied and cared for. In response to community concerns and opposition to invasive collaring, the ʔehdzo Got'İne Gots'ę Nákedı (Sahtú Renewable Resources Board), together with community members, Elders, and Indigenous Guardians, in collaboration with Environment and Climate Change Canada and Trent University, developed a non-invasive fecal DNA monitoring program. Over five years, more than 2,000 samples have been collected across the Redstone range, generating high-quality genetic data to identify individuals, family groups, and patterns of connectivity within and among herds. The results reveal extensive genetic exchange across the Mackenzie Mountains and into neighbouring regions, underscoring the importance of maintaining movement pathways for herd resilience. At the same time, low detection of mother-offspring pairs raises potential concerns about

recruitment and population health. Through on-the-land sampling, community-based lab work, and shared interpretation of results, this project builds local capacity and ensures research remains grounded in Indigenous values. By integrating Indigenous knowledge with genetic science, Following Trails of the Mountain Caribou demonstrates how community-driven, non-invasive monitoring can strengthen conservation and indigenous stewardship.

Assessment of Vulnerability Due to Genetic Diversity and Inbreeding Extent in Rangifer

Rebecca Taylor¹, Micheline Manseau¹, Paul Wilson²

¹Environment and Climate Change Canada,
²Trent University

Maintaining genetic diversity is crucial due to its importance for population persistence and adaptive capacity. As such, maintaining and restoring genetic diversity is now included within the Kunming-Montreal Global Biodiversity Framework (KMGBF) under the Convention on Biological Diversity. When populations decline, breeding between individuals with shared ancestry, or inbreeding, can occur. Inbreeding results in genetic diversity loss and the expression of harmful genetic variants which leads to fitness reductions in offspring, known as inbreeding depression. It is therefore important to measure genetic diversity and inbreeding to assess the vulnerability of a population. We investigate the role of demographic history and contemporary declines on levels of genetic diversity and inbreeding in caribou across Canada. Demographic histories vary across their range and between Designatable Units (DUs). For example, mainland barren-ground caribou have maintained high genetic diversity over long periods, whereas many Arctic caribou groups

demonstrate lower genetic diversity. Genetic erosion and high inbreeding are occurring alongside recent declines at the southern edge of the boreal range. We calculate the risk of fitness declines and show that some populations are at a high risk of demonstrating fitness consequences due to inbreeding. This is particularly true in small populations with reduced connectivity due to, for example, anthropogenic disturbances. Management actions can be taken to prevent and mitigate genetic diversity loss by addressing the cause of population declines, conserving habitat, restoring connectivity, translocation or breeding programs. Monitoring genetic diversity into the future will be necessary to support management actions and ensuring population resilience.

Collectively, these approaches will enhance our capacity to identify the drivers of population decline and inform evidence-based management and recovery strategies. These findings support the overarching conservation objective of maintaining populations that are demographically viable, genetically diverse, functionally connected, and broadly distributed across heterogeneous environmental gradients.

Conclusion: Insights Into Emerging Methods To Improve the Cost-Effectiveness and Efficiency of Genetic Monitoring Tools, Advancing Conservation Science and Management Strategies

The application of genomic approaches to caribou conservation has advanced substantially in recent decades, revealing ongoing demographic decline and genetic erosion across multiple populations nationwide. Comprehensive national baseline datasets now enable robust inference of both contemporary and historical population structure and demography. These resources facilitate the development and application of advanced analytical approaches and informative molecular markers, including functional gene variants (e.g., PRNP, the prion protein gene), metagenomic profiling for diet reconstruction and pathogen detection, and DNA methylation-based epigenetic clocks for age estimation.

RESPONSE TO LANDSCAPE CHANGE

Exploring the Effects of Linear Features on Caribou When Interactions Are Limited

Kerman Bajina¹, Mike Settingington¹

¹EDI Environmental Dynamics Inc.

Northern caribou populations adjust their distribution to access resources during different life-cycle periods. Barriers that inhibit broad-scale movements between seasons and fine-scale movements within them may pose a risk to populations. Thus, a fundamental management issue is to what extent linear features like roads affect caribou movement. In practice, ecologists address this question by studying the movement of radio-collared caribou. However, direct assessment is precluded when caribou-road interactions are limited. So one must explore what is possible instead of what has been observed. A simple yet effective way to do this is via simulation. Recent modelling advances in movement ecology like the integrated step selection function (iSSF) allow ecologists to bridge the gap between movement and habitat selection to help infer animal space use. Using this framework, we investigate the potential effects of a road on individuals from a northern caribou population. We use iSSFs to (1) assess how individuals select habitat and move on the landscape and (2) simulate caribou movements dependent on underlying habitat selection patterns. These simulations allowed us to explore whether the road inhibits movement, thereby reducing habitat connectivity and access to portions of caribou range. Our results demonstrate that caribou typically avoided habitat within the road's north-south corridor regardless of its presence, while the east-west

corridor likely functioned as a semi-permeable barrier. This case study highlights the importance of ecological context when inferring the effects of linear features on caribou.

Quantifying the Behavioural Response of Barren-ground Caribou to Arctic Mines and Supply Roads: The Case Studies of the Meadowbank and Meliadine Mines

Mitch Fennell¹, Oliver Carroll², Manon Turmel³, Greg Sharam²

¹ERM - Environmental Resource Management, ²ERM, ³Agnico Eagle Mines Ltd.

Understanding behavioural responses of caribou to mines and roads is essential for designing mitigation measures and reducing potential energetic costs to caribou populations. Consequently, behaviour surveys are a key monitoring requirement of Arctic mines in Canada. We examined caribou behaviour from 2020-2025 at the Meadowbank and Meliadine mines in Nunavut, which overlap the spring and fall ranges of the Lorillard herd and the post-calving and summer ranges of the Qamanirjuaq herd, respectively. Caribou responses to mine site and all-weather access road disturbances (vehicles, ATVs, convoys) were monitored by wildlife biologists and Inuit from the Kivalliq Inuit Association using scan sampling protocols developed by the Government of Northwest Territories. Caribou near mines primarily exhibited non-response behaviours (standing, lying, feeding), but groups within 300 m of infrastructure showed higher frequencies of response behaviours (walking, running, alert) compared to those farther away. At both sites, caribou in smaller groups (fewer than 25 individuals) exhibited a

higher frequency of response behaviours compared to larger groups. Immediately following disturbance events, caribou exhibited significant increases in response behaviours. Subsequently, models indicated that most caribou (89% at Meliadine, 98% at Meadowbank) returned to baseline behaviours within nine minutes or less. Multiple disturbances prolonged response duration, highlighting that the existing mitigation measure of consolidating traffic into convoys is likely effective at reducing impacts. These findings provide real-world evidence of how mines and supply roads influence caribou behaviour and identify conditions under which mitigation measures can successfully minimize energetic effects.

Northern Development and Rangifer Risks: A Review of the Impacts of Resource Extraction for Caribou and Reindeer

Éloïse Lessard¹, Philip Walker², Eric Vander Wal¹

¹Memorial University of Newfoundland,

²Wildlife Division, Department of Forestry, Agriculture, and Lands Government of Newfoundland and Labrador

In response to the growing global demand for energy, mineral and hydrocarbon extraction activities are expected to intensify, particularly in northern ecosystems where resource potential is high. The expansion of resource extraction infrastructure could pose considerable risks for species vulnerable to anthropogenic disturbance. The impacts on caribou and reindeer (*Rangifer tarandus*) are of particular concern, due to their low tolerance to human-induced rapid environmental change and the fast decline experienced by many populations over the last decades. To support effective conservation planning and mitigation strategies, we conducted a scoping review to

synthesize Rangifer responses to resource extraction activities and highlight potential knowledge gaps. Across 71 studies, we documented impacts of mineral and hydrocarbon extraction activities on various populations and ecotypes of Rangifer, ranging from changes in (1) distribution and habitat selection, (2) movement and behaviour, (3) forage quality, contaminant exposure, and body condition, and (4) vital rates and demographics. A majority (76%) of studies reported negative effects for Rangifer. With this review, we highlight the need to implement long term, non-invasive contaminants monitoring (e.g., fecal or hair sampling) and calls for future work focussing on assessing impacts on vital rates and demographic trends. Uncovering the mechanisms linking behaviour, movement, and contaminant exposure to fitness outcomes is an essential step to anticipate population trajectories and halt the decline of Rangifer in increasingly industrialized landscapes.

Altered Spatial Strategies in Increasingly Disturbed Landscapes

Dominic Noce¹, Brian McLaren¹, Michel Laforge¹

¹Faculty of Natural Resources Management, Lakehead University

Woodland caribou (*Rangifer tarandus caribou*) populations are declining across their range, with human activities altering landscapes often cited as the most important factor. While guidelines surrounding sustainable levels of disturbance for population viability exist at the landscape scale, determining the level of habitat disturbance that results in behavioural responses by caribou is critical for guiding conservation action. Caribou have evolved alongside natural disturbance, e.g. fire, and have presumably evolved behavioural cue-

response mechanisms to respond spatially to such disturbances. Cue responses are ingrained decisions animals have evolved to react to stimuli, e.g. predators when they are encountered. Anthropogenic disturbance may parallel responses to natural disturbance, however proximate cues eliciting such responses remain an important outstanding question. Establishing disturbance-response thresholds across disturbance types will be critical to establishing caribou tolerance to environmental change. Using telemetry data from caribou, we tested how spatial behaviour (e.g. home range size and movement rate) changed across a gradient of anthropogenic disturbance levels. We then compared responses between natural and anthropogenic disturbance. Our goal was to compare response curves across disturbance types and to determine if thresholds in spatial behaviour can be established and if they varied by disturbance type. By identifying critical disturbance thresholds at which behaviour changes, we can begin to infer the level of disturbance that may be detrimental to caribou vital rates, which is key for informing forest management to create a sustainable mosaic that allows for caribou recovery in human-dominated landscapes.

Migration of Woodland Caribou Through an Open-Pit Gold Mine

Philip Walker¹, Erica Gillis¹, John Neville¹, Eric Vander Wal²

¹Wildlife Division, Government of Newfoundland and Labrador, ²Memorial University of Newfoundland

Animal migrations are going extinct globally, and one hypothesized cause is anthropogenic disturbance. Sufficient historical data are often lacking to capture how developments affect migration. However, the Buchans caribou herd

in Newfoundland has been monitored for nearly 70 years, during which time they have experienced multiple anthropogenic disturbances, including hydroelectric dams and transmission lines. In October 2022, construction of the largest gold mine in Atlantic Canada began, bisecting the herd's ~100 km-long migration corridor. As part of the Environmental Impact Assessment release, 40 caribou are continuously GPS-collared for the 14-year lifespan of the mine, beginning in 2020. From 316 migration events, we assessed current temporal and spatial changes in migration before and during mine construction. Thus far, we have not detected changes in spring migration. However, since construction began, start of fall migration has shifted ~2 weeks earlier (pre-construction: 26 Nov; construction: 11 Nov) and migration duration has increased by 3 days (pre-construction: 9 days; construction: 12 days). Spatial fidelity to the traditional migratory route has also changed during fall, but not spring. The proportion of caribou migrating directly through the mine during fall has declined by 17% (from 85% pre-construction to 68% during construction). No discernable changes in population size or demographic rates have been observed to date. With increased demand for gold and other rare-earth minerals, mining is expected to increase in the north. Careful consideration is required to disentangle the largely unknown impacts of mines on caribou from changing population, nutrition, or predator-prey dynamics.

CO-MANAGEMENT

The Caribou Collaboration Project: A Knowledge Hub for Collaborative Conservation

David Borish¹, Andrea Hanke¹, Jamie Snook¹,
Danilo Piljevic¹

¹Cloudberry Connections

The Caribou Collaboration Project is a co-management-led education project that explores how diverse northern Canadian communities collaborate to protect caribou. This initiative expands the Co-Management Knowledge Hub (www.co-management.ca), using caribou as a case study for collaborative conservation. Through short films and online learning experiences, the project shares stories from Indigenous harvesters, Elders, scientists, and decision-makers navigating collaborative challenges and successes. This initiative breaks down complex ideas of partnership and stewardship for the public and conservation professionals. By grounding conservation education in story and relationship, the project strengthens the shared capacity to protect caribou and the systems that sustain them.

In this presentation, we will share our co-creation process for storytelling and education. In particular, we will showcase case studies from various partners taking part in this initiative, including the Porcupine Caribou Management Board, Sahtú Renewable Resources Board, Kugluktuk Hunters and Trappers Organization, and the Nunavut Wildlife Management Board. We hope this presentation sparks conversation about how we communicate collaboration in this space, and how we can better support the next generation entering caribou co-management.

Joining Forces to Protect Woodland Caribou on the Lower North Shore: An Agreement Between the Nutashkuan Innu First Nation and the Government of Québec

Jean Mestokosho¹, Alexis Brodeur², Geneviève Brosseau², Tony Malec³, Athanase Mestokosho³

¹Conseil de la Première Nation des Innus de Nutashkuan | Nutashkuan | Québec | Canada,

²Ministère de l'Environnement, de la Lutte contre les Changements climatiques, de la Faune et des Parcs, Gouvernement du Québec,

³Conseil de la Première Nation des Innus de Nutashkuan

In May 2024, the Première Nation des Innus de Nutashkuan (PNIN) and the Government of Québec reached an agreement for the management and conservation of woodland caribou. This agreement, based on dialogue and collaboration between the two parties, aims to ensure the protection and sustainability of woodland caribou for current and future generations. To achieve this objective, the agreement provides for the temporary suspension of woodland caribou subsistence hunting by the Innu of the PNIN, while allowing for a limited community hunt for cultural and educational purposes. This community hunt is organized and supervised by the PNIN and targeting adult male caribou. It aims to maintain and perpetuate the special cultural bond that the Innu have with caribou. The agreement also includes education, awareness-raising and monitoring measures. This agreement comes after several years of discussions and more than 10 years after the PNIN initiated a project to acquire traditional and scientific knowledge on woodland caribou. A year after implementing the agreement, results are encouraging, with no caribou harvested in the agreement territory by the PNIN, a significant decrease compared to

previous years. Woodland caribou populations on the PNIN's territory, the Nitassinan, namely the Basse-Côte-Nord, Lake Joseph and Joir River populations, are either in a vulnerable or critically imperilled state (Joir River), with densities among the lowest in Québec. We will present the main elements of the agreement, and the lessons learned after 2 years of implementation.

Using Traditional Knowledge and Camera-Trapping to Understand the Relationship Between Boreal Caribou and the Deninu Kue First Nation in Response to a Changing Environment

Marc d'Entremont¹, Amanda Degray², Kelsey Kimble³

¹LGL Limited, ²Trailmark Systems, ³Deninu Kue First Nation

For generations, the Deninu Kue First Nation (DKFN) has relied on boreal caribou for their cultural, social, and physical well-being. This long relationship has provided DKFN with Traditional Knowledge (TK) of boreal caribou and the land where it occurs. This knowledge has been passed down inherently through generations and has been ingrained into a way of thinking naturally. This reliance continues today but is being impacted by climate change, industrial development, forest fires and mining activities both within and beyond DKFN's territory. While previous studies conducted by the DKFN helped to understand the impacts to boreal caribou in the South Slave Region, they did not explore how changes to boreal caribou habitat are impacting DKFN's long-standing relationship with caribou. This multi-year project has established a wildlife camera trapping study that combines the collection and sharing of TK and standard scientific methods to understand

how the relationship between the DKFN people and boreal caribou has changed in response to cumulative impacts. This project commenced in April 2024 and so far, three community meetings have been held in Fort Resolution to explore the relationship between the DKFN and boreal caribou and discuss on whether the species observed in on the cameras aligned with participants' TK and their experiences with wildlife habitat use. Themes coming out of these discussions include cultural connections and traditions, hunting and access, habitat and environmental change and recommendations for management and monitoring. This presentation will provide an update on this project.

Two-Eyed Seeing in Practice: Integrating Indigenous Knowledge and Western Science to Understand Boreal Caribou and Woodland Buffalo Dynamics in Treaty 8 Territory

Chloe Larmand¹, Darren Epperson¹

¹Ecologix Solutions

A boreal caribou herd (*Rangifer tarandus* caribou) known as the Red Earth Caribou Herd and a small population of wood bison (*Bison bison athabasca*) known as the Ronald Lake Buffalo Herd (RLBH) occupy overlapping ranges within Treaty 8 territory in northeastern Alberta, an area presenting complex management challenges that demand approaches grounded in both Indigenous Knowledge and western science. This presentation describes our ongoing community-based research partnership with Athabasca Chipewyan First Nation, guided by the Two-Eyed Seeing framework or *Etuaptmumk* (in Mi'kmaw), learning to see from one eye with the strengths of Indigenous Knowledge and from the other

eye with the strengths of western science, using both together for the benefit of all. Central to our approach is the recognition that Indigenous Knowledge must lead, not merely supplement ecological research and wildlife management. We integrate Indigenous Knowledge with ecological monitoring through participatory mapping, land-based knowledge documentation, and collaborative field research, situating this work within a socio-ecological systems framework (SES) that understands caribou and buffalo populations as inseparable from the Indigenous peoples who have stewarded these lands and animals since time immemorial. Athabasca Chipewyan First Nation Elders drive research design, data collection, interpretation, and application. This Indigenous Knowledge-led approach has already advanced ecological understanding: community research has identified the presence of boreal caribou and wood bison outside government documented home ranges, revealing critical gaps in provincial monitoring. These findings demonstrate how Indigenous Knowledge advances both the science and practice of wildlife management, offering more complete and accurate information than western methods alone. In this presentation, we discuss how we incorporated Two-Eyed Seeing into practice and argue that advancing caribou and buffalo conservation in Treaty 8 territory requires governance structures that position Indigenous Knowledge and jurisdiction as foundational to wildlife management, not as consultation but as leadership.

Integrating a Decade of Aerial Surveys and Inuit Knowledge for Collaborative Monitoring of the Torngat Mountains Caribou Herd

[Katrien Kingdon](#)¹, Aaron Dale¹, Mônica Engel¹, Kathleen Simms¹, Serge Couturier²

¹Torngat Wildlife Plants and Fisheries Secretariat, Happy Valley-Goose Bay, NL, Canada, ²Independent caribou biologist, Lévis, Québec, Canada

Inuit from Labrador and Québec first recognised the Torngat Mountains Caribou Herd (TMCH) as distinct from other woodland caribou in the region. These montane ecotype caribou are an important resource for Inuit communities. Due to an annual range that spans over Nunavik, Nunatsiavut, and Nunavut, the TMCH is of interest for two provinces, six governments, two parks and two Co-Management Boards. In response to shared conservation concerns, the Torngat Caribou Technical Committee was formed in 2013 to coordinate monitoring of the herd. The research program began with a comprehensive Inuit Knowledge study that refined the study area and identified priority questions. The first systematic aerial population survey occurred in March 2014, with subsequent surveys flown in 2017, 2021, and 2024 across the herd's historical range of more than 26,000 km². Guided by Inuit Knowledge of the land and species, observers used distance sampling during low-altitude flights to record group size and composition. These surveys provided population estimates while further refining the herd's current range. Survey findings indicate the TMCH has grown, increasing at an average annual rate of 12.4% since 2014, which had an estimated herd size of 930 caribou. In 2024, the TMCH population size was estimated at 2,997 individuals, with calves representing 23.5% of the population. While the rate of population increase slowed to 7.4% between 2021 and 2024, population monitoring suggests that recruitment remains high and is contributing to the TMCH growth. Inuit values and participation remain central to research design, survey implementation, analysis, and communication. These surveys continue to inform inter-jurisdictional co-management dialogue and decision-making.

Seeing Snow Through the Eyes of Caribou: How Fuzzy Cognitive Mapping Methods Can Be Used to Inform Snow Modelling

Josée-Anne Langlois¹, Cheryl Ann Johnson², Alexandre Langlois³

¹Centre for Northern Studies - CEN, Applied geomatics department, Sherbrooke University, Sherbrooke, Quebec, Canada, ²Landscape Science & Technology, Environment and Climate Change Canada, ³Centre for Northern Studies - CEN, Applied geomatics department, Sherbrooke University

Climate change is transforming the Arctic snowscape, with significant implications for Arctic food web interactions. This is particularly true for herbivores, like Peary caribou (*Rangifer tarandus pearyi*), whose survival and reproduction depends on snow conditions. We used a two-step, fuzzy cognitive mapping approach to summarize interviews with Knowledge Holders from communities across Nunavut (Ajuittuq [Grise Fiord] and Qausuittuq [Resolute Bay]) and the Northwest Territories (Ikaahuk [Sachs Harbour] and Ulukhaktok). Knowledge Holders were first asked to qualify and quantify characteristics related to snow depth, snow cover, duration, timing, snow hardness and ice layer creation. Knowledge holders were then asked whether the snow characteristics had a positive, neutral or negative effect on caribou fitness. This work enhances our understanding of how snow variability influences caribou ecology from foraging to movement, predation and insect avoidance to inform Arctic snow monitoring and characterization efforts aimed at supporting strategies for the protection of species at risk.

HABITAT USE & MOVEMENT

Flexible Movements and Resource Use Drive Fitness Tradeoffs for Barren-ground Caribou Experiencing Rapid Environmental Change

Molly Caldwell¹, Heather Johnson²

¹University of Wyoming, Laramie, WY, USA, ²USGS

Rapid environmental changes can outpace evolutionary adaptations, but animals that adjust their behaviors to these changes often increase their fitness. For wide-ranging animals like migratory caribou, adjusting movement behaviors allows them to alter their exposure to environmental conditions and access different resources. However, it is unclear how caribou shift their movement behaviors, such as their seasonal space use, daily movements, and forage use, in relation to changing environmental conditions, and how such shifts are associated with caribou fitness. To investigate this, we used a combination of GPS collar locations from the Central Arctic caribou herd in Alaska, USA (2015-2021), remotely sensed forage and insect indices, and survival and calving data. First, we quantified summer home ranges, daily displacements and sinuosity, and forage use. Then, we used linear mixed models to determine the effect of annual forage and insect conditions on different movement behaviors. Finally, we used logistic mixed models to measure the effect of behavior shifts on annual survival and calving rates. We found that caribou were consistent in their forage use, but highly flexible in their space use and daily movements. With earlier, warmer summers associated with increased insect

harassment, caribou expanded their space use, moved further distances, and had straighter movements. While such behavioral shifts were associated with increased fitness during cooler summers, they were associated with reduced fitness during earlier, warmer summers. These results suggest that movement strategies that are beneficial to caribou during historical, average environmental conditions may no longer be beneficial as climate conditions change.

Context-Dependent Site Fidelity in Boreal Caribou During Periods of Insect Outbreaks

Clément Couloigner¹, Louis-Paul Rivest², Jérôme Cimon-Morin³, Martin Barrette⁴, Daniel Fortin⁵

¹Department of Biology, Laval University, Québec, Québec, Canada, ²Department of Mathematics and Statistics, Laval University, ³Department of Wood and Forest Sciences, Laval University, ⁴Ministère des Ressources naturelles et des Forêts, ⁵Department of Biology, Laval University

Home-range establishment is a fundamental behaviour across animals, enabling individuals to develop environmental knowledge that enhances fitness. When disturbances change landscapes, animals must weigh declining habitat quality and uncertain spatial knowledge against the risks and benefits of relocating. Although home-range shifts are common, the conditions under which site fidelity remains adaptive are largely unknown. We investigated site fidelity in boreal caribou, a threatened species whose habitat is periodically disturbed by spruce budworm (SBW) outbreaks that are expanding northward. SBW defoliates conifers, promoting deciduous growth consumed by moose, which increases wolf presence and predation risk for caribou. Using GPS data from

200 caribou tracked over two years across a 335,000 km² area, we examined how SBW disturbance and forage availability (deciduous browse for moose and lichens for caribou) affected site fidelity and its implications for survival. Caribou typically reduced site fidelity following local increases in SBW disturbance and deciduous browse, conditions expected to elevate moose and wolf densities. Reduced fidelity affected mortality, but the strength and direction of this effect varied with landscape composition. In SBW-free landscapes, high site fidelity lowered mortality when browse was scarce but tended to increase mortality when browse was abundant. Under SBW disturbance, reducing fidelity no longer decreased mortality in browse-rich landscapes and could even have the opposite effect. Our study demonstrates how the movement decisions and survival of caribou are impacted by SBW and food availability at a large scale, processes likely to become increasingly important as SBW expands across northern caribou ranges.

Peary Caribou Movements in the Northwest Territories

Tracy Davison¹, Adam Thom¹

¹GNWT, ECC

Peary Caribou are a small caribou that live on Canada's Arctic Archipelago. In 2004 they were listed by COSEWIC as Endangered. Since then they have shown some recovery and were reassessed as Threatened by COSEWIC in 2015. Due to their high Arctic range, scientific information on Peary Caribou is limited. In 2022 and 2023 we deployed a total of 33 GPS collars on female Peary Caribou on Victoria, Melville and Banks Island. These collars were programmed to collect data for just over 2 years. We have used this data to better understand their seasonal movements including calving

areas. Peary caribou do not make long yearly migrations to calving grounds like Dolphin-Union or Barren-Ground caribou to the south however Traditional knowledge does identify areas which they use during calving. Calving is a sensitive time and understanding more about it and other seasonal movements gives more insight that hopefully will help protect Peary Caribou to continue their recovery.

Geographic Space Use Sharing by Two Caribou Ecotypes in Northern Ontario

[Rachael Derbyshire](#)¹, Arthur Rodgers², Jennifer Shuter², Frances Stewart³, Webber Quinn¹

¹University of Guelph, ²Ontario Ministry of Natural Resources, ³Wilfrid Laurier University

The boreal woodland caribou (*Rangifer tarandus caribou*) is considered Threatened in Ontario and Canada. In Northern Ontario, two ecotypes, eastern migratory ("migratory") and boreal sedentary ("sedentary"), overlap in geographic (latitude and longitude) space. Ecotypes are delineated based on their behaviour before and during the calving/summer season (movement, proximity to conspecifics, and habitat use) and are considered Designatable Units by the Committee on the Status of Endangered Wildlife in Canada. Despite the importance of understanding seasonal patterns of range use by these two ecotypes, little is known about interannual variation in the extent of seasonal range overlap, particularly during winter when both ecotypes occupy the boreal forest. We use GPS data from long-term monitoring efforts in Northern Ontario to identify parturition locations for 726 caribou-years, then use these locations to assign ecotype. Of 390 individual caribou, we designate 82 as migratory and 308 as sedentary, with no individuals clearly switching ecotypes between years. We then

generate year-specific geographic range estimates for both ecotypes in winter and calving/summer to determine the geographic range overlap between ecotypes, and investigate the extent to which winter range overlap varies across years using data from both ecotypes over four winters. Lastly, we explore whether seasonal ranges have shifted in geographic space for each ecotype over time. Our work is ongoing and will inform our understanding of boreal caribou as part of the Caribou Conservation Stewardship Program.

Causes and Consequences of Switching Calving Grounds by Migratory Barren-ground Caribou

[Benjamin Larue](#)¹, Ophélie Couriot², Alicia Kelly³, Anne Gunn⁴, Howard Cluff⁵, John Nishi⁶, Eliezer Gurarie⁷

¹Université Laval, Québec, Québec, Canada, ²University of Alaska Fairbanks, ³Government of Northwest Territories, ⁴CircumArctic Rangifer Monitoring and Assessment Network, ⁵Wek'ëezhii Renewable Resources Board, ⁶EcoBorealis Consulting Inc, ⁷SUNY College of Environmental Science and Forestry

Fidelity to calving grounds has long structured how barren-ground caribou (*ekwə̀*) herds are defined and managed, yet movement data reveal that some females switch calving grounds between years. The neighboring Bluenose-East, Bathurst and Beverly herds have overlapped extensively on shared winter ranges in recent years, creating more opportunities for interherd travel and association. This increasing winter overlap may complicate efforts to monitor and recover the Bathurst herd, which has declined rapidly over the past two decades. Using multi-year GPS collar data from adult females across six herds (1,745 individuals; 4,069 collar-years), we first identified calving-ground switching events and evaluated

temporal trends. We then tested whether late-winter social proximity, winter spatial overlap, and herd size predicted switching. Switching was not evenly distributed among neighboring herds, with Bathurst animals showing the highest probability of switching. Switching has also become more frequent in recent years. Individuals that associated most closely with members of another herd during late winter were more likely to calve with that herd the following spring. Together, these findings suggest that herd identity is dynamic, with winter associations shaping connectivity and challenging how monitoring frameworks and recovery strategies are applied across the migratory landscape.

Mechanism of Plasticity in Site Fidelity as a Rewarding Tactic in Changing Environments

Daniel Fortin¹, Varvara Vladimirova¹, Glenn Yannic², Sabrina Plante³, Joelle Taillon³

¹université Laval, ²Université Grenoble Alpes, ³Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs

Home-ranging is common among animal species, as site fidelity facilitates cognitive map development and promotes efficient habitat use. The adaptive value of site fidelity, however, should decline as environmental conditions change, yet empirical evidence remains limited. We investigated how fire and forest harvesting affect home-range stability in boreal caribou, a species typically exhibiting strong site fidelity. We then identified conditions where fidelity increases mortality risk and when shifting home ranges becomes advantageous. Most deaths were caused by wolves, a predator that benefits from forest disturbance. We monitored 331 GPS-collared caribou across 667,000 km² of boreal forest. Forest harvesting and fire

disturbance levels were related to indices of home-range fidelity derived from the spatial proximity of locations across successive years. Survival was then evaluated in relation to habitat conditions following home-range adjustment. Caribou increasingly altered their home ranges as local disturbance intensified. This reduced fidelity increased survival, but only in highly disturbed landscapes. Individuals remaining in high-disturbance areas had lower survival than those that moved into similarly disturbed areas. Conversely, high fidelity in low-disturbance environments was associated with relatively high survival. These results show that site fidelity can become maladaptive under shifting risk regimes, whereas reduced fidelity enables adaptive exploratory movements. Our findings clarify how behavioral responses to disturbance translate into demographic outcomes. From a conservation perspective, protecting habitats currently used by caribou and maintaining connectivity among them is essential, as strong site fidelity can yield positive survival outcomes in low-disturbance landscapes.

CONSERVATION & MANAGEMENT II

Evaluation of a Mobile Conservation Zone for Bathurst Caribou Harvest Management and Recovery

H. Dean Cluff¹, Laura Meinart¹, Aimee Guile¹,
Karin Clark², James Hodson³, John Nishi⁴,
Stephanie Behrens⁵, Bruno Croft⁶

¹Wek'èezhii Renewable Resources Board,

²Environment and Climate Change,
Government of Northwest Territories,

³Environment and Climate Change - North
Slave Region, Government of Northwest
Territories, ⁴EcoBorealis Consulting Inc., ⁵Tłı̄chǫ
Government, ⁶Yellowknives Dene First Nation

The Bathurst barren-ground caribou herd declined significantly from peak numbers in 1986 of about 472,000 to approximately 3600 in 2025. After the rapid decline between 2006 and 2009, co-management actions recommended by the Wek'èezhii Renewable Resources Board (WRRB) in 2010 led to the closure of all non-Indigenous hunting of Bathurst caribou within the Northwest Territories (NWT). The WRRB also recommended an annual harvest target of 300 caribou (80% male) for Indigenous hunters in the NWT, down from a previously unrestricted harvest that was mostly females. Further decline in the herd led to closure of the Indigenous harvest of Bathurst caribou in the NWT in 2015 for conservation, creating hardships for communities and Indigenous peoples in the NWT. Regulations to implement zero harvest of Bathurst caribou were enacted in early 2015 through a mobile conservation zone delineated around Bathurst collared caribou locations in winter and adjusted weekly. Here we document the effectiveness of the mobile zone to prevent

any harvest of Bathurst caribou from 2015 to 2025. The mobile zone has been useful as a harvest management tool because it largely protected Bathurst caribou while still providing access to large areas for subsistence use of adjacent caribou herds. Although some illegal harvesting of caribou has occurred within the mobile zone, the number has been low in most years. However, as of 2025, the Bathurst caribou herd has not recovered. Unfortunately, overlap of adjacent caribou herds in winter has confounded assessment of selective harvest management as a recovery tool.

Inuit Knowledge in Motion for Migratory Caribou Conservation in Nunavik

Rachel Guindon¹, Barrie Ford², Billy Palliser³,
James May³

¹Department of Environment, Wildlife, and
Research, Makivvik, Kuujuaq, Québec, Canada,

²Department of Environment, Wildlife, and
Research, Makivvik, ³Anguvigaq (Nunavik
Hunting, Fishing and Trapping Association)

Nunavik Inuit have been stewards of migratory caribou for millennia, maintaining deep cultural, ecological and subsistence relationships with this species. However, the two migratory herds in Nunavik (Quebec, Canada), the George River herd and the Leaf River herd, have experienced significant population declines in the last decades. In response, Makivvik and the Anguvigaq launched a comprehensive Inuit Knowledge of Migratory Caribou project to support the development of an Inuit-led management initiative. This study documents Inuit Knowledge through interviews and focus groups with 75 participants from five Nunavik communities: Kangiqsualujuaq, Tasiujaq, Salluit, Inukjuaq, and Umiujaq. The research captures the cultural significance of caribou, harvesting values, ecological observations and

perspectives on management. Participants emphasized seven core harvesting values: respect for the animal, need-based harvesting, herd care, observation, avoiding waste, appreciation and sharing of the catch. Ecological insights included observations on caribou population cycles, health and reproduction as well as interactions with predators, muskoxen and climate change. Participants expressed concern over declining abundance, particularly for the George River herd, and identified sport hunting, predator pressure and environmental change as key stressors. The study also reflects on past management approaches, including the impacts of colonial policies and the need for Inuit-led conservation strategies. These findings affirm the critical role of Inuit Knowledge in shaping sustainable and culturally grounded caribou stewardship. The study also forms the foundation for the development of an Inuit-led management initiative: the Nunavik Caribou Protection Plan.

Wildlife Management and Monitoring Plans: A Tool to Manage and Protect Caribou and Other Wildlife

Greg Look¹, Chris Shapka¹, Pete Cott¹, James Hodson²

¹Wildlife Management Division, Environment and Climate Change, Government of the Northwest Territories, ²North Slave Region, Environment and Climate Change, Government of the Northwest Territories

Wildlife, particularly culturally important harvested species like caribou, are top valued ecosystem components to the people of the Northwest Territories. Recognizing the critical need to understand and minimize impacts to caribou from industrial activities, mitigation and monitoring requirements became law under

the territorial Wildlife Act in 2014. Section 95 of the Wildlife Act states that a developer may be required to prepare a Wildlife Management and Monitoring Plan (WMMP) if the project is likely to significantly disturb, alter, damage, or destroy wildlife or wildlife habitat or contribute to cumulative impacts. The Government of the Northwest Territories Department of Environment and Climate Change (GNWT-ECC) implements and enforces the Wildlife Act. Development projects likely to require a WMMP include mines, all season or winter roads, forestry operations, oil and gas extraction, mineral exploration, and remediation projects. The WMMP may include practices to manage vehicle-wildlife collisions, waste management, staff education, and mitigation effectiveness monitoring. Three tiers of WMMP exist, determined by the certainty of a project's impacts and complexity of mitigation and monitoring programs needed. The lowest tier WMMP is voluntarily implemented but encouraged, while higher tiers of WMMP require approval by the Minister of ECC, include wildlife effects monitoring contributing to regional cumulative effects monitoring, and are enforceable. The implementation of WMMPs help adaptively manage and protect caribou and other wildlife, and improvements are made by engagement and collaboration among developers, government, Indigenous Government and Organizations and the public.

Quantifying Forest Disturbance Regimes Within Caribou (*Rangifer tarandus*) Range in British Columbia

James Maltman¹, Nicholas Coops¹, Gregory Rickbeil², Txomin Hermosilla³, Cole Burton¹

¹University of British Columbia, ²WSP, ³Canadian Forest Service

Habitat disturbance is a major contributor to population declines of woodland caribou in Canada. Different causes of disturbance have differing impacts on caribou populations; thus, it is important that managers and scientists have a detailed understanding of disturbance regimes affecting caribou. Recent advances in satellite-based land cover mapping and disturbance detection have allowed for identification of forest disturbances through time, with consistent, spatially explicit methodology. These products are well suited to evaluating polygonal (e.g forest harvesting cutblocks or burned areas) disturbances affecting caribou, provide coverage of remote areas, characterization of the spatial organization of disturbance, and analysis of change through time. In this work, we utilize these advances to evaluate the polygonal forest disturbance regimes affecting all caribou herds in BC from 1985-2019. We additionally evaluate rates of forest harvesting since the Species at Risk Act (SARA) was implemented, and recovery strategies for caribou were published. We found that Southern Mountain caribou were affected by the most polygonal disturbance, with 22.75% of forested habitat disturbed within their range over the study period. 16.4% of all forested area in caribou range in BC was affected by polygonal disturbance during the study period. We found that the implementation of SARA, and publication of recovery strategies likely had little impact on forest harvesting levels, and that caribou in BC face high, often increasing, amounts of disturbance. This work provides a detailed understanding of polygonal disturbances affecting caribou in BC, and demonstrates how advances in satellite-based forest monitoring can be used for caribou conservation.

What Would My Grandfather Think if I Let Those Caribou Disappear? Biigtigong Nishnaabeg's Plan to Protect and Recover the Gchigmiing Dikwag (Lake Superior Caribou)

Allie Mayberry¹, Chief Duncan Michano²

¹Wildlife Coordinator, Biigtigong Nishnaabeg,

²Biigtigong Nishnaabeg

Biigtigong Nishnaabeg were once caribou people. However, over a century of landscape-scale habitat disturbance has led to the near-extirpation of caribou from our territory. Today, few of our community members have ever seen a caribou, let alone harvested one according to our rights and traditions. Our cultural connection to caribou is fading in tandem with their disappearance from our lands. The Lake Superior Coast Range faces critical challenges. It is one of Canada's smallest boreal caribou ranges and is isolated from the rest of Ontario's caribou by a highly disturbed landscape known as the "Discontinuous Distribution". It is believed that the population is now confined to two offshore islands in Lake Superior. Between 2013 and 2015, extremely cold winters created ice bridges that allowed wolves to travel from the mainland to these otherwise predator-free islands, nearly decimating the populations by 2018. The protection and recovery of the Lake Superior Coast Range requires optimistic advocacy, proactive planning, and immediate action. Recognizing this, Biigtigong Nishnaabeg developed a Caribou Stewardship Plan in 2022. This presentation outlines our long-term vision for the Lake Superior caribou, and highlights the following recent initiatives: 1. Mapping habitat disturbance in the Lake Superior Coast Range and Discontinuous Distribution using ECCC and Ontario models; 2. Creating a contingency plan to protect island populations from mass predation; 3. Implementing trail

camera monitoring. We also discuss measures to revitalize the community's cultural connection to caribou through youth education and on-the-land learning with other First Nations.

For the Protection of Caribou in the Nitassinan of the Innu of Uashat Mak Mani-Utenam

André Michel¹

¹Innu Takuaikan Uashat mak Mani-utenam

For millennia, the Innu of Uashat mak Mani-utenam have held a deep and spiritual relationship with caribou. Caribou was not only a food source for our people, but it has also been integral to our rituals and legends. Now in dramatic decline, the Innu of Uashat mak Mani-utenam are establishing themselves as leaders in the fight to protect and restore woodland caribou populations on their traditional territory, their Nitassinan. André Michel will be presenting the hard work of the Innu over the past several years, including two aerial caribou inventories aimed at determining the size of caribou herds, assessing changes in population numbers as well as identifying essential habitats in need of protection, DNA testing of caribou fecal matter, the study of potential presence of contaminants in caribou carcasses, the use of satellite imagery to assess caribou populations and habitat quality, and the development of an Indigenous protected and conservation area aimed at protecting caribou and its habitat from human activities, such as mining and forestry. The presentation will be done orally by Mr. Michel, who will also be using a powerpoint presentation as visual aid.

COMMUNICATING THROUGH CHANGE

Managing Caribou in Nunatsiavut

Jason Dicker¹

¹Nunatsiavut Government

Mr. Jason Dicker, an Inuk originating from Nain, Nunatsiavut, currently serves as the Wildlife Manager for the Nunatsiavut Government. His responsibilities encompass a wide range of issues involving species such as polar bears, caribou, moose, and migratory birds. He actively participates in several national committees dedicated to wildlife conservation, including the National Inuit Wildlife Committee under Inuit Tapiriit Kanatami, where he also holds the position of Co-Chair for the Polar Bear Technical Committee. Additionally, he is a member of the Aboriginal Traditional Knowledge Subcommittee under the Committee on the Status of Endangered Wildlife in Canada. As the Wildlife Manager, he oversees three significant caribou herds relevant to Nunatsiavut: the George River Caribou (8,600, 2024), the Torngat Caribou (2,997, 2024), and the Mealy Mountain Caribou (1,289, 2022). Managing the population trends of these herds is a complex task, due to the presence of multiple stakeholders who share common interests with the Nunatsiavut Government. Jason's experience with caribou, in particular, originates from his upbringing with his family, who hunted and harvested from the George River Caribou Herd in northern Labrador. His interest in the subject was further cultivated during his academic pursuits in natural resources. His extensive experience has facilitated his studies in environmental studies and environmental policy at Memorial University. Jason is interested in gaining a deeper understanding of the challenges involved in communicating Indigenous values,

actions, and potential solutions to caribou populations.

How To Share Good News

Tina Giroux-Robillard¹, Earl Evans²

¹Beverly and Qamanirjuaq Caribou Management Board, ²-

The Beverly and Qamanirjuaq Caribou Management Board (BQCMB) is a co-management board established to safeguard two herds of barren-ground caribou. Created in 1982, the Board provides a way to navigate the multi-jurisdictional and multi-cultural nature of caribou management. Like many barren-ground herds, the Beverly and Qamanirjuaq herds have seen notable declines in recent decades; however, a 2023 aerial survey of the Beverly herd indicated a significant increase in the population from 103,400 in 2018 to 152,000 in 2023. In our presentation, we will explore how we communicate this good news, informed by the broader context of declines in neighboring herds, development across the range, and the BQCMB's vulnerability assessment for these caribou. We will speak to some of the challenges of discussing population increase and how we are addressing them in our co-management setting.

Communications Through Co-Management

Deana Lemke¹, Joe Tetlich²

¹Porcupine Caribou Management Board, ²PCMB

The Porcupine Caribou Management Board is a co-management advisory board established under the Porcupine Caribou Management Agreement, through the Inuvialuit Final Agreement. The Board communicates with

management agencies and user communities about the status, research and conservation of the herd. This work is guided by the Harvest Management Plan, Native User Agreement, annual harvest meetings, research and monitoring, and more. A notable success has been the collaboration across partners, stakeholders and user communities; for example, the Board engages regularly with all Parties and stakeholders to discuss herd status at its Annual Harvest Meeting. The Porcupine Caribou Herd was estimated at a high of 218,000 animals in 2017; however, multiple streams of information suggest this trend of growth may be changing. We are aiming to continue proactive conversations with partners and stakeholders as we navigate this shift. Early detection of change, diverse monitoring metrics, and a robust co-management framework have been key. We will discuss our communications approach for this new phase and lessons learned from past work.

On Balancing: The Advisory Committee for Cooperation on Wildlife Management

Jody Pellissey¹

¹Wek'eezhii Renewable Resources Board and the Advisory Committee for Cooperation on Wildlife Management

The Advisory Committee for Cooperation on Wildlife Management (ACCWM) was established to exchange information, develop cooperation and consensus, and make recommendations about wildlife that cross regional and territorial boundaries. The ACCWM developed the Taking Care of Caribou: The Cape Bathurst, Bluenose-West, and Bluenose-East Barren-ground Caribou Management Plan to address caribou management and stewardship over the long term. Developed in consultation with most of

the communities that harvest from the three herds, this management plan coordinates management actions for each herd's conservation and describes recommended actions depending on the status of the herd. The ACCWM determines herd status each year at its annual status meeting using information gathered through traditional knowledge and scientific studies. Action Plans are then submitted to governments to guide the management of the herds. In November 2022, the ACCWM discussed community-based monitoring and scientific information for the Bluenose-East caribou herd. Based on the information provided, the ACCWM determined the herd status to be both Red (low) and Yellow (intermediate and increasing). Follow-up meetings were held, but no consensus could be reached. In April 2022, the Member Boards decided upon a hybrid Red & Yellow status. This decision recognized the positive community and scientific observations while noting the concerns about the population of the herd. The ACCWM recommended the continuation of management actions associated with Red, with the hopes that the Bluenose-East herd would be firmly in the Yellow range by the following year.

CARIBOU CONSERVATION USING EX-SITU APPROACHES

Conservation Breeding for Caribou Populations: Québec's Experience, Expertise, and Vision

Michaël Bonin¹, Marion Barbé¹, Mathieu Morin¹,
Céline Isaaz¹, Benjamin Jakobek¹, Caroline
Hins¹, Stéphanie Pellerin¹

¹Gouvernement du Québec

In addition to monitoring around caribou populations in the wild, Québec is undertaking ex-situ conservation efforts for three caribou populations whose status is considered precarious. One of the main measures implemented is conservation breeding, which involves keeping and reproducing caribou in captivity with the objective of releasing individuals back into the wild. This measure is part of Québec's broader approach, alongside actions targeting habitat quality and disturbance reduction, to support the survival of the Val-d'Or (since 2020), Charlevoix (since 2022) and Gaspésie (since 2024) caribou populations. Captive care and breeding for each caribou population present unique challenges and learning opportunities. Drawing on Québec's experience and expertise, this presentation will outline the issues encountered, the challenges overcome, and the opportunities for knowledge acquisition across three distinct yet interconnected ex-situ conservation projects. We will present the specific story of each conservation breeding project while also covering how our teams deal with veterinary cares, nutrition and behavioral topics as well as reproductive and demographic

management with the underlying objective of returning populations to the wild.

Addressing the Everyday Challenges of Reintroduction Work

Sakari Mykrä-Pohja¹, Milla Niemi²

¹Metsähallitus Wildlife Service Finland (Address: Metsähallitus Wildlife Service Finland, Yrjönkatu 6, FI-28100 Pori, Finland), ²Metsähallitus Wildlife Service Finland

The seven-year EU co-funded WildForestReindeerLIFE project (2016-2023) reintroduced wild forest reindeer into two areas of their historical range through captive breeding and soft releases. Between 2019 and 2022, 82 individuals - over half born in enclosures - were released into two national parks. A new seven-year project, LIFEline4Fennicus, will continue supporting these populations and establish a new reintroduction site. The reintroduction has been largely successful, yet not without challenges. We highlight several issues shared by other similar projects. One major challenge is the availability of animals: Finnish zoos can produce only limited numbers of genetically high-quality founders, and the situation was further complicated by the bankruptcy of a key partner zoo. Possible solutions include combining the breeding enclosure and maternity pen or increasing the number of wild-caught founders. Another concern is the availability of skilled staff, as gaps in animal care or welfare monitoring can endanger animals and increase workload for other team members. Finally, habituation to humans remains an issue, particularly among zoo-born males. In the new project, we aim to develop daily management practices that minimize human contact. In addition, daily work involves a constant stream of small practical challenges. They varied from

finding suitable ear tags to identifying the best materials for fixing fence nets and determining the optimal settings for monitoring cameras. As many of these issues are likely universal, we encourage open discussion and knowledge exchange between projects - not only about successes, but also about the difficulties and on-the-ground realities of reintroduction work.

Conservation Breeding For the Recovery of Caribou in Jasper National Park

Layla Neufeld¹, Jean-Francois Bisailon², Leanna Parker², Madeline Trottier², Scott Taylor², Joshua Kummerfield²

¹Jasper National Park, Parks Canada, ²-

Jasper's southern mountain caribou subpopulations, part of the Jasper/Banff Local Population Unit, have been at or below quasi-extinction levels for many years, primarily due to decades-ago management actions that led to high wolf density. Despite the continued improvement in ecological conditions for caribou survival and ongoing protection of critical habitat and individuals under the Species at Risk Act and the National Parks Act, current subpopulations are too small to recover from declines experienced in previous decades. With only two of the four subpopulation ranges still occupied in 2025, and after an extensive review of available options for caribou recovery, Parks Canada completed the building of its Conservation Breeding Centre in late 2024 and populated the Centre with its first founders in spring 2025. We present a brief overview of the background of conservation breeding, and an update on current status and next steps in conservation breeding to recover southern mountain caribou in Jasper National Park.

Lessons Learned from 13 Years of Southern Mountain Caribou Maternity Penning

Carmen Richter¹, Clayton Lamb¹

¹Nikanêse Wah tzee Stewardship Society

The Nīkanêse Wah tzee Stewardship Society, a joint project of Saulteau First Nations and West Moberly First Nations, has operated maternity pens in the Peace region of BC (Treaty 8 Territory) since 2013. In that time the herd has increased from 36 to ~200, from a combination of the pen and predator control. Maternity penning is challenging but has been a necessary intervention to bring back these animals. We are now operating in our third location.

APPARENT COMPETITION

Considering Complexities of Caribou Ecosystems to Inform More Effective Recovery

Cole Burton¹, Tazarve Gharajehdaghipour², Katie Tjaden-McClement², Lindsay Watson², Goncalo Curveira-Santos²

¹University of British Columbia, Vancouver, Canada, ²University of British Columbia

Caribou conservation in western Canada is often presented as a problem of disturbance-mediated apparent competition. This posits that forest disturbances from timber harvest and fire, among other sources, drive increases in ungulate prey such as moose and deer, which in turn drive increases in wolf predation on caribou. Management has focused predominantly on reducing predation risk through culling wolves or penning vulnerable cows and calves. However, this oversimplifies complexities of caribou ecosystems that can influence long-term conservation outcomes. Recent research in our lab suggests that the effects of disturbances and management actions on the broader mammal community are context dependent and connect caribou to other species beyond wolf, moose, and deer. In northern Alberta, camera trap surveys and structural equation models suggested that the indirect effects of anthropogenic disturbances link caribou to snowshoe hares, a keystone prey species for multiple potential caribou predators. In central British Columbia, a cyclic increase in snowshoe hares bolstered coyote populations, which were further released from top-down control by wolf removal, raising the possibility that the upcoming hare decline could elevate coyote predation on caribou. Furthermore, caribou in this low-productivity

ecosystem were attracted to recent clearcuts with higher forage availability, exposing them to greater predation risk from wolves, coyotes, and black bears. And habitat protections to reduce clearcut logging remain inadequate in this and many other caribou ranges. Ongoing habitat disturbances combined with continued reductions of apex predators could shift caribou ecosystems towards alternative states that may no longer support caribou recovery.

Non-Consumptive Effects of Apparent Competitors

Quinn Webber¹, [Nicola Love](#)¹

¹University of Guelph

Apparent competition describes an indirect interaction in which the abundance of one prey species negatively affects another through shared predation. The classic pathway operates through one prey species subsidizing predator populations, increasing predation on a co-occurring prey species. Prey may also respond to apparent competitors through a non-consumptive pathway, whereby competitor presence signals elevated predation risk and triggers behavioural responses with energetic consequences, such as habitat displacement or increased locomotion. Here, we integrate community ecology theory with movement ecology tools to test whether caribou respond to moose as a predation risk cue in a boreal caribou-moose-wolf system. We test two hypotheses: (1) caribou perceive any neighbouring prey, including conspecifics, as an equivalent predation threat; or (2) caribou respond neutrally to conspecifics but treat moose as a wolf-associated risk cue, responding as they would to a predator encounter. Under the alternative hypothesis, we predict caribou will increase movement following moose encounters comparably to wolf encounters, and distance-to-moose and

distance-to-wolf will exhibit comparable effects on habitat selection. To test these predictions, we identify caribou-moose, caribou-caribou, and caribou-wolf encounters from GPS telemetry. For each encounter, we fit a two-state hidden Markov model (HMM) to pre-encounter movement, identifying resting and directed travel states. We simulate 500 null trajectories forward using fitted HMM parameters, seeding each with the animal's observed pre-encounter speed and direction. Deviation of actual post-encounter positions from this null distribution quantifies encounter-driven behavioural change, allowing us to disentangle consumptive and non-consumptive pathways of apparent competition.

Predator-Prey Dynamics of Cougar, Caribou, and Feral Horse: An Apparent Competition Hypothesis

[Julie Thomas](#)¹, Shane White², Chris Johnson¹

¹University of Northern British Columbia, ²British Columbia Ministry of Water, Lands and Resource Stewardship

Non-native species are a leading cause of human-mediated shifts in species assemblages. Introduced prey may compete with native prey directly for shared resources, or indirectly via a shared predator (i.e., apparent competition). It is unknown what role non-native species, such as feral horse, could play in an apparent competition dynamic with rapidly declining woodland caribou. Our research examines the predator-prey dynamics of caribou and cougars in central British Columbia, Canada. Specifically, we tested a hypothesis of spatial apparent competition between caribou and feral horse, facilitated by landscape disturbance and range-expanding cougars. We predicted that caribou would experience greater mortality risk in places and times of overlap with feral horses.

From 2022-2025, we deployed GPS collars on 17 cougars and investigated kill sites to quantify diet. Additionally, we tracked cause-specific mortality of 107 GPS-collared caribou. We deployed a network of 150 wildlife cameras to model the spatial distribution of the prey of cougars. Feral horses were a major prey item for cougars, comprising 30% and 13% of annual male and female cougar diet, respectively. Conversely, cougars preyed on caribou opportunistically, when caribou migrated to their low-elevation winter range. To date, we have identified 42 caribou mortality events attributed to cougar. Preliminary evidence suggests that mortality risk for caribou is positively correlated with spatiotemporal overlap with feral horses. Our research examines a poorly documented source of predation for woodland caribou and expands our understanding of the potential role of apparent competition in population decline of this threatened species.

The Alternative Alternative Prey: Beaver Are the Main Prey Item for Wolves in Northeast British Columbia

Jesse Tigner¹, Katherine Wolfenden², Nicole Boucher¹, Andrea Morehouse³

¹SwampDonkey, ²Fort Nelson First Nation,

³Winisk Research and Consulting

In western Canada wolves are the primary predator of boreal caribou. High wolf densities, especially in areas with high densities of linear disturbance features, translate to increased predation rate of caribou and subsequently low caribou populations. High wolf densities are themselves driven by widespread habitat disturbance that increases in early successional vegetation and by decreases in winter severity, which together increase the non-caribou

ungulate carrying capacity and distribution. In northeast British Columbia, continuous oil and gas development since the 1950s has left persistently low caribou populations and a staggering anthropogenic footprint (linear densities > 25km/km²). However, the link between disturbance, increased ungulate biomass, and increased wolf density has not occurred. Over the last 15 years wolf populations have remained high (> 7 wolves / 1,000km²) while moose populations have remained low (~ .01 moose / km²) and other ungulates are virtually non-existent. Beaver, however, are both ubiquitous and widely understood to be an important prey item for wolves by the Fort Nelson First Nation. Here, we use a combination of metabarcoding and stable isotope analyses to determine and compare seasonal wolf diet across eleven wolf packs in four caribou ranges. We show that beaver comprise > 60% of wolf diet likely supporting the current wolf population even in the absence of high densities of other ungulates. We discuss the ramifications of this alternative prey item that is inelastic to anthropogenic habitat disturbance using a long-term dataset on beaver habitat selection in the same study area.

Apparent Competition in Ontario's Far North

Margaret M. Welsh¹, Quinn Webber², Brent Patterson³, Ashley Thomson⁴, Arthur Rodgers⁵, Jennifer Shuter⁵, Michel Laforge⁴

¹Lakehead University, Natural Resources Management Masters Program, ²Department of Integrative Biology, University of Guelph, ³Wildlife Research and Monitoring Section, Ontario Ministry of Natural Resources, ⁴Faculty of Natural Resources Management, Lakehead University, ⁵Centre for Northern Forest Ecosystem Research, Ontario Ministry of Natural Resources

Boreal caribou are declining across much of their range, and therefore studies informing potential reasons for this decline across ecological contexts are becoming increasingly important. Many studies investigating ecological drivers for boreal caribou decline are focused on mechanisms such as disturbance-mediated apparent competition (DMAC). DMAC occurs when anthropogenic and natural disturbance increases habitat quality for alternate prey such as moose, resulting in these species encroaching into caribou habitat, and increasing predator densities and ultimately predation risk for caribou. Evidence for DMAC comes primarily from the western and southwestern parts of the caribou range where human-mediated disturbance is high. In Ontario's Far North, most disturbance is naturally occurring as opposed to anthropogenic. Using GPS collar data from moose, we'll test if DMAC could play a significant role in caribou population dynamics up North where anthropogenic disturbance is rare. Our goal is to determine if moose selected for disturbed areas and/or areas with higher primary productivity and plant diversity to test whether disturbance is likely to lead to higher moose abundance in Ontario's Far North. We predicted that moose would select for disturbed habitat characterized by highly productive, and diverse, early seral vegetation. Our project aims to fill the gap of how moose and caribou share a landscape with minimal anthropogenic disturbance, and to observe how natural disturbance can affect their coexistence. The results of this project will help inform management decisions and increase general understanding of mechanisms behind boreal caribou decline by testing population dynamics in novel moose-caribou-wolf systems.

Apparent Competition Affects Woodland Caribou Habitat Use as Well as Demography: The Role of Refugia

Steven F. Wilson¹

¹EcoLogic Research, Nanaimo, BC, Canada

Habitat-mediated apparent competition is hypothesized to be the main driver of woodland caribou declines throughout their range. Although apparent competition is often discussed in the context of human-caused habitat alteration, the mechanism can occur wherever coexisting prey share a common predator, regardless of the level of habitat disturbance. Theory predicts that coexistence among prey species depends on the less-productive prey having access to refugia from predation. Consequently, apparent competition has the potential to affect not only caribou demography but also habitat use. I present extensions to current predator-prey theory to characterize the expected effects of primary prey enrichment on caribou habitat selection and demonstrate how caribou must use predation refugia to compensate for their lower productivity compared to primary prey, even where habitat disturbance and primary prey densities are very low. Caribou reliance on refugia is predicted to increase as primary prey become more abundant, and this prediction is consistent with historic and current accounts of caribou range contractions, as well as with observations of nutritional deficiencies among caribou in apparently suitable ranges. This suggests that caribou persistence is more likely where higher proportions of ranges serve as predation refugia, and that more aggressive recovery actions will be required where refugia are less extensive.

HABITAT MANAGEMENT & PLANNING

Boreal Caribou Range Plans: Tools for Wildlife Managers and Industry

Pete Cott¹, Lisa Worthington¹, Kathy Unger¹,
Chris Shapka¹

¹Wildlife Management Division, Environment and Climate Change, Government of the Northwest Territories

Boreal Caribou Range Plans are a useful wildlife management instrument and a helpful planning tool for Industry. In the NWT, boreal caribou are listed as “threatened” under federal and territorial Species at Risk legislation, and it is unlawful to damage their habitats. Range plans are also required under federal and territorial boreal caribou recovery strategies. The boreal caribou range in the NWT is known as NT1, and this is subdivided into five administrative regions for range planning purposes. Range plans include a compilation of data on boreal caribou habitat and landscape disturbances from anthropogenic development and forest fires. This data are gathered from the best available sources, including science and Traditional Knowledge. This information is mapped and prioritized in terms of caribou habitat value. Land use best management practices are assigned to these areas according to the caribou habitat value. Range plans help industry to plan projects in a way that minimizes, mitigate, or avoids impacts to caribou, resulting in improved project planning and efficiency and demonstrated due diligence. Having established range plans also help to make the environmental assessment and regulatory process more efficient and

predictable. By identifying and delineating critical boreal caribou habitats and outlining associated mitigative actions, developments may proceed while protecting boreal caribou and remaining in compliance territorial and federal Species at Risk legislation.

Estimating Climate and Forest Management Impacts on Future Trade-Offs Between Wildfire Mitigation and Caribou Habitat Quality in West Central Alberta

Kelsey Gritter¹, Eric Neilson¹

¹Canadian Forest Service

The likelihood, severity and size of wildland fires across Canada’s forests are predicted to increase due to climate change, potentially impacting the importance of wildfire risk mitigation. Wildfire mitigation efforts aim to break up the distribution of fuels, which changes forest composition and age, thereby impacting other forest values including habitat of threatened woodland caribou (*Rangifer tarandus caribou*). Forest managers must make decisions that trade-off among forest values, which requires projections of how those decisions affect future landscapes. Useful projections must capture the spatiotemporally explicit effect of changing weather on various forest processes. We developed a simulation framework, the Forest Ecosystem Simulator (ForES), which models the interaction between forest succession, anthropogenic disturbance, and wildfire. We used ForES to compare among a set of climate and harvest scenarios to assess how varying forest management impacts wildfire risk mitigation and woodland caribou habitat quality trade-offs in a forest management area in Western Canada overlapping the range of two southern mountain caribou herds. Our comparative

analysis indicates that harvest could effectively reduce the amount of area burned by wildfire. However, caribou habitat lost to harvest in a maximum timber yield scenario, due to stand age reduction, was higher than what was lost due to wildfire in a no-harvest scenario. However, the trade off was sensitive to climate change, whereby climate driven fire size increase was partially mitigated by increased forest harvest. We will outline the model components, discuss the scenarios tested, and present results describing trade-offs, with recommendations for future management planning.

Evidenced by Indigenous and Western Science: An Arctic Nation Building Project Threatens Caribou and Inuit Harvesting Rights

[Andrea Hanke](#)¹, Amanda Dumond², Susan Kutz³, David Borish¹

¹Cloudberry Connections, ²Kugluktuk Angoniatit Association, ³University of Calgary

Canada's ambition for mineral security and its responsibilities to protect endangered species and uphold Indigenous rights clash in the case of the Grays Bay Road and Port (GBRP) in Nunavut, an infrastructure project intended to unlock critical mineral deposits in the western part of the territory. The proposed GBRP location is also home to four migratory caribou herds, three of which are at-risk and all of which are important to Inuit food security. We completed a hexagonal binning density analysis to compile harvesting data of Dolphin and Union caribou (*Rangifer tarandus groenlandicus* x *pearyi*) near the proposed project site. The data were retrieved from (i) a multi-year Inuit Knowledge study, (ii) a decade long community-based monitoring program, and (iii)

harvest reports from the Government of Nunavut.

We identified three consistently used harvesting hotspots, each representing a key area for caribou survival and connection to Inuit cultural practices for a particular season. The largest and most dense hotspot is between Tree River and Wentzel River and lies directly in the path of the proposed GBRP project. These results suggest the GBRP project will have significant and irreversible negative effects on caribou conservation and Inuit harvesting rights. The effects are unmitigable in nature; regardless of caribou disappearance or displacement, there will be cumulative impacts on the caribou, and there will be detrimental harm to Inuit harvesting rights. The development project reviews for the GBRP project must take these findings into account.

Mapping Traditional Knowledge for the Boreal Caribou Range Plan

[Petter Jacobsen](#)¹, [Stephanie Behrens](#)¹

¹Tlicho Government

Boreal caribou were designated as a threatened species under the federal Species at Risk Act (SARA) in 2003 and in the Northwest Territories (NWT) under the Species at Risk (NWT) Act in 2014. Under the federal SARA legislation, critical habitat must be identified for boreal caribou and effectively protected within the NWT's boreal caribou range - referred to as NT1 in the federal plan. As part of the NWT recovery strategy's objectives, the Government of the Northwest Territories (GNWT) committed to producing regional range plans for boreal caribou in collaboration with co-management partners. The Interim Wek'èezhìi Range Plan for boreal caribou is one of these regional plans. To meaningfully integrate Tłı̄chų traditional knowledge into the Interim Wek'èezhìi Boreal Caribou Range Plan, Tłı̄chų Government

organized several workshops with elders and harvesters to document and map tōdzı (boreal caribou) habitat. We used a “Tłı̨cẖo̱ trails” method to mapping wildlife habitat. The elders identified their travel routes into tōdzı habitat, followed by marking where harvesters generally see tōdzı activity and successfully hunt tōdzı. Once tōdzı habitat was identified, elders defined critical habitat where tōdzı are consistently observed during each season, and locations such as islands or peninsulas used by tōdzı at sensitive times of the year such as during calving. Throughout the mapping process, Tłı̨cẖo̱ elders emphasized maintaining connectivity within tōdzı range and identified a broader area, encompassing all tōdzı critical habitat features used during specific times of the year, to ensure habitat connectivity be implemented in the Wek’èezhì range plan for boreal caribou.

Inuvialuit Woodland (Boreal) Caribou Traditional Knowledge and Habitat Classification Study

Gilly McNaughton¹, Chanda Turner²

¹Inuvialuit Game Council and Boreal North Consulting, ²Boreal North Consulting

The Inuvialuit Woodland (Boreal) Caribou Traditional Knowledge and Habitat Classification Study was developed by Inuvialuit co-management bodies to ensure Inuvialuit knowledge, values, and governance guide all stages of research on woodland caribou habitat in the Inuvialuit Settlement Region. The study reflects an Inuvialuit-led approach in which regional Hunters and Trappers Committees (HTCs), the IGC, and the Wildlife Management Advisory Council (NWT) directed decisions on study design, timing, and verification. Through workshops in Inuvik and Paulatuk and community-based interviews, Inuvialuit knowledge holders shared insights on

woodland caribou behaviour, movement, and habitat. The co-developed methodology - based on storytelling, knowledge mapping, and iterative verification at individual, community, and board levels - ensured that Inuvialuit perspectives shaped every stage of the work and stood alongside Western science in informing range planning. Community Research Technicians led the community-based work and supported data collection and verification, strengthening local capacity and ensuring Inuvialuit direction throughout. All study products require IGC and WMAC(NWT) approval, and data-sharing agreements maintain Inuvialuit ownership and control. By grounding research in Inuvialuit knowledge systems and governance, this project offers an example of collaborative habitat research guided by community priorities, supporting both ecological understanding and Inuvialuit knowledge of woodland caribou.

Evaluating Land-Use Planning in Wild Reindeer Mountain Areas: A Mixed-Method Assessment of Policy Implementation, Spatial Change, and Multi-Level Governance

Marianne Singsaas¹, Aleksander Bern², Merethe Lørfald², Nora Warhuus Samuelsen², Ulla Higdø², Kjell Overvåg², Hans Olav Brått², Vegard Gundersen³, Trond Simensen³, Einy Brænd⁴

¹Telemark Research Institute, Norway, ²Eastern Norway Research Institute, Inland Norway University of Applied Sciences, ³Norwegian Institute for Nature Research, ⁴Norwegian Foundation for Wild Reindeer

Norway’s 24 wild reindeer areas face escalating pressure from land-use change, infrastructure

development, and intensified human activity. Despite planning instruments intended to safeguard habitat quality, evaluations show limited progress in reversing negative trends in fragmentation and disturbance. This project presents a comprehensive evaluation of regional and municipal land-use plans in wild reindeer mountain areas, assessing their effectiveness in protecting reindeer habitat and guiding sustainable development. We examine how well planning tools—regional plans, municipal plans, zoning instruments, and sectoral legislation—function in practice, and identify structural, legal, and governance factors that facilitate or hinder plan implementation. Using a triangulated research design, the project integrates GIS-based analyses of actual land-use change, systematic document analysis enhanced with machine-learning-based text processing, and a two-round Delphi study involving planners, authorities, and stakeholders across selected case areas. These processes culminated in targeted workshops that co-developed practical recommendations for strengthening future land-use planning. GIS analyses map both built development and planned future pressures, linking them to reindeer habitat vulnerability. Document analysis assesses how regional plans are translated into municipal plans and sectoral decisions, including dispensations and land-use exemptions. The Delphi process and workshops reveal where planning tools succeed or fall short, highlighting tensions between development interests, tourism growth, and reindeer conservation. With final delivery set for January 2026, the project will supply timely, consolidated results that can directly inform national and international efforts to strengthen land-use planning for wild reindeer and caribou habitat. By integrating spatial data, AI-supported text analysis, and participatory methodologies, this evaluation advances both methodological innovation and practical guidance for sustaining wild reindeer habitat in multi-use mountain landscapes.

POPULATION ECOLOGY & GENETICS

Parentage Analysis Reveals Variation in Sex-Specific Reproductive Success in the Kennedy Siding Caribou Herd

Mackenzie Askin¹, Doug Heard²

¹Eco-Web Ecological Consulting Ltd., ²Tithonus Wildlife Research

Supplemental feeding of caribou in the Kennedy Siding caribou population in Central British Columbia has provided a unique opportunity to investigate reproductive success. Through long-term, individual-based DNA sampling and field-based observations. We were able to construct pedigrees that revealed reproductive success of both males and females. Multi-year genetic and field datasets allow for an in-depth analysis of parentage and reproductive patterns, and potential biases in calf sex. We found substantial variation in male reproductive success, with 41.1% of males fathering multiple calves across years while 37.5% produced none. 20% of males repeatedly paired with the same females, resulting in full-sibling offspring, and 16.1% of males successfully sired two or more offspring in a given year. On the maternal side, females that produced multiple calves during the study period were identified along with the males that they repeatedly selected. 17% of the females repeatedly paired with the same 20% of males. 55.2% of the females gave birth to multiple calves while 20.7 produced none. We also found that like males, a small percentage of females produce most of the calves, 19.6% of males and 31.0% of females produced over 60.4% of the calves at Kennedy Siding. Our

results came from a small but rapidly increasing population ($N < 150$, $\lambda = 0.15$). They are similar to those found by McFarlane et al. 2018 for small and declining populations ($\lambda = 0.87$) in Jasper NP, suggesting that these reproductive dynamics may be characteristic of small population sizes regardless of population trend.

Performance of High Throughput SNP Tools on Non-invasively Collected Caribou Fecal DNA

Samantha Barrette¹, Samuel Deakin¹, Pauline Priadka², Weronika Klecel¹, Agnès Pelletier², Helen Schwantje², Caeley Thacker², Lalenia Neufeld³, Marco Musiani⁴, Jocelyn Poissant¹

¹University of Calgary, ²Ministry of Water, Land and Resource Stewardship, Government of British Columbia, ³Parks Canada, ⁴Università Di Bologna

In recent years, single nucleotide polymorphisms (SNPs) have become the genetic marker of choice for studying population genetics, structure, hybridization, and other evolutionary processes in wildlife. One of the main barriers to the implementation of SNPs for wildlife conservation is the high DNA input requirements for some SNP tools. This is problematic for studies of at-risk species like caribou which use non-invasively collected feces as a source of DNA. Despite often yielding low quality and quantity DNA, fecal sampling provides a solution for collecting important data that can be used in caribou conservation and management while minimizing disturbances to ecologically and culturally significant populations. An existing SNP genotyping approach for caribou samples is the Illumina iSelect caribou 60K SNP chip; however, it has a relatively high DNA input requirement, and its feasibility for use with fecal samples is unclear. We used woodland caribou

fecal pellets collected from southern British Columbia to determine if the caribou SNP chip is a viable option for fecal samples, and compared results with a new genome-wide targeted genotyping-by-sequencing panel designed for caribou fecal DNA. We quantified caribou DNA amount and proportion (caribou DNA / total DNA) with qPCR and identified optimal input thresholds necessary for sample genotyping success with the SNP chip. We then compared genotyping call rates and error rates with the new targeted genotyping-by-sequencing panel. This research will help establish robust and accessible methods for large-scale non-invasive genomic monitoring of caribou.

Range Dynamics of Barren-Ground Caribou Implied by Historical Population Cycles

Eric Bongelli¹, Philip McLoughlin², Martha Dowsley³, Dean Cluff⁴, Mitch Campbell⁵, Mitch Taylor³

¹KBM, Lakehead University, ²University of Saskatchewan, ³Lakehead University, ⁴Wildlife Analytics, ⁵Wildlife Research Division, Government of Nunavut

The presentation will be an oral discussion of the results and implications from our recent publication (Arctic, 2025) Range Dynamics of Barren-Ground Caribou Implied by Historical Population Cycles and Logistic Growth. Using three focal subpopulations (Qamanirjuaq, Bathurst and George River) we used time series census data to project population numbers, calculate finite rates of population increase and estimate a time-series of range condition (carrying capacity). We found that subpopulation numbers for Qamanirjuaq, Bathurst, and George River subpopulations closely tracked carrying capacity throughout their respective population cycles. This implies

that other factors appear to be of relatively minor or transitory importance to population growth for barren-ground caribou if barren-ground caribou are truly a logistic growth species. Range recovery and population increase did not occur until caribou numbers declined to a recovery threshold number. Predator management and restrictive harvest practices during the low portion of the caribou cycle may unintentionally extend the time required for caribou to decline below the grazing threshold, and thus prolong the period of scarcity. Once a subpopulation range begins to recover, the rapid recovery of subpopulation numbers suggests that other density-dependent and density-independent factors are of relatively minor importance compared to range condition. Continuation of barren-ground caribou cycles at historical levels is likely if habitat conservation measures are adopted so that annual migration patterns are not disrupted, summer and winter range remain undisturbed, and the natural decline of caribou to the threshold for range recovery is not artificially extended.

Leveraging Genomics to Improve Captive Breeding Outcomes in Woodland Caribou (*Rangifer tarandus caribou*)

Samuel Deakin¹, Lalenia Neufeld², Madeline Trotter², Jocelyn Poissant³

¹University of Calgary, Calgary, Alberta, Canada,

²Jasper National Park of Canada, ³University of Calgary

Throughout North America, anthropogenic actions, primarily habitat loss and alteration, have resulted in significant declines in woodland caribou. Among their conservation units, Southern Mountain caribou are considered the most at risk. The Jasper-Banff

Local Population Unit, spanning two national parks, was historically home to four herds; today, only two remain. Although current ecological conditions in Jasper National Park favour caribou persistence, the extremely low population sizes make natural recovery unlikely. As a result, Jasper National Park is implementing a captive-breeding-assisted recovery program for its herds. Incorporating genomics into captive breeding can substantially improve conservation outcomes. Traditionally, breeding decisions assume that: (a) all wild-caught “founder” individuals are unrelated, and (b) related individuals share predictable proportions of their genomes. However, when sourcing multiple unknown animals from the wild, there is a substantial risk that individuals are closely related, and real-world inheritance patterns often deviate from theoretical expectations. These uncertainties can hinder efforts to avoid inbreeding or maintain genetic diversity. Here, we present the framework and preliminary results of a genomic, simulation-based approach designed to optimise breeding-pair selection and maximise genetic diversity in both the captive population and the herds that will be supplemented. This work is being implemented at the newly established caribou breeding centre in Jasper and provides a template for genomically informed conservation breeding in other at-risk wildlife populations.

Functional Connectivity of Arctic Island-Dwelling Caribou-Where Melting Sea Ice and Human Trails Increase Isolation

Deborah Jenkins¹, James Schaefer², Glenn Yannic³, Geoff Andrews², Erin Koen², William Peterman⁴, Nicolas Lecomte⁵

¹Trent University, 1600 West Bank Drive, Peterborough, ON, Canada, ²Trent University,

³Université Grenoble Alpes, Université Savoie Mont Blanc, CNRS, LECA, ⁴School of Environment and Natural Resources, Ohio State University, ⁵University of Moncton

Habitat disturbance and fragmentation can degrade functional landscape connectivity with detrimental impacts on wildlife. Yet, functional connectivity is vital. By facilitating movement and gene flow, it supports metapopulation dynamics, genetic diversity, and range shifts in response to anthropogenic change. For Arctic island caribou, which move over vast areas, including sea ice, rapid environmental change threatens increased isolation. Protecting habitat and its linkages is critical and depends on identifying such areas at broad spatial scales. Here, we modelled and mapped the drivers of caribou connectivity across the Canadian Arctic Archipelago - a region where the pace of climate change is among the highest and caribou face extinction. First, we assessed hierarchical genetic structure, identified genetically discrete groups, and evaluated individual-based landscape genetics within these groups. Specifically, we applied circuit theory and simultaneous multi-surface optimization, and tested whether land- and sea-scape heterogeneity [isolation-by-resistance] or geographic distance [isolation-by-distance] better accounted for movement and gene flow. Finally, we used a point-based omnidirectional method to map caribou connectivity. We found that anthropogenic forces are far-reaching. For High Arctic caribou, glaciers, low sea-ice concentrations, and human trails impeded functional connectivity [isolation-by-resistance]. In contrast, for more southerly caribou, gene flow was largely unrestricted. These divergent results highlight the importance of intra-specific structure and responses, and emphasise that organism-landscape relationships can vary across space. Our study demonstrates how critical movement pathways can be identified and mapped, even for remote and imperilled species. It supports broad-scale conservation

planning and accounts for complex organism-landscape relationships across vast heterogeneous ecosystems.

Doomed From the Start: Consequences of a Harsh Early Life on Migratory Caribou Life-History Traits

Mattis Pelletier¹, Joëlle Taillon², Vincent Brodeur², Julien Hénault-Richard¹, Steeve Côté¹, Sandra Hamel¹

¹Université Laval, ²Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs

Environmental conditions in early life can generate long-term individual differences in life-history traits such as survival and reproduction. Early-life conditions can challenge developing individuals through distinct environmental mechanisms. Each mechanism can induce long-term consequences, potentially leading to cohort effects in which individuals born in different years exhibit persistent differences in life-history traits. In ungulates, early life spans three sensitive periods—gestation, pre-weaning, and post-weaning—during which distinct environmental mechanisms may exert long-term effects. Most studies, however, have examined only a single period or mechanism, leaving the combined effects of multiple mechanisms across development largely untested, despite evidence that these effects are often multifactorial. Benefiting from over 20 years of life-history data on migratory caribou (*Rangifer tarandus*) from the Rivière-aux-Feuilles and Rivière-George herds in northern Québec and Labrador (Canada), we investigated how environmental energetic constraints, resource availability, and competition during gestation,

pre-weaning, and post-weaning influenced life-history traits. Our results indicate that high energetic constraints during gestation and limiting resource availability in late gestation and early pre-weaning reduced early-life body condition and survival to adult age of migratory caribou. High energetic constraints during gestation and early-life competition also reduced longevity. All effects on life-history traits were associated with environmental conditions during gestation or early pre-weaning and stemming from multiple mechanisms. These findings underscore the importance of gestational and early postnatal environments in shaping caribou life-history. Monitoring variables that cause cohort effects can aid management agencies in predicting population trends and enhance the understanding of contributing limiting factors.

NUTRITION & FORAGING ECOLOGY

Successional Development of Caribou Forage Resources in Montane and Boreal Habitats of Canada

John Cook¹, Rachel Cook¹, Kristin Denryter²,
Philip Walker³, Katherine Parker⁴, Evelyn Merrill⁵,
Alicia Kelly⁶

¹National Council for Air and Stream Improvement, ²Alaska Department of Fish and Game, ³Wildlife Division-Government of Newfoundland and Labrador, ⁴Ecosystem Science and Management-University of Northern British Columbia, ⁵Department of Biological Sciences-University of Alberta, ⁶Department of Environment and Climate Change-Government of the Northwest Territories

Understanding how disturbance such as logging or wildfire and subsequent succession in forest ecosystems affect forage resources is fundamental to landscape management and planning for ungulate populations. We placed captive caribou in native habitats in boreal and montane forests of northern British Columbia and northwestern Ontario to identify forage selection patterns and caribou nutrition (e.g., dietary quality; forage and nutrient intake rate) during summer. We sampled vegetation and site characteristics in these study areas and in southern Northwest Territories and northeastern Ontario. We grouped plants into accepted (use $\geq$ available) grass, forbs and deciduous shrubs (GFS), accepted horsetails, accepted lichens, and accepted mushrooms. We evaluated how abundance of these forage groups and associated nutritional value changed with forest succession after natural and anthropogenic, stand-replacing disturbance. Successional

changes in accepted biomass after disturbance were reasonably consistent among ecoregions but varied by site potentials, with stronger positive responses apparent in productive upland sites and modest, variable effects in wetlands and unproductive upland sites. Abundance of accepted GFS and accepted horsetails decreased over time as overstories developed, the abundance of accepted lichens peaked in mid-succession, and the abundance of accepted mushrooms exhibited inconsistent patterns with overstory development. Dense overstory canopies strongly suppressed accepted biomass and often reduced nutrition for foraging caribou. Our findings show highly dynamic spatial and temporal patterns in abundance of key forages and nutrition for caribou in summer and illustrate the need to account for effects of disturbance, succession, and site potential in landscape planning directed at conserving caribou populations.

Are Nutrition and Disease Important Factors Limiting Population Recovery of the Mulchatna Caribou Herd?

Kristin Denryter¹, John Crouse²

¹Alaska Department of Fish and Game, Palmer, AK, USA, ²Alaska Department of Fish and Game

Nutrition, disease (brucellosis), and predation have been hypothesized as reasons the Mulchatna Caribou Herd (MCH) has not recovered following a precipitous decline in the late 1990s. We initiated a longitudinal study on the MCH beginning in 2023, to test hypotheses that nutrition and disease are limiting the recovery of the MCH. We captured adult female Mulchatna caribou in autumn and late winter and estimated their body mass, body fat, and body protein; determined lactation and pregnancy status; collected blood samples for disease serology; fitted pregnant females with

vaginal implant transmitters; assessed neonate health and viability during parturition; and tracked whether females recruited calves to autumn. Caribou maintained or gained body mass, body fat, and body protein overwinter and lost condition over summer. Annual adult female survival was high and was not a function of nutritional condition. Adult caribou had high pregnancy rates (>90%), even among females with <6% body fat in autumn, and among females that were seropositive for *Brucella*. Yearlings also had high pregnancy rates (67%). We did not detect any abortions, stillbirths, or observe any weak calves during parturition. Maternal nutritional condition did not influence probability of pregnancy or recruitment of a calf to autumn. Maternal seropositivity for brucellosis did not influence probability of giving birth to a live calf, calf survival, or recruitment. Females that successfully recruited calves were in poorer condition in autumn than females that failed to recruit. Our findings fail to support hypotheses that nutrition or disease are limiting the recovery of Mulchatna caribou.

Seasonal Nitrogen Selection Aligns With Diet Shifts in Woodland Caribou

Jack Hendrix¹, Kristy Ferraro², Allegra Love³, Jill Kusch⁴, Dara Albrecht⁵, Shawn Leroux⁴, Quinn Webber³, Eric Vander Wal⁴

¹Cognitive and Behavioural Ecology Interdisciplinary Program, Memorial University of Newfoundland and Labrador, St. John's, NL, Canada, ²School for Environment and Sustainability, University of Michigan, ³Department of Integrative Biology, University of Guelph, ⁴Department of Biology, Memorial University of Newfoundland and Labrador, ⁵Environmental Law Institute

Nitrogen (N) is limiting for terrestrial herbivores, particularly overwinter. Caribou (Rangifer

tarandus) respond to this seasonal scarcity by putting on muscle mass during the growing season when N is more abundant, then rely on these stores to make up for winter dietary deficits. As their diet shifts from N-rich green vegetation to N-poor lichen overwinter, caribou can lose up to 30% of their muscle mass. Catabolized N is shed in urine and could potentially be reabsorbed by lichen to enrich their meagre winter diet. We tested this potential transport via three steps. (1) We analyzed caribou forage plants and Cladonia lichen across Fogo Island, Newfoundland, using %N content as our metric of forage quality. (2) We compared seasonal habitat selection responses to forage quality by caribou using integrated step selection analyses (iSSA). Caribou selected for higher vascular plant %N in summer but were unresponsive to Cladonia quality. In contrast, caribou selected higher quality Cladonia overwinter with neutral responses to vascular plant quality. (3) We compared seasonal distributions to determine whether nitrogen summer intake and winter deposition occurred in different locations. Despite this herd being non-migratory, population level kernel density estimates for summer and winter were distinctly different from one another. Given what is known about caribou seasonal metabolic changes and site fidelity, these results lend credence to potentially adaptive seasonal N recycling by caribou.

Examining the Gut Microbiome of Southern Mountain Caribou

Kim Hinz¹, Aimee Chhen¹, Amélie Mathieu², Erin McLeod³, Frances Swan³, Paul Seaton³, Sam Legebokow³, Logan Robertson³, Laura Grieneisen⁴

¹University of British Columbia - Okanagan,

²Wildkin Veterinary Service, ³Arrow Lakes Caribou Society, ⁴Old Dominion University

The gut microbiome is the collection of bacteria, fungi, and viruses that inhabit the digestive system. Its composition is associated with various health factors, including weight, pregnancy, and disease status. It thus provides us with an opportunity to measure the health of endangered caribou using only fecal samples. In 2025, we partnered with Arrow Lakes Caribou Society and their Central Selkirk Caribou Maternity Pen. Over the summer, we collected fresh fecal samples from the 10 adult and 1 yearling caribou hosted in the maternity pen. We analysed their gut microbiome using shotgun metagenomics. We estimated the relationship between the gut microbiome composition and caribou body condition, pregnancy status, and age; identified a neonatal calf microbiome; and assessed the presence of pathogens.

Landscape Drivers of Trace Element Imbalances in Dolphin and Union Caribou

William Justus¹, Amanda Dumond², Angela Schneider¹, Elham Zeini Jahromi³, Lisa-Marie Leclerc⁴, Fabien Mavrot¹, Terry Milton⁴, Katherine Moyes¹, Ekaluktutiak Hunters & Trappers Organization⁵, Kugluktuk Angoniatit Association², Erica Sutor¹, Olivia Hee¹, Douglas Whiteside¹, Susan Kutz¹

¹University of Calgary, ²Kugluktuk Angoniatit Association, ³Alberta Centre for Toxicology, ⁴Government of Nunavut, ⁵Ekaluktutiak Hunters & Trappers Organization

Background: Adequate trace element (TE) intake is essential to the health of animals, but wildlife species may struggle to meet their nutritional requirements. The Dolphin and Union (DU) caribou herd migrates between Victoria Island (VI) and the Kitikmeot mainland across seasonal sea ice. The DU herd has

suffered declines since 1997, with a drastic decline from 2015-2018. We investigated the TE status of DU caribou and landscape factors which may drive the TE status of the caribou. Methods: We quantified the TE content of caribou hair from animals harvested by hunters from 2018-2025, as well as the TE in vegetation and soils on VI from spring to autumn 2025-2026. Results: The copper content of DU caribou hair has declined since 2018 and is now considered deficient in cervids (2018 median: 6.11 mg/kg, 2025 median: 4.74 mg/kg, Deficient: < 5.0 mg/kg). Selenium in DU caribou was lower than in an adjacent herd (DU 2018-2024 median: 0.22 mg/kg, Bluenose East 2018-2024 median: 0.35 mg/kg). The selenium content of forages on VI was below caribou dietary requirements, while willows contained sufficient copper until autumn despite seasonal copper declines (spring: 6.09 mg/kg, summer: 3.87 mg/kg, autumn: 2.99 mg/kg). Conclusions: As the copper content of forages declines from emergence to senescence, meeting nutritional demands becomes more difficult for DU caribou. As climate change delays migration due to slow sea ice formation, DU caribou may increasingly struggle to meet their nutritional requirement for copper, while low selenium remains a year-round concern for caribou health.

Greenlandic Caribou Have Two Different Physiological Strategies to Sustain Pregnancy

Mathilde Le Moullec¹, Aurélien Grange², Laura Barbero-Palacios³, Glenn Yannic⁴, Josephine Nymand³, Perry Barboza⁵, Christine Cuyler³

¹Greenland Institute of Natural Resources, Pinngortitaleriffik, Greenland, ²Greenland Institute of Natural Resources, Pinngortitaleriffik and Université Savoie-Mont Blanc, Laboratoire d'Ecologie Alpine, ³Greenland Institute of

Natural Resources, Pinngortitaleriffik, ⁴Université Savoie-Mont Blanc, Laboratoire d'Ecologie Alpine, ⁵College of Agriculture and Life Sciences Texas A&M University

In ecosystems with strong seasonality like the Arctic, food availability and quality determine body condition of herbivores with implications for survival and reproduction. We here studied the relationship between diet (faeces DNA metabarcoding) and body conditions of two neighbouring populations of barren-ground caribou (*Rangifer tarandus groenlandicus*) located in an inland (Kangerlussuaq) and coastal (Akia) area of West Greenland. Additionally, we measured the reallocation of resources from own body reserves with stable isotopes. This scientific harvest program was an initiative from CARMA, conducted in 2008-2009. We found that in late winter, coastal caribou primarily ate lichen while inland population ate graminoids and shrubs. Kidney fat increased with lichen consumption, thus, it was more abundant in coastal caribou. Inland caribou, however, were bulkier with more muscular mass than coastal caribou. Stable isotope analysis unraveled that inland caribou relied more on their body reserves to support pregnancy (as a capital breeder), while coastal caribou appeared to rely on energy directly extracted from their diet (as an income breeder). Changes in climate and hunting practices may affect these two caribou's phenotypes differently.

THE CIRCUMARCTIC RANGIFER MONITORING AND ASSESSMENT (CARMA) NETWORK IN 2026: AN UPDATE ON GLOBAL CARIBOU

CARMA 10: What's Happening Around the Circumarctic World to Migratory Tundra Caribou

Anne Gunn¹, Don Russell²

¹CARMA, Salt Spring Island, British Columbia, Canada, ²CARMA

Migratory tundra caribou numbers increased to peak values in the 1990s and early 2000s but then declined an overall 65%, although the extent of declines and recoveries vary regionally. The most severe declines were for the five largest herds which are currently either stable at low numbers (Qamanirjuaq and George River) or continuing to decline (Taimyr, Bathurst, George River, Qamanirjuaq and Western Arctic). In the western Arctic, the coastal herds are, in general, smaller and recovery was underway. However, we will be updating this information as herd sizes were estimated in 2025 for several herds and results are expected fall 2025. The CircumArctic Rangifer Monitoring and Assessment (CARMA) Network of scientists, community representatives, and co-management agencies started in 1998 when the Arctic Council identified the need to “assess the effects of climate change on Arctic ecosystems”. The same core group of organizers persisted from

2004 to 2018 in fund-raising to bring caribou people together. Since 2018, CARMA has slowed down as its core organizers (Don Russell and Anne Gunn) are also slowing down although the need for sharing knowledge and experience is only increasing as caribou and reindeer face a rapidly changing world. It is time to discuss the options to revitalize CARMA to continue its role within and among the Arctic people on behalf of caribou and wild reindeer.

Coordinated Monitoring and Reporting of Circumpolar Caribou and Wild Reindeer to Unite Circumarctic Peoples

Courtney Price¹, Anne Gunn²

¹CAFF Executive Secretary, CAFF International Secretariat, Akureyri, Iceland (or alternate),

²CARMA

The CircumArctic Rangifer Monitoring and Assessment (CARMA) network is a core component of the Circumpolar Biodiversity Monitoring Program (CBMP), the cornerstone program of the Conservation of Arctic Flora and Fauna (CAFF), the biodiversity Working Group of the Arctic Council. CARMA provides a vital foundation for understanding Rangifer population dynamics across the Arctic. Within CBMP's framework for coordinated biodiversity monitoring, CARMA exemplifies the collaborative approach needed to develop and deliver essential data and assessments to inform conservation and management of a species central to Arctic ecosystems and cultures, and facing a rapidly changing environment. Accelerating environmental change, driven by climate warming, industrial expansion, and cumulative ecological stressors, is amplifying risks to Rangifer populations. Addressing these challenges requires integrated monitoring systems that transcend national boundaries and disciplinary silos.

CARMA's role within CBMP exemplifies this collaborative model, combining standardized protocols, harmonized indicators, and shared data platforms to generate actionable knowledge at circumpolar scales. Strengthening CARMA's contributions within CBMP is critical for filling knowledge gaps, improving data accessibility, and supporting adaptive management strategies. By fostering partnerships among governments, Indigenous organizations, researchers, and more, the network ensures timely, reliable information for decision-makers. Enhanced collaboration will enable comprehensive assessments of cumulative impacts and promote resilience in Rangifer populations amid accelerating Arctic change.

HABITAT QUANTIFICATION

A Recurring Fragmentation Process: Integrating Long-term Trends in Connectivity and Habitat Availability in the Canadian Arctic Archipelago

Carlos Alberto Arnillas¹, Xin Wen¹, Estéban Hamel Jomphe², Josée-Anne Langlois³, Alexandre Roy², George Arhonditsis¹, Cheryl Ann Johnson⁴

¹Department of Physical and Environmental Sciences, University of Toronto at Scarborough,

²Université du Québec à Trois-Rivières,

³Sherbrooke University, ⁴Science & Technology, Environment and Climate Change Canada

The Canadian Arctic Archipelago is a naturally oscillating system, switching from almost a perfectly connected set of islands in the winter to an almost perfectly disconnected system during the summer. However, climate change has been reducing the connectivity among islands. Furthermore, there is evidence suggesting decreasing snow cover and increases in primary productivity on each island. These simultaneous changes are expected to have dramatic impacts on the local ecosystems that will strongly affect terrestrial species mobility and survivability (e.g., Peary caribou, muskox, wolves, foxes) with potential cascading effects on other components of the ecosystem. Combining Arctic data from multiple databases (e.g., Landsat satellite images, snow cover, sea ice cover) we assess how these concurrent impacts can transform the whole Arctic landscape. Here, we will present some novel methods based on network analysis that we are developing to adequately account for the concurrent changes in vegetation, snow cover,

and sea ice, and how their integration can provide novel ways to conceptualize their effect on the environment.

The Impact of Permafrost Thaw on Caribou Lichen Biomass Across the Northwest Territories, Canada.

Katerina Coveny¹, Raquel Alfaro-Sánchez², Sharon Smith³, Merritt Turetsky⁴, Jennifer Baltzer¹

¹Department of Biology, Wilfrid Laurier University, ²Northern Forestry Centre, Natural Resources Canada, ³Geological Survey of Canada, Natural Resources Canada, ⁴Arctic Security, University of Colorado Boulder

Up to 80% of the boreal biome is found within permafrost regions, and with rapid high latitude warming, widespread thaw is occurring. As the ground warms, permafrost thaws leading to a thickening of the active (seasonally-thawed) layer and an increase in soil resource availability. Caribou lichen (e.g., *Cladonia* spp.) is a common boreal taxa that forms a critical winter food resource for caribou. Caribou lichens are often found in regions of low productivity, such as soils underlain by permafrost, yet we know little about the impact of thaw on their availability. Permafrost thaw may increase plant productivity, potentially outcompeting established caribou lichen populations, or may directly affect lichen populations through ground surface deformation and/or ponding. Caribou lichen responses to landscape level disturbances may vary regionally, with evidence that lichen recovers faster at lower compared to higher latitudes. Our research investigates how caribou lichen biomass responds to permafrost thaw and how this response is mediated by environmental conditions, with implications for caribou forage availability. We analyzed how caribou lichen biomass varied as a function of active layer thickness and permafrost thaw rates

at sites spanning a latitudinal gradient from 61°N to 69°N in the Northwest Territories, Canada. We found that thicker active layers and rapidly thawing permafrost were correlated with decreased lichen biomass. This is examined in the context of co-occurring environmental variables, including fire history, latitude, and forest type. This study advances our knowledge of climate warming-induced disturbances on caribou forage, a research priority identified by Territorial and Indigenous governments.

Peatlands and Northern Climate Shape Woodland Caribou Winter Habitat in Northern Ontario

Samantha McFarlane¹, Victoria Van Mierlo², Micheline Manseau³, Allison Kroeze², Ewen Eberhardt², Judith Girard²

¹ECCC - Canadian Wildlife Service, ²Canadian Wildlife Service - Ontario Region, Environment and Climate Change Canada, ³Landscape Science and Technology Division, Environment and Climate Change Canada

Mapping winter habitat suitability is critical for the persistence and conservation of at-risk woodland caribou. While well documented at the national scale, particularly in highly disturbed southern ranges, winter habitat suitability remains understudied in the largely intact and remote northern ranges, such as those in northern Ontario. In this study, we used boosted regression tree species distribution modeling and ecologically relevant environmental variables to predict and map suitable winter woodland caribou habitat in northeastern Ontario, Canada. Our best-performing model showed that specific peatland types, combined with the bioclimatic influence of James and Hudson Bay, had a dominant effect on winter habitat suitability, together accounting for nearly 70% of the model's relative influence. These results

highlight the importance of peatland composition (e.g., bogs, fens, treed wetlands) and regional climatic gradients in shaping winter habitat selection at northern latitudes. The predictive model identified a large, clustered zone of suitable winter habitat centered in the transition zone between the boreal forest and peatland-dominated Hudson Bay Lowlands, emphasizing the ecological significance of this transitional landscape. By incorporating both fine-scale habitat characteristics and broad bioclimatic drivers, our model provides a comprehensive and spatially explicit understanding of winter woodland caribou habitat in northeastern Ontario. These findings underscore the need to account for peatland heterogeneity and northern climate effects when assessing caribou distribution, and they provide valuable insights to guide habitat conservation and management in northern regions.

To Eat or Not to Eat, That Is Selection: Examining the Seasonal Dietary Niche of Boreal Woodland Caribou (*Rangifer tarandus*)

Rose Myatt¹, Quinn Webber¹, John Fryxell¹

¹University of Guelph

For herbivores, plant quality varies temporally as indigestible matter accumulates during maturation, constraining consumer digestion and absorption. Given that forage quality and quantity change throughout the growing season, animals must make foraging decisions to maximize energy intake. In accordance with the Forage Maturation Hypothesis, we predict that caribou will maximize energy intake by specializing on high quality plants at intermediate plant biomass and generalize when plant quality is low. Using video collar

data, we determined diet breadth and diet composition for the population over the growing season, and analyzed individual's diets using a community network analysis. We observed that caribou don't forage optimally throughout the growing season, but show niche partitioning via foraging strategy. We determined two foraging strategies that remained consistent through time, one generalist, and one lichen specialist. This finding has important conservation implications for conserving lichen rich habitat throughout the year.

Validating Caribou Habitat Classifications in Ontario's Managed Boreal Forest

Jennifer Shuter¹, Robby Marrotte², Lani Stinson³, Glen Brown⁴, Arthur Rodgers⁵, Philip DeWitt³, Alexis Pereira⁵

¹Centre for Northern Forest Ecosystem Research, Ontario Ministry of Natural Resources | Thunder Bay | Ontario | Canada, ²Crown Forests and Lands Policy Branch, Ontario Ministry of Natural Resources, ³Biodiversity and Monitoring Section, Ontario Ministry of Natural Resources, ⁴Wildlife Research and Monitoring Section, Ontario Ministry of Natural Resources, ⁵Centre for Northern Forest Ecosystem Research, Ontario Ministry of Natural Resources

The southern distribution of boreal caribou in Ontario overlaps the zone where commercial forestry occurs - i.e., the Managed Forest (MF). Provincial forest management guidelines combine coarse filter (e.g, natural disturbance pattern emulation) and fine filter approaches (e.g., species-specific habitat considerations), to align harvesting practices with sustainability and biodiversity conservation goals. In the boreal forest, guidelines include regional ranked habitat suitability classifications, based on stand composition and age, which are used to assess

amount and arrangement of caribou habitat. Classifications were developed before large-scale monitoring data were collected in Ontario and thus, have not been formally validated with empirical data. We applied classifications to map year-round and winter habitat in four study areas within and north of the MF, in both north-western and north-eastern Ontario. GPS-collar data collected from 115 adult female caribou in the north-west and 47 caribou in the north-east (2009-2015), were used for validation. Chi-square analysis was conducted to determine whether caribou used habitat classes in proportion to availability at annual and winter range scales. Spearman-rank correlation was applied to compare observed with expected use, based on class suitability ranks. Preliminary results suggest caribou use of higher suitability classes was greater than expected based on availability. Additionally, correlations between observed and expected use, were fairly strong. Exceptions identified for some study areas and seasons include more intensive use of a medium suitability (vs. high suitability habitat) class and disproportionately low use of a moderate suitability class. Validation results will inform future assessments of Ontario's boreal caribou habitat classifications.

Decades of Logging Have Eroded Functional Connectivity of Boreal Caribou Habitat, and Its Restoration May Be Compromised by Climate Change

Martin-Hugues St-Laurent¹, Catherine Morin², Yan Boulanger³, Pierre Drapeau⁴

¹Université du Québec à Rimouski, Centre for Forest Research, 300 allée des Ursulines, Rimouski (QC) Canada, ²Université du Québec à Rimouski, ³Natural Resources Canada, Centre

de Foresterie des Laurentides, Canadian Forest Service, ⁴Université du Québec à Montréal, Centre for Forest Research

The cumulative disturbances that have altered North American boreal forests have led to the decline of the woodland caribou (*Rangifer tarandus caribou*), a threatened species in Canada. Caribou recovery requires the protection and restoration of critical habitat, but also the maintenance of connectivity corridors between habitat patches and populations. These critical features could be strongly altered in the upcoming decades by on-going anthropogenic disturbances and climate change, but the impacts are yet to be assessed. To fill this gap, we produced a functional connectivity map for caribou in Québec (eastern Canada). We used telemetry data (2004-2019) collected from 438 animals to build resource selection models, map occurrence probability and resistance matrices, delineate core habitat areas large enough to be connected, and validate all these steps. We revealed functional responses in caribou habitat selection with respect to longitude and forest roads. We also highlighted how decades of logging have compromised functional connectivity between different caribou populations, with potential implications for gene flow and population persistence. Using the LANDIS-II model, a spatially-explicit, forest landscape model, we simulated future forest landscapes under different radiative forcing and forest management scenarios to reveal future changes in habitat connectivity. We showed how the future increase in fire regime will compromise our ability to restore habitat and functional connectivity and will force difficult decisions regarding our forest management strategies and conservation objectives. Our results can support caribou recovery efforts, particularly to restore movement corridors despite the challenges posed by future climate change.

UNDERSTANDING AND MITIGATING INFRASTRUCTURE IMPACTS ON MIGRATORY CARIBOU

Quantifying the Permeability of Roads for Barren-ground Caribou (*Rangifer tarandus groenlandicus*) Populations in the Northwest Territories, Canada

Nicole Barbour¹, Eliezer Gurarie², Alicia Kelly³,
James Hodson³

¹Towson University, Department of Biological Sciences, MD, USA; State University of New York College of Environmental Science and Forestry, Syracuse, New York, USA, ²State University of New York College of Environmental Science and Forestry, ³Government of the Northwest Territories, Department of Environment and Climate Change

Animals naturally navigate environments characterized by linear features that influence movement, whether rivers, ridges, or ravines. However, anthropogenic features such as roads can be largely impermeable and can result in decreased habitat connectivity, avoidance behavior, and direct or indirect mortalities for the animals interacting with them. For migratory (barren-ground caribou, *Rangifer tarandus groenlandicus*) caribou in the Northwest Territories (NWT), Canada, characterizing the permeability of existing roads in the region can inform predictions of how the proposed Slave Geologic Province (SGP) Road, will impact their movement and connectivity to important habitats. We used a straightforward method to

estimate permeability of existing roads to caribou movement, available in the R package, "permeability". Key functions in the package allow for the permeability of linear features (roads) to be estimated as a quantitative index (κ , where $\kappa = 0$ captures total impermeability, $0 < \kappa < 1$ intermediate permeability, and $\kappa > 1$ "hyper-permeability") and within a model selection framework, to evaluate covariates influencing permeability for a given road. The permeability tool was applied to GPS-tracking datasets for barren-ground caribou (N=301, 2016-2023), for multiple main roads intersecting their ranges. Models supported both spatial and temporal variability in permeability, with low permeability values aligning with periods of high vehicle traffic. Overall, permeability of NWT roads for caribou was low ($\kappa \approx 0.3$) even for the most permeable roads. These results support that the SGP road would also have low permeability for caribou and could cause significant disruptions to their movement and connectivity in the region.

Visualizing and Estimating the Effects of Roads on Caribou

John Boulanger¹, Robin Kite², Mitch Campbell³,
David Lee⁴, Stephen Atkinson⁵, Jason Shaw²

¹Integrated Ecological Research | Nelson, BC | Canada, ²Caslys Consulting, ³Government of Nunavut, ⁴Nunavut Tunngavik Inc., ⁵Wildlife Biologist and Veterinarian

A challenge for management of wildlife species is the assessment of the effect of roads on migration. In this talk, we discuss approaches that allow visualization of the interaction of caribou with roads. We then develop models to estimate the spatial (ZOI: zone of influence) and temporal (delays in migration) effects of roads, and test if road closures reduced delays in migration. To apply this approach, we analyzed collar (2011-2019) and road survey data from 2

barren ground caribou herds to assess the impact of a 171 km mine road in Nunavut that bisects their migration corridor. We estimated ZOI's of 16-17 km prior to crossing the road during 2018 and 2019, and 3.0 km after crossing. Estimates of mean delay were 4.3 and 2.5 days for 2018 and 2019 which were reduced by 28-68% (1.2-1.7 days) if roads were closed when caribou were within the zone of influence. In 2017-2018, when the road was extended 64 km north, caribou were 12% less likely to deflect north around the road therefore increasing delays. Road surveys indicated aggregation of caribou prior to crossing the road, with few caribou observed after crossing, a finding supported by collar data. However, our results also illustrate the limited spatial scale of road sampling relative to potential spatial effects of roads. Our methods can estimate the spatial and temporal effects of roads and assess mitigation strategies in reducing delays in migration.

Fine-Scale Behavioural Responses of Migratory Caribou to Roads and Traffic in Nunavik

Caroline Deslongchamps^{1,2,3}, Julien Richard^{1,2},
³, Joëlle Taillon^{1,4}, Vincent Brodeur^{1,4}, Martin-Hugues St-Laurent^{1,2,5}, Steeve Côté^{1,2,3}

¹Caribou Ungava, ²Centre d'études nordiques,

³Université Laval, Québec (Qc), Canada,

⁴Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, Qc, Canada, ⁵Université du Québec à Rimouski, Rimouski (Qc), Canada

Linear structures such as roads can modify the space use behaviour of wildlife by acting as semi-permeable barriers to their movements. Effects of roads on migratory caribou (*Rangifer tarandus*) have been observed in Nunavik (Canada), where the presence of a mining road reduced habitat use beyond the road. These

results are of concern given the proximity of this road network to the calving grounds of the Rivière-aux-Feuilles herd, whose abundance has declined ca. 70% in recent decades. Our main objective was to assess the effects of roads and traffic on the fine-scale behaviour of caribou. Using direct observations, we quantified the proportion of caribou fleeing in relation to their distance from the road when a vehicle passed, as well as the spatiotemporal distribution of individuals near the road. We evaluated their probability of crossing the road as a function of traffic frequency, and compared the structural characteristics of the road between crossing sites and sites where no crossing was observed. When a vehicle passed, the proportion of caribou fleeing decreased with distance from the road. Caribou stayed further from the road when traffic was high, whereas they moved closer to the road when traffic was reduced. They also tended to cross where the road was low and the embankment's granulometry was fine. Our results allowed us to quantify the fine-scale effect of road disturbance, to suggest guidelines for mitigating activities requiring a road network and to contribute to the sustainable management of migratory caribou in Nunavik.

Encountering Infrastructure, How Disturbance Affects Migratory Tundra Herd Productivity: A Sensitivity Analysis

Don Russell¹, Robert White², Kayleigh Chalkowski³, Tim Fullman³, Anne Gunn¹, Kelsey Russell⁴

¹CARMA Network, ²UAlaska, Fairbanks, ³The Wilderness Society, ⁴Yukon Government

Quantifying cumulative effects on productivity of migratory tundra caribou from human infrastructure and associated activity is an

essential step in an environmental assessment. Moreover, incorporating cumulative effects from past, present and future development when the Arctic climate is rapidly changing adds assessment complexity. Our Caribou Cumulative Effects model has been applied to the cumulative effects of roads, mines and hydrocarbon extraction for several migratory tundra caribou herds. Recently we have integrated the effects of a warming climate into assessing the effects of a road and traffic. We use daily collared caribou locations, superimposed on climate, vegetation and development spatial layers to estimate caribou forage intake. The model then allocates daily metabolizable energy-protein produced in the rumen to the cow's maintenance and lactation and which in turn, projects the cow and calf's body condition. The modelled body condition changes are linked to a population model through probability of pregnancy and overwinter calf survival. In this presentation, we will consolidate thinking based on these model applications and conduct a sensitivity analysis that will consider: seasonal encounter pattern, Zone of Influence buffer size and the "cost" of each encounter day (in the ZOI) with respect to reduction in foraging with coincident increase in vigilance, walking and running. The model can be used to explore the tradeoff of alternate route alignments, provide input into traffic management plans, including convoys and seasonal road closures, assess harvest management and become an evaluation tool when incorporated into an Adaptive Monitoring and Management Plan.

Investigating the Cumulative Effects of the Ice Road to Barren-Ground Caribou in the Northwest Territories - A Guardian-Led Initiative

Orna Phelan¹, Wayne Mercredi¹

¹North Slave Métis Alliance

Caribou have long been at the heart of North Slave Métis culture and community. For many members of the North Slave Métis Alliance (NSMA), caribou represent more than just a crucial food source—they are a spiritual anchor and a cornerstone of cultural identity. However, the dramatic decline of the Bathurst caribou herd, which has plummeted by nearly 98% since the 1980s, poses a severe threat to both ecological balance and cultural heritage. This decline is a classic example of cumulative effects, where multiple environmental and anthropogenic pressures converge to impact a single species and, consequently, the communities that depend on it. Factors such as climate change, disturbance from diamond mining, over-harvesting, and increased predation collectively exacerbate the decline of the Bathurst herd, illustrating the complexity of cumulative impacts. In response to this crisis, the NSMA has initiated the Guardianship Winter Road Monitoring Program, an innovative initiative designed to tackle these cumulative effects comprehensively. Guardians conduct on-the-ground patrols, while advanced remote sensing equipment, including audio recorders and wildlife cameras, captures critical data on the caribou's interactions with the road environment during their migration to their traditional calving grounds. This session will showcase the Guardianship Winter Road Monitoring Program, highlighting how it integrates western science with traditional knowledge. We will explore how field data collected by Guardians and technological tools

are being used to validate local and traditional insights. Through workshops with community members, we assess changes in caribou occurrence, disturbances, and mortality factors, and examine the evolving relationship between caribou and the people.

The Kivalliq Inuit Association's Experience With Mine Traffic Monitoring and Mitigation on the Ranges of Migratory Tundra Caribou

Jakob Voisey¹, Jamie Kataluk¹, Luis Manzo¹, Jeff Tulugak¹, Anne Gunn²

¹Kivalliq Inuit Association, ²CARMA

The annual migrations of three migratory tundra caribou herds (Wager Bay, Lorillard and Qamanirjuaq) cross the corridors of three all-weather roads affiliated with large open pit mines in Nunavut's Kivalliq Region. Many caribou can encounter the roads for example, in 2024, 28,000 caribou were observed during fall migration along the Meadowbank road (107 km road length). Traffic frequency is high: for example, annually 143,764 vehicle passages used the Whale Tail Haul Road haul road in 2024. Traffic monitoring and mitigation is collaborative as the roads are on leased Inuit Owned Land. The Kivalliq Inuit Association staff monitors the roads through daily surveys in cooperation with mine staff and nearby Inuit community's hunters and trappers' organization. The KIA is the regional organization representing Inuit and works closely with the mining company on daily decisions for scheduling of mine activities relative to traffic. The KIA's presentation is provide more detail on its experience with using the monitoring for adaptive mitigation such as the use of convoys to create traffic gaps for caribou to cross the roads.

METHODS & SYNTHESIS

Seeing Change Through Indigenous Science: Emerging Themes on Caribou Health and Environment

Amish Dua¹, Stephanie Behrens², Walter Bayha³, Amanda Dumond⁴, Susan Kutz¹

¹University of Calgary, ²Tłı̨chǫ Government, ³Délı̨nę Got'ı̨nę Government, ⁴Kugluktuk Angoniatit Association

Indigenous knowledge holders describe caribou health as emerging from interwoven relationships among animals, people, and the land. Within the Bluenose-East (BNE) caribou range, around the communities of Kugluktuk, Wekweètì, and Délı̨nę, ongoing interviews, in-depth discussions, and participatory activities are beginning to illuminate early themes that reflect both ecological and social dimensions of change. Knowledge holders and elders described how shifts in migration routes, health, and the broader environment intersect with changing fire conditions, predation pressure, insects, disease, and other stressors. Mapping exercises add further depth by showing where caribou once travelled, where they now avoid, and how these shifts overlap with concerns about disturbance and access. These spatial narratives connect closely with stories shared during interviews. Often rooted in personal and intergenerational experience, these stories demonstrate long-term ecological awareness and reveal patterns that may not be easily captured through conventional monitoring systems. Alongside ecological observations, participants highlighted important social dimensions of change. When opportunities to harvest caribou decline, the effects extend well beyond harvest numbers. These changes

interrupt relationships that sustain both caribou and community, underscoring that understanding caribou health requires attention to the social indicators that accompany ecological shifts. Together, these show that caribou health cannot be separated from the cultural and social systems it supports. By documenting stories, maps, and lived experience, this work aims to strengthen community-derived indicators of caribou that reflect both biological and social realities, contributing to decision-making rooted in enduring relationships between people and caribou.

Combining Remote Sensing and Social Approaches to Study Vegetation Changes in the Peary Caribou Habitat

Estéban Hamel Jomphe¹, Cheryl Ann Johnson², Esther Lévesque¹, Carlos Albertos Merinos³, Alexandre Langlois⁴, Alexandre Roy¹

¹Université du Québec à Trois-Rivières,

²Environment and Climate Change Canada,

³University of Toronto Scarborough,

⁴Sherbrooke University

Arctic temperatures are rising more than four time higher than elsewhere around the globe. These changes impact vegetation and landscape features that are key to the arctic wildlife and habitats of caribou. We investigated vegetation changes across the distribution of Peary caribou, an endemic species of northern Canada. We combined remote sensing analysis and a method from the social sciences to document Inuit Knowledge to quantify and qualify vegetation change along the latitudinal gradient across the Canadian Arctic Archipelago in the last 40 years. First, we used a machine learning algorithm to create yearly vegetation maps from 1984 and 2024 of areas

used and avoided by Peary caribou. Our results suggests that areas of moist to wet tundra increased across the archipelago while mesic tundra and barrens ground areas have decreased. Secondly, we then adapted a method for inter-reliability analysis from the health sciences to document Inuit perspectives of landscape change during a workshop using photographs. The participants reached a consensus by subdividing the photographs into feeding areas, calving areas, migration routes and seasonal changes in habitat use. While the themes were similar, the photographs identifying them were sometimes different, suggesting regional variability in the representation of Peary caribou habitats across the Canadian Arctic Archipelago. Both analyses therefore inform us about the changes occurring in the habitat of the Peary caribou and can support future conservation actions for the species.

A Management Tool to Quantify Offset Requirements for the Restoration of Boreal Caribou Habitat in Eastern Canada

Marilou Lepage¹, Martin-Hugues St-Laurent¹, Mathieu Leblond²

¹University of Quebec at Rimouski (UQAR),

²Environment and Climate Change Canada

Environmental impact assessments (EIA) aim to prevent or mitigate significant adverse effects of human development projects on the environment, including species-at-risk like the boreal caribou. Under EIA, impacts induced by human development should firstly be avoided, then minimized, and residual impacts should be offset to achieve “no net loss”. It can be complex, however, to quantify the negative impacts of an industrial project on animals and their habitat, and thus the offset requirements needed to ensure ecological equivalence can

be difficult to predict. Our objective was to identify which parameters should be considered to offset the negative impacts of a project, to then build a mathematical model aimed specifically at achieving ecological equivalence for boreal caribou in eastern Canada. To do so, we elicited two separate groups of experts: one with expertise on habitat restoration and compensation, and the other with expertise on boreal caribou ecology. Using a method adapted from the Nominal Group Technique, restoration experts identified the important parameters that would be required to achieve “no net loss”, including habitat suitability, time lags and methodological uncertainty. Then, caribou experts compared the relative importance of each parameter using the Analytical Hierarchy Process. We applied this newly-built “offset” model to case studies (mining projects and linear structures) to help managers appreciate its flexibility. Our management tool could be used by promoters and policy analysts during EIA processes to quantify habitat offsets for boreal caribou in eastern Canada. Our model could also be adapted for other caribou and reindeer populations worldwide.

Transparency: An Online Tool To Track Changes in Caribou Habitat

Robert Serrouya¹, Craig DeMars², Melanie Dickie²

¹Wildlife Science Centre, Biodiversity Pathways,
²

Habitat loss is a primary driver of biodiversity decline, yet evaluating whether habitat recovery is occurring, and at a rate sufficient to support self-sustaining wildlife populations, remains challenging. For woodland caribou (*Rangifer tarandus caribou*), a species whose declines are linked to human-caused habitat alteration and the resulting impacts on predator-prey

dynamics, management policies rely heavily on recovering disturbed habitat. However, existing approaches typically use coarse structural thresholds to classify habitat “loss” and “gain,” which are often weakly linked to the mechanisms underlying population declines, especially predation. Because disturbance types, ecological conditions, and vegetation recovery trajectories vary widely across caribou ranges, uniform recovery thresholds fail to capture the functional habitat attributes necessary to restore low-predation landscapes. To address these limitations, we developed an online, transparent, publicly facing and interactive tool for tracking rates of habitat change within caribou ranges. The tool allows users to apply disturbance-specific and ecologically grounded recovery thresholds, quantify gross and net habitat change through time, assess progress toward habitat-based management targets, and evaluate alternative land-use scenarios. By enabling transparent, biologically defensible, and comparable assessments of habitat dynamics, this framework supports more effective, mechanism-informed strategies for conserving woodland caribou in multi-use landscapes.

The Long Winter's Choice: A Combined RSF-SSF Approach using Novel Snow Information to Assess Porcupine Caribou Habitat Selection

Ophelie Couriot¹, Jasmine Ware², Mike Suitor², Glen Liston³, Adele Reinking³, Katherine Gura³

¹University of Alaska Fairbanks, Institute of Arctic Biology, Fairbanks, Alaska, USA, ²Government of Yukon, Department of Environment, ³Colorado State University, Cooperative Institute for Research in the Atmosphere (CIRA)

As the Arctic undergoes unprecedented warming and rapid changes in weather and climate, scientists and communities have noted changes in the movements and winter distribution of the iconic Porcupine caribou herd (PCH). Historically, the herd's winter range extended from Venetie and Arctic Village, Alaska (AK) in the west, to Aklavik and Fort McPherson, Northwest Territories in the east, and as far south as Eagle, AK and Dawson City, Yukon. Utilizing aerial surveys and GPS location data from over 500 caribou monitored between 1985 and 2024, we show that in the last decade (2014-2024), winter ranges have shifted northward, and lateral fall migration pathways have supplanted historic north-south corridors. Given the critical role of caribou in community nutrition, well-being, cultural and spiritual practices, and transmission of traditional knowledge, values, and wisdom, understanding the underlying environmental drivers of this distribution shift is essential for informing future conservation strategies. Thus, in collaboration with communities, we used topography, vegetation mapping, and sophisticated snow models that integrated observations to quantify snow characteristics important to caribou, to examine the herd's large-scale habitat selection during winter, and fine-scale step selection during fall migration. Our findings confirmed that snow characteristics and environmental factors significantly influence seasonal habitat selection and movement. While this study provides critical insights into the PCH's winter distribution shift, further research is needed to evaluate the implications of these results in the context of community needs and the design of interventions that may help maintain critical areas for caribou and the people depending on them.

Using Structural Topic Models to Synthesize Caribou Science since 1943: Where Have We Come From, And Where Might We Think About Going

Eric Vander Wal¹, Alec Robitaille², Jack Hendrix³, Kristy Ferraro⁴, Allegra Love⁵, Jill Kusch², Shayla Jackson⁵, Ally Menzies⁶, Quinn Webber⁵

¹Memorial University of Newfoundland,

²Department of Biology, Memorial University of Newfoundland, ³Cognitive and Behavioural Ecology Interdisciplinary Program, Memorial University of Newfoundland, ⁴School for Environment and Sustainability, University of Michigan, ⁵Department of Integrative Biology, University of Guelph, ⁶Department of Biological Sciences, University of Calgary

In the past 80 years, ~10,000 primary research articles on caribou science have been written; a number that exceeds any individual's or research group's capacity for synthesis. As a result, it is difficult to capture the historical breadth of caribou research or track trends. Without better synthesis of what is known about caribou, ascertaining what we still need to learn is difficult. We used a structural topic model to create patterns of word co-occurrence within primary caribou science since 1943. Our synthesis identified approximately 60 coherent topics, distilled into 13 categories. The topics within categories related to climate change, management, and space use are increasing in frequency in recent years, whereas frequency has decreased for topics related to physiology and disease. The generality and specificity of topics varied. For example, climate change research appears to lack specificity, i.e., climate change is a general context in which caribou exist, rather than a precise test of its effects on caribou. Representing topics as a dichotomous tree illustrated persistent broad divisions driven

by laboratory and field work. At finer resolutions, pairwise gaps appear between disease and movement/habitat selection; and between disease, physiology, and genetic inferences with governance, culture, and conservation. Some gaps may not be promising intersections, and some topics may be in decline because consensus suggests they are resolved or not priorities. Alternatively, some topics and intersections we spotlight are fruitful domains for interdisciplinary research to advance caribou science.

CONSERVATION & MANAGEMENT III

Evaluating the Evidentiary Base of Mitigation for Caribou in Environmental Impact Assessment

Emilie Cameron¹, Rosemary Collard², Fiona Doyle¹, Gabrielle Wong³

¹Carleton University, ²Simon Fraser University, ³University of Toronto

Across Canada, the stated purpose of environmental impact assessment (EIA) is to review major projects to ensure the environment is protected and Indigenous rights are considered or in some jurisdictions, upheld. A central way EIA attempts to do this is through the identification of mitigation measures for projects' potential adverse effects. These mitigation measures are often assumed to render those adverse effects insignificant, including impacts to caribou, who in many parts of the country are both endangered and subject to Indigenous and treaty rights. Given the powerful role mitigation plays in neutralizing impacts to caribou, it is important to assess the evidentiary base underpinning mitigation measures' effectiveness and applicability. This research critically evaluates the evidence, or lack thereof, for caribou-related mitigation measures for proposed mines in BC and Yukon, where caribou are in decline and mining is a recognized driver of those declines. Based on an analysis of all 18 EIAs for approved BC and YT mines between 2006 and 2024 where caribou were considered potentially impacted, we identify threats to caribou detailed in the EIA; mitigation measures proposed to address those threats; and the evidence for those measures' effectiveness given in the EIAs or academic

literature. Out of over 300 distinct proposals for caribou-related mitigation measures in the EIAs, less than ten percent provide evidence specific to the measure, and only a quarter provide evidence of some kind, with variable specificity, rigor, and applicability. An academic literature review determined scarce peer-reviewed evidence supporting any of the mitigation measures.

Adapting Management of Woodland Caribou in the Face of Uncertainty

Melanie Dickie¹, Robert Serrouya¹, Tom Habib²

¹Wildlife Science Centre, Biodiversity Pathways,

²Alberta-Pacific Forest Industries

Recovering populations of woodland caribou presents a wicked management problem, one that encompasses logistical challenges, socioeconomic constraints, and the uncertainties associated with global climate change. Since the development of the federal recovery strategy for boreal caribou over a decade ago, a primary objective of management has been to recover caribou habitat by reducing the footprint of natural and anthropogenic disturbances to <35% of caribou range. While this target remains relevant, it assumes vegetation recovery will result in caribou population recovery, an assumption that is untested and potentially untenable in some areas due to climate change. Here, we outline a framework that extends beyond monitoring vegetation regrowth, one that evaluates habitat recovery on a continuum with interim indicators indexed to putative mechanisms underlying caribou population declines. We show how such indicators can inform monitoring of caribou habitat and provide an example of how an understanding of the relative strength of mechanisms within a given caribou range can inform how habitat

restoration may be prioritized. We also identify emerging threats associated with climate change that may compromise caribou recovery efforts in the coming decades. Going forward, effective management of caribou will likely require more frequent monitoring of disturbance trends, an expansion of how caribou habitat recovery is evaluated, and the consideration of alternate management strategies and objectives to confront the uncertainties of climate change.

Assessment of the Production or Protection Benefits of a Maternity Pen in Conserving Endangered Caribou in Northeastern British Columbia, Canada

Clayton Lamb¹, Scott McNay², Landon Birch²

¹Niᓕaneᓂe Wah tzee Stewardship Society and Biodiversity Pathways, ²-

In British Columbia, Canada, caribou populations have due to high mortality from predation. Maternity pens are used to protect newborns, but they might also boost calf production by providing high-quality diets that offset the energetic costs of previous reproduction. We studied the Klinse-Za caribou herd in northeastern BC, where maternity penning and wolf removal have occurred since 2014, to assess whether increased calf recruitment was due to protection from predators, improved calf production, or both. We monitored 258 caribou-years (141 penned, 117 free-ranging) and recorded 192 calves. Most cows (92%) were pregnant. Pregnancy was positively influenced by having a calf-at-heel the previous year and negatively by age. Among pregnant cows, 88-91% successfully gave birth, and penned cows that retained calves longer were more likely to reproduce successfully again. Calf survival was unaffected by cow age,

prior reproduction, or previous-year management. However, calves born in pens had a 3.8-fold lower risk of death than those born free-ranging. Mortality of penned calves (11%) was mainly from accidents and wolves, while 40% of free-ranging calves died, mostly from bears and wolverines. These findings suggest Klinse-Za cows maintained reproductive performance on natural diets, with little added benefit from pen feeding. The primary conservation benefit of maternity pens came from protecting calves from remaining predators after wolf removal.

Overview of Recent Habitat-Based Offsets for Caribou in British Columbia - Successes and Opportunities

Greg Sharam¹, Mitch Fennell¹

1ERM - Environmental Resource Management

Large industrial projects in British Columbia are required to assess and manage potential effects on mountain caribou, which are designated as Endangered (southern population) and of Special Concern (northern population) within the Province. To address these risks, provincial and federal regulators—alongside Indigenous groups—expect proponents to follow the mitigation hierarchy of avoidance, minimization, and restoration. Where residual effects remain, habitat-based offsets are often required. In practice, however, differing regulatory objectives and guidance have resulted in inconsistent approaches to offsetting, creating uncertainty for proponents. The effectiveness of habitat offsets has also been a matter of discussion, leading to some groups proposing alternative offsetting paradigms that may not meet government objectives. This presentation reviews recent offsetting strategies implemented across the province and identifies key processes and conditions that have

contributed to successful outcomes. A critical factor in effective offsetting is the early and meaningful integration of Indigenous Knowledge, with Indigenous groups engaged as partners throughout the full lifecycle of offset design and implementation. Successful programs also depend on achieving alignment on core objectives - whether that be habitat securement, habitat restoration or hands-on herd protection. Technical considerations also require consideration, including offset ratios, methods for quantifying project effects, evaluation of habitat quality, and metrics for measuring offset effectiveness. Additional challenges include establishing durable legal protections for offset areas, navigating overlapping land-use designations and regulatory jurisdictions, and addressing practical constraints such as land access and the feasibility of habitat restoration or enhancement. This presentation will explore these challenges, highlight emerging best practices, and discuss pathways to improve consistency, regulatory alignment, and long-term outcomes for mountain caribou conservation in British Columbia.

Evaluating the Success of Mitigation Measures to Limit Disturbance to Caribou: A Case Study of the Meliadine Mine, Kivalliq Region, Nunavut

Greg Sharam¹, Anne Gunn², Mitch Fennell³, Jakob Voisey⁴, Janna Foster-Wilfong³

¹ERM - Environmental Resource Management,

²Independent Biologist, ³ERM, ⁴Kivalliq Inuit Association

Mining projects in the Canadian Arctic are required to implement mitigation to protect caribou from disturbance due to mine operations. These mitigation measures are

costly for mines and their effectiveness in protecting caribou is uncertain. Additional mitigations are proposed as caribou seasonal use has changed but without a clear understanding whether existing mitigations are effective. Using the Meliadine Mine in eastern Kivalliq region, Nunavut, we evaluated whether mitigation for caribou was effective in protecting caribou. The Qamanirjuaq caribou herd's seasonal ranges overlap the mine site and its associated all-weather road. We asked four questions to evaluate mitigation effectiveness: 1. Can caribou be reliably observed as they approach the mine? 2. Once caribou are observed, are the correct mitigations triggered; helicopter, road and mine shutdowns? 3. When mitigations are implemented, do they have the desired effect; E.g., when an access road is closed to traffic, do traffic levels drop and by how much? 4. What are the effects on caribou? E.g., What proportion of caribou experience roads shut down vs. In operations, what behaviour changes are observed, and what is the exposure rate of cows to mine operations? Meliadine road and mine site are on Inuit owned land and consequently, there is a close relationship between the mining company and the Kivalliq Inuit Association (KivIA). We describe how the KivIA and mine staff work together to implement monitoring protocols and when mitigation will be triggered by the presence of approaching caribou.

both community well-being and a healthy caribou population. Today, Inuit across the North face unprecedented challenges that threaten this relationship, including climate change-causing unpredictable weather patterns and melting sea ice-and growing industrial activities that disrupt migration routes and degrade critical habitats. In response, the Taloyoak Umarulirigut Association (TUA), the local Hunters and Trappers Association, is leading the establishment of the Aqviqtuuq Inuit Protected and Conserved Area(IPCA)-a proposed nearly 90,000km² land and marine conservation initiative. Envisioned as a regional effort across the Kitikmeot, Aqviqtuuq seeks to protect ecological integrity while upholding Inuit rights, knowledge, and governance. In this presentation, Jimmy Ullikatalik, Manager of TUA, will share insights from TUA's journey towards Indigenous-led conservation and the lessons that can guide communities pursuing similar initiatives across the North.

From the Land, For the Land: A Path Toward Aqviqtuuq Inuit Protected and Conserved Area

Jimmy Ullikatalik¹

¹Taloyoak Umarulirigut Association

For generations, Inuit of Taloyoak, NU have stewarded the caribou herds of Boothia Peninsula, maintaining a balance that supports

LANDSCAPE ECOLOGY

Mapping Caribou Forage Lichens Under Changing Climate and Fire Regimes in the Northwest Territories, Canada

Andres Caseiro Guilhem¹, Pierre Racine², Maria Belke-Brea³, Ruth Greuel⁴, Geneviève Degré-Timmons², Marcus Lapeyrolerie⁵, Jennifer Baltzer⁶, Ceres Barros⁷, Steven Cumming²

¹Department of Wood and Forest Sciences, Laval University, Quebec City, QC, Canada,

²Department of Wood and Forest Sciences, Laval University, ³W8banaki, ⁴Department of Biology, University of Saskatchewan,

⁵Department of Forest Resources Management, University of British Columbia, ⁶Department of Biology, Wilfrid Laurier University, ⁷Canadian Forest Service, Pacific Forestry Centre, Natural Resources Canada

Terrestrial lichens play an important ecological role in northern ecosystems, particularly as winter forage for caribou. Despite their importance, spatially explicit estimates of lichen biomass remain scarce across northern Canada. We present a novel workflow to predict and forecast lichen biomass using vegetation plot data, statistical modelling, and forest landscape simulations. Our work extends the statistical framework established by Greuel & Degré-Timmons et al. (2021), which modeled variation in lichen biomass accumulation in relation to forest type, time since fire, and ecoprovince across northwestern Canada. Model forecasts to 2100 are derived from coupled models of forest stand dynamics and wildfire, driven by downscaled climate projections. To generate lichen model covariates, we developed a series of classifiers that convert landscape state into the required forest types and stand ages We

also developed a drainage model, using a random forest classifier and spatialized environmental covariates, to distinguish well-drained from poorly drained spruce-dominated stands. This enabled the statistical model to be applied spatially across dynamic and heterogeneous landscapes. For non-forested areas, we estimated lichen biomass using class-mean values derived from an extensive compilation of plot data and remotely-sensed land cover products. The resulting wall-to-wall forecast of lichen abundance and distribution will improve understanding of caribou forage availability and patterns of post-fire lichen recovery.

An Indigenous-led Wildlife Monitoring Program Provides Opportunities to Examine Caribou Responses to Anthropogenic Disturbance and Wildfire

Ryan Cheng¹, Nicole Doll², Matthew Munson³, Fred Didzena⁴, Kecia Kerr², Kaitlyn Philip²

¹Canadian Parks and Wilderness Society Northern Alberta, ²CPAWS Northern Alberta, ³TK Array, ⁴Dene Tha' First Nation Lands Department

Alberta's northwestern landscape is home to the Traditional Territory of Dene Tha' First Nation and the threatened Bistcho boreal caribou. Both the region surrounding Mbehcho (Bistcho Lake) and the caribou herd hold deep cultural significance for Dene Tha' people. The Nation is leading the way for the herd's recovery through several initiatives, including a Guardians Program, wildlife monitoring programs, efforts to establish an Indigenous-led conservation area, and involvement with landscape level planning and habitat restoration. The 2024 wildfires significantly

altered the landscape, burning several monitoring sites and large portions of the range. Our project seeks to assess the species' response to fire by comparing pre- and post-fire data across burned, unburned, and fire-refuge zones. With their range heavily impacted by legacy industrial and natural disturbances, questions remain about whether caribou will be forced to use burned areas or face increased pressure from species better adapted to such conditions. By analyzing results alongside community members, we gain a fuller understanding of the changes unfolding in Mbehcho and ensure data application reflects community priorities. The project utilizes DTFN's existing wildlife camera array which was designed using an integrated methodological approach informed by TK. To date, the array has played a critical role in identifying unique features around Mbehcho that influence wildlife behaviour and movements including identifying key areas for caribou use and movement, predator refuges, and areas of concern that might be impacting species recovery. DTFN's leadership underscores the importance of Indigenous-led, knowledge-integrated monitoring for adaptive caribou conservation in a changing ecosystem.

Microclimatic Refugia: A Framework for Mapping Fine-Scale Thermal Landscapes Used by an Endangered Caribou Population

Timothee Nozieres¹, Martin-Hugues St-Laurent¹, Mathieu Leblond²

¹University of Québec at Rimouski,

²Environment and Climate Change Canada

Climate change is one of the main drivers of global biodiversity decline and is suspected to negatively affect caribou. Historically, some

caribou populations have persisted in pockets of habitat offering favorable climatic conditions in an otherwise unfavorable macroclimate. These microclimatic refugia could be essential for species with a limited adaptive or migratory capacity, yet they remain difficult to map with conventional meteorological models, whose spatial resolution is often too coarse to capture fine scale variability. Precise tools are thus required to identify these potentially important microclimatic refugia. We developed a statistical approach that allows the reconstruction of fine-scale thermal landscapes at any point in time when climate reanalyses and environmental data are available. This approach couples in-situ temperature data from a network of loggers dispatched across our study area (2023-2026) with climate reanalysis data (ERA5-Land), as well as topographic and land cover variables. Our results show that this framework improves the representation of local thermal conditions compared to raw reanalysis data. This provides the foundation for reconstructing past microclimates where only coarse climatic data are available. We explore the use of reconstructed thermal landscapes by integrating them in resource selection functions for the endangered Atlantic-Gaspésie caribou, relying on GPS locations collected on 43 adults from 2013 to 2016. Our study provides a new framework for reconstructing thermal landscapes in the habitat of endangered species and supports better identification and conservation of microclimatic refugia for the conservation of caribou in a changing climate.

Caribou Habitat Selection and Forest Management in Northern Ontario

Jake O'Flaherty¹, Ashley Thomson¹, Brigitte Leblon¹, Julie Turner², Michel Laforge¹

¹Lakehead University, ²Biodiversity Pathways

Woodland caribou habitat selection is driven primarily by forage availability, avoidance of anthropogenic features, and spatial separation from predators and competitors. Caribou typically avoid forest harvest areas and road networks, selecting for large areas of mature conifer forest. Like other ungulates, caribou habitat selection is also driven by changing environmental variables such as temperature and snow depth. For example, populations in Quebec have been observed to select mature deciduous and mixedwood areas when temperatures increase in summer, which may spatially overlap with competitors, namely moose. Ontario's forest management framework currently sets landscape targets designed to manage the quality, quantity, and arrangement of key habitat for select species, including caribou. Incorporating caribou response to weather conditions and disturbance will add further insight into habitat management in an uncertain future.

We created habitat suitability models for caribou using location data from 2010-2015 in Ontario's managed forest. These resource selection function models use a matched-case design to examine the interactions between weather (temperature and snow depth), landcover, landscape texture, and disturbance. Model coefficients were mapped to landcover derived from LANDSAT imagery and a Random Forest model to examine the change in high-quality caribou habitat under landscape conditions ten years later. Results indicate that weather changes selection responses in some habitats. This work aids in predicting shifts in caribou habitat selection under changing disturbance and weather conditions, aiding in the evaluation of forest management strategies.

The Relative (Un)Importance of Natural Disturbance for Woodland Caribou

Robin Steenweg¹, Steve Ross², Megan Watters³, Carolyn Shores³, Cole Burton⁴

¹ECCC-CWS, ²Trophic Ecology, ³BC WLRS, ⁴UBC

Woodland caribou declines are widely attributed to high cumulative habitat disturbance from both anthropogenic activities and natural processes, including wildfire and pest outbreaks such as mountain pine beetle (MPB). Although previous research generally shows that caribou avoid burned habitat, responses vary widely across regions, with some herds using remnant patches or selecting burned areas and others avoiding them entirely. Fires may have little effect on adult female survival. On the Chilcotin Plateau in British Columbia, caribou inhabit landscapes shaped by logging, MPB, and fire. Recent work indicates that survival in this region is strongly affected by logging, but little is known about how natural disturbances - particularly MPB - shape habitat use. MPB-affected stands vary in attack severity, with the most severely affected stands in caribou range being targeted for salvage logging due to concerns about increased blowdown impeding movement. We tested competing hypotheses that (1) caribou avoid MPB stands because increased blowdown reduces movement ability, or (2) caribou prefer MPB stands due to increased forage from canopy openings and potentially reduced predator mobility in more cluttered habitat. To evaluate these hypotheses, we conducted paired field surveys at locations used and unused by GPS-collared caribou in both MPB-affected and undisturbed stands, measuring vegetation structure, blowdown density, and forage availability. Preliminary results show caribou use across all stand types and MPB severity levels. These findings suggest that MPB-affected stands may not warrant

preferential salvage logging and that natural disturbances may play a smaller role in affecting caribou habitat than previously assumed.

relationships from site-level across the winter range. This research will quantify long-term trends in lichen availability and evaluate the impacts of large and intense fire years such as 2023.

Impacts of Changing Lichen and Shrub Cover on Barren-ground Caribou Across Northern Canada

Hana Travers-Smith¹, Isla Myers-Smith², Michael Suitor³

¹Faculty of Forestry/University of British Columbia | Vancouver | BC | Canada, ²Faculty of Forestry, University of British Columbia, ³Department of Environment, Government of Yukon

Lichens are slow-growing and disturbance-sensitive, yet critically important as winter food source for caribou and change in lichen cover was identified as a key priority at the 2025 Porcupine Caribou Knowledge Hub. However, fires can completely remove lichen, taking 40-70 years to recover and become suitable for caribou. Declines in and recovery of lichen during recent decades of intensifying fire regimes have yet to be quantified. There is also substantial variability in lichen recovery rates between ecosystems and within individual fires. Remotely sensed observations from satellites and aerial photography can be used to map fire regimes over large areas and impacts to vegetation communities, but additional research is needed to relate these trends with long-term patterns in lichen recovery. In particular, historic imagery from the National Air Photo Library can establish baseline lichen conditions predating the satellite record and to assess almost a century of landscape change beginning in 1930. I will use high-spatial resolution imagery and historic air photographs to quantify long-term lichen recovery in the winter range of the Porcupine caribou. I will use Bayesian hierarchical models to estimate effects of fire on lichen recovery, extrapolating

UNDERSTANDING AND MITIGATING INFRASTRUCTURE IMPACTS ON MIGRATORY CARIBOU II

Developing a Simulation Model for Caribou Response to Roads

Kayleigh Chalkowski¹, Timothy Fullman¹,
Heather Johnson², Elie Gurarie³, Benjamin
Larue⁴, Sagnik Nandy³, Nicole Barbour⁵, Chloe
Beaupre³, Anne Gunn⁶, Don Russell⁶, Mariah
Meek¹

¹The Wilderness Society, ²United States
Geological Survey, ³SUNY-ESF, ⁴Laval University,
⁵Towson University, ⁶CircumArctic Rangifer
Monitoring and Assessment

Infrastructure developments such as roads pose major ecological challenges for caribou. While numerous studies have documented caribou avoidance of roads and other disturbances, less is known about how local behavioral changes scale up to influence caribou migration dynamics and survival across landscapes. To address this gap, we are developing an agent-based simulation model to characterize emergent space-use and connectivity patterns in Arctic caribou under varying road scenarios. We discuss findings on how road networks alter movement behaviors and outline our plans to integrate these movement responses into survival and demographic models using an energetic approach. Our model will advance understanding of behavioral mechanisms driving population-level impacts of infrastructure on caribou dynamics and provide

a flexible tool for evaluating mitigation strategies to support ongoing caribou conservation efforts.

Identifying Caribou Movement Responses to Alaskan Roads Using the Barrier Behavior Analysis

Timothy J. Fullman¹

¹The Wilderness Society

Animal migration relies upon connected landscapes and can be hindered by anthropogenic barriers. It is critical to identify responses of migratory species to infrastructure to inform where negative impacts occur and how they can be mitigated. Caribou (*Rangifer tarandus*) are among the world's longest terrestrial migrants. We adapted the Barrier Behavior Analysis to investigate movement responses of caribou in proximity to roads in northwestern Alaska. Movement straightness and heading near roads were compared to seasonal average values to detect changes in behavior and classify five potential movement behaviors: normal movement, back-and-forth, bounce, trace, and quick cross. Analyzing over 1 million locations from 366 GPS-collared adult female caribou of the Western Arctic Herd between 2009-2024, we found that the roads were semi-permeable barriers to movement. Overall, 63.1% of collared animals in our dataset entered road buffers and 61.5% of those displayed altered movement. Most altered movements occurred near the Red Dog mining road (60.3%) or during fall migration (51.9%) but lasted longest during winter. Caribou with altered behavior spent 9.4 days longer, on average, in proximity to focal roads than those with unaltered movement. Given increasing pressures for infrastructure development and global challenges facing migratory species, it is critical to identify

mitigation measures and inform management decisions seeking to balance responsible development with conservation of natural systems. Our analyses support this and can be applied to other systems and species to better reveal the impacts of a globally expanding human footprint and to guide management and conservation interventions.

Tłıchǫ Caribou Guardians on the Winter Road

Petter Jacobsen¹, Stephanie Behrens¹

¹Tłıchǫ Government

Due to the decline and harvest restrictions on the Bathurst and Bluenose-East barren-ground caribou herds, the Tłıchǫ communities have increasingly used the Tibbitt to Contwoyto winter road to access and harvest the Beverly caribou herd. Since 2020, Tłıchǫ government has been operating a harvest monitoring program on the winter road to document the level of Tłıchǫ harvest and update harvesters of the Mobile Core Bathurst Caribou Management Zone (no-hunting zone). The program was also developed to help manage the over-harvesting, wastage and poaching of barren-ground caribou along the winter road. Harvesting behaviors depend on the location of the no-hunting zone. When the zone's location is away from the road, it allows for ease of access for hunters from NWT to harvest alongside the road, and numerous incidents of disrespectful harvesting have been reported during the recent winter hunting seasons. In 2024, Tłıchǫ Government expanded its Ekwǫ̀ Nàxoèhdee K'è to include caribou monitoring of the Beverly and Bathurst herds along the winter road. This presentation demonstrates results from caribou monitoring conducted during winter 2024 and 2025, highlighting the cumulative impacts from the road on barren-ground caribou herds. Based on observations and reports from the

winter road, Tłıchǫ Government developed several recommendations to improve the current situation, such as establishing a no-shooting corridor alongside the road, increasing the presence of officers and guardians on the road, and shift harvesting focus back to the fall community hunts; as efforts to teach and promote more culturally respectful harvesting practices to new and younger harvesters.

Testing the Efficacy of Industrial Mitigation Measures for Barren-Ground Caribou in the Arctic

Heather Johnson¹, John Severson²

¹U.S. Geological Survey, Alaska Science Center,

²U.S. Geological Survey, Southwest Biological Science Center

Oil fields in the Arctic typically incorporate design features intended to increase permeability for migratory, barren-ground caribou, despite limited empirical evidence of the effectiveness of some of these features. Given expected increases in energy development in the Arctic, we examined whether two mitigation measures commonly used for barren-ground caribou, elevating pipelines and separating roads and pipelines, were effective at increasing the probability caribou would cross infrastructure. We conducted our investigation on adult female caribou in the Central Arctic herd of Alaska during summer, analyzing movement data from telemetry collars (2015-2020) in conjunction with spatial data on oil field infrastructure. To evaluate whether caribou would cross infrastructure as a function of the mitigation measures, we employed a generalized additive modeling framework capable of detecting non-linear and threshold responses. We found that caribou were more likely to cross a pipeline when the nearest one was elevated (≥ 1.7 -m), a

result that supports current mitigation recommendations. We also found that caribou were more likely to cross both a road and pipeline when they were directly adjacent to one another, as opposed to being spatially separated, a result that contradicts current recommended mitigation strategies. As new energy projects are designed and implemented, it is important to ensure that mitigation efforts for caribou are scientifically validated for their efficacy. In the North American Arctic, such efforts will be critical for minimizing the impacts of expanding industrial development on barren-ground caribou and on the human communities that rely on them for subsistence.

LISTENING TO CARIBOU: NOTES FROM THE BARRENLANDS

Caitlin Scarano¹, Megan Perra², Eliezer Gurarie²

¹University of Alaska Fairbanks, ²SUNY College of Environmental Science and Forestry

Listening to the Caribou: Notes from the Barrenlands is an interdisciplinary storytelling initiative that transforms cutting-edge Arctic wildlife research into an immersive audio work for public audiences. This presentation introduces the collaborative scientific and creative foundations of the project, tracing how fine-scale ecological data become soundscape, narrative, and poem. Grounded in research led by wildlife biologist Megan Perra, the work draws on high-resolution acoustic recordings from land-based sensors and animal-borne devices. These recordings reveal how climate change, industrial noise, and insect harassment shape caribou behavior across winter, spring, and summer. Listening provides an intimate register of these pressures, capturing subtleties of movement, stress, and adaptation that are often invisible to the eye. Our session will offer an inside look at how these scientific recordings are being shaped into an audio story following a mother caribou and her calf across the Barrenlands, blending authentic field audio with ecological interpretation and poetic narration by writer Caitlin Scarano. We will discuss methods for integrating science, sound, and story. The presentation will conclude with a brief live reading from the project's narrative script, giving attendees a first encounter with its sonic and emotional landscape.

POSTER SESSION

Promoting a Sustainable Future for Wild Reindeer; Action Plans and Dialogue Processes Dealing With CWD Measures

Roy Andersen¹, Peter Köller¹, Olav Strand¹, Anders Mossing¹, Lena Romtveit¹, Ingrid Sønsterud Myren¹, Einy Sunniva Brænd¹, Karina Gjerde¹, Kamilla Rust¹, Are Endal Rognes¹, Kristin Gansmo Brenna¹

¹Norwegian Wild Reindeer Centre

The Norwegian Wild Reindeer Foundation is a national institution dedicated to sustainable management of wild reindeer and their mountain habitats in Norway. We were established by the Norwegian Environment Agency in 2006. The foundation's aim is to be a connection point and bridge between central- and local management, different stakeholders in society, the general public, science institutions and decisionmakers.

Norway manages approximately 90 percent of Europe's remaining native wild mountain reindeer (*Rangifer tarandus tarandus*), distributed across 24 designated wild reindeer areas. These populations face increasing pressure from habitat fragmentation, human disturbance, and disease, highlighting the need for coordinated, knowledge-based management.

To address this situation Norway has introduced a national quality standard for wild reindeer, providing standardized assessments of population status, grazing resources, and human impacts. The first nationwide evaluation showed that most areas face significant challenges, and action plans are currently being made in order to improve conditions and hopefully ensure long-term population viability.

The foundation's involvement in the restocking of the Nordfjella reindeer herd after the CWD-outbreak and the following eradication exemplifies some of our core missions. Our role has been to lead a work plan for restocking this population. In doing so we have also communicated to the public, moderated discussions and provided a secretariat for a group of experts. This plan requires a balance between animal welfare, practical implementation, further disease transmission and ownership and participation in local communities.

Tòdzı Néné - Boreal Caribou Range Planning in the Sahtú: Process, Learnings, and Reflections

Melanie Harding¹, Leon Andrew²

¹?ehdzo Got'ıne Gots'ę Nákedı - Sahtu Renewable Resources Board, ²?ehdzo Got'ıne Gots'ę Nákedı

This poster will provide an overview of the Tòdzı Néné (boreal caribou range planning) process in the Sahtu region. It will show the pre-planning and planning work that has been completed so far, including considerations on how to work in a good way within the co-management system.

Lichen Regeneration Rate Responses to Post-Fire Conditions in Central Yukon

Claire Bandet¹, Steve Cummings², Jill Johnstone³, Colin Bonner¹, Jennifer Baltzer¹

¹Wilfrid Laurier University, ²Laval University,

³University of Alaska Fairbanks

Warming in northern Canada is altering various biotic and abiotic disturbances that affect boreal ecosystems. Boreal fires are burning at higher frequency and greater severity, triggering changes in boreal forest composition and function. These changes may be an emerging threat to Canada's caribou because fire eliminates critical food stocks until enough time has passed for them to grow back. Terrestrial lichen, which represents 70% of caribou's winter diet, can take anywhere from 30 to 80 years to recover after fire, and even then, only if the forest composition regenerates as open, conifer-dominated stands that supports high lichen biomass. Shifts from spruce to deciduous dominance after fire therefore inhibit lichen recovery and affect caribou habitat and food resources. Here we present new data on the post-fire recovery of caribou forage lichens (*Cladonia* spp., *Cetraria* spp., *Flavocetraria* spp., and *Stereocaulon* spp.) in central Yukon. We conducted surveys of forest cover type, lichen cover, and lichen biomass on sites that burned between 1950 and 2002 (n=200). We found that lichen cover is more than 30x higher in conifer and unforested stands than in broadleaf or mixed stands, consistent with other boreal regions. Additionally, we found that lichen grew more rapidly after wildfire when stands regenerate as conifer or unforested. We are also constructing lichen biomass allometries of the target morphological groups by modeling the relationship between biomass, height, and percent cover of samples collected from 80 plots in 2024. This work is intended to test whether the more generalist species are allometrically similar between Yukon, Northwest Territories, and Saskatchewan, and to fill in an allometry library for species more common in Yukon. This new understanding of lichen in central Yukon will be tied in with the Canadian Forestry Service's Spatial Discrete Event Simulation framework (SpaDES), to support forecasts of the recovery and availability of critical caribou forage under climate warming.

Understanding Drivers of Adult Female Survival in Barren-Ground Caribou Across the North American Arctic

Chloe Beaupre¹, Tracy Davison², Kyle Joly³, Alicia Kelly², Michael Sutor⁴, Eliezer Gurarie¹

¹State University of New York College of Environmental Science and Forestry,

²Environment and Climate Change, Government of Northwest Territories, ³Arctic Inventory and Monitoring Network, Gates of the Arctic National Park and Preserve, ⁴Department of Environment, Fish and Wildlife, Government of Yukon

While barren-ground caribou are globally declining, population trajectories can vary widely among herds. For example, the Bathurst herd has experienced a steady and precipitous decline beginning in the early 2000's, while the Porcupine herd increased during that same period. Understanding adult female survival, a key component of wildlife demography, is essential for explaining these contrasting trends. We conducted a comprehensive analysis of adult female mortality across multiple barren-ground caribou populations, compiling multi-decadal tracking data from the Western Arctic, Porcupine, Tuktoyaktuk Peninsula, Cape Bathurst, Bluenose West, Bluenose East, Bathurst, and Beverly herds. Our work focuses on patterns of variability in survival, including seasonal effects within individuals, individual variability within herds, and differences among herds. Using fate data, we estimate individual hazard rates to evaluate how mortality risk changes across space, time, and environmental conditions. Notably, we found striking heterogeneity in temporal dynamics, with some herds exhibiting strong year-to-year reversals while others showed persistent multi-year conditions. This herd-specific temporal variability suggests that

continental-scale drivers are filtered through local ecological contexts, creating distinct mortality patterns unique to each herd's geography and ecology. This synthesis improves understanding of the mechanisms underlying herd-specific population trajectories and provides insight into the conditions necessary to sustain barren-ground caribou populations. Identifying the ecological and environmental variables that shape demographic rates will help managers anticipate shifts in population trends and inform adaptive, evidence-based wildlife stewardship, which is particularly critical in the context of rapid climate change.

Holding the Edge of Southern Mountain Caribou: A Collective, Connected Path Forward

Megan Petersohn¹, Adam Christian², Robert Serrouya³, Tal Avgar¹, Clayton Apps⁴, [Colin Bergeron](#)⁵

¹University of British Columbia, ²Splatsin te Secwépemc, ³Wildlife Science Center, ⁴Aspen Wildlife Research Inc., ⁵Parks Canada

The southern limit of Southern Mountain Caribou distribution is retreating northward at an alarming rate. Of the 15 Southern Mountain Caribou subpopulations extirpated (or functionally extirpated) in the last 20 years, 11 were located along the southern edge of the species' distribution. Mount Revelstoke and Glacier national parks (MRG) lie at the forefront of conservation efforts, providing the remaining ecological bridge between the two southernmost extant herds—Columbia North and the Central Selkirs.

Slowing or stopping the northward progression of this extirpation front demands coordinated, multi-jurisdictional action. To support this work, MRG collaborated on extensive regional mapping of caribou habitat and priority

connectivity corridors within and between subpopulations. These spatial tools now guide and prioritize recovery actions, including habitat restoration, natural resource and recreation management, and targeted habitat protection.

Complementing these initiatives, an expansive wildlife-camera monitoring grid (covering approximately 7,000 km²) was deployed across key habitats and movement routes. This system provides essential data on caribou, predators, and primary prey, enabling evaluation of the effectiveness of various management actions over time. Emerging results from this grid indicate that ungulates such as white-tail and mule deer are increasing in both abundance and distribution, encroaching on caribou range and changing predator prey dynamics. This finding will challenge recovery efforts and clarify the direction of recovery actions.

Ultimately, holding the southern edge of Southern Mountain Caribou requires united, cross-boundary collaboration. Only through shared commitment and connected conservation strategies can this irreplaceable population persist.

Collaboration Opportunities at University of Alaska's Large Animal Research Station

[Todd J. Brinkman](#)¹, Ophelie Couriot¹

¹University of Alaska Fairbanks

The University of Alaska's Large Animal Research Station (LARS) is a 52-hectare facility in Fairbanks, Alaska that houses approximately 40 reindeer (*Rangifer tarandus*), 40 muskox (*Ovibus moschatus*), and 10-50 wood bison (*Bison bison athabasca*). LARS facilitates excellence in large mammal research and teaching. LARS has rich history of international collaboration to address pressing needs related to wildlife management and conservation. Our objective is to provide participants of the North

American Caribou Workshop with information on how to engage and collaborate with LARS. Staff at LARS can assist researchers with proposal development, permitting (e.g., Animal Care protocols), study designs, project implementation, veterinary procedures and care, and data collection. Our facility provides researchers with access to equipment and supplies to support animal handling and measurements of animal diet, nutrition, body condition, health and physiology diagnostics, environment conditions (e.g., weather stations), genetics, and behavior. LARS also can host teaching and other education and outreach events. We are eager build our network of research partners.

Cause-Specific Mortality of Sympatric Caribou and White-Tailed Deer in West-Central Alberta

Leonie Brown¹, Laura Finnegan¹

¹fRI Research - Caribou Program

White-tailed deer (WTD) populations have expanded into Alberta's west-central caribou ranges driven by a combination of landscape and climate change. Changes in distribution and density of WTD have cascading impacts on the boreal ecosystem, including negative impacts on threatened caribou. Although understanding population dynamics of caribou and WTD is essential to inform wildlife management, little is known about what limits survival of both species in Alberta, and how they may overlap. We investigated cause-specific mortality of 25 caribou and 10 WTD collared in west-central Alberta during 2013-17, and 2019-22, respectively, conducting mortality site investigations, collecting data and biological samples to determine cause of death and overall health. Probable causes of death of caribou were predation (56%; 2 wolf, 5 bear, 4

cougar, 3 multiple predator predation events), disease (12%), human-caused mortality (12%), unknown cause (12%), and environmental accident (8%). For WTD probable causes of death were predation (60%; 2 wolf, 1 bear, 1 cougar, 2 lynx predation events), human-caused mortality (30%), and unknown cause (10%). Overall health measured by bone marrow fat content indicated that all caribou assessed (n=17) experienced nutritional stress. Of the 7 WTD assessed 3 were in good body condition, 2 experienced nutritional stress, and 2 experienced starvation. Additional work is needed to identify whether disease (sample testing in progress) or limited forage likely caused these patterns in body condition. The finding that caribou and WTD health may differ but that they share many predators contributes to the knowledgebase for adaptive management of these sympatric boreal ungulates.

"If there's one or two, take them but if there's three, leave them": Inuit Cultural Norms and Traditional Knowledge Regarding Sustainable Harvest Leading Contemporary Species Management Planning

Jason Dicker¹

¹Nunatsiavut Government

Inuit have carried out sustainable harvests of caribou and other wildlife throughout the Arctic for millennia - even during large wildlife population fluctuations and prior to contemporary, often western science-based, harvest/quota regulations. Inuit Elders and harvesters hold immense knowledge regarding cultural norms and traditional practices surrounding sustainable harvest and

management that have helped sustain species for millennia. With rapidly shifting climate conditions and changes in access to traditionally harvested species, the importance of acknowledging the contribution of this knowledge in guiding future wildlife management efforts cannot be understated. Through Inuit graduate student and Inuit youth-led interviews with Elders and harvesters in Nunatsiavut, this study will respectfully gather and acknowledge the value of past and present Inuit approaches to sustainable wildlife harvest and management for culturally significant species like caribou while also fostering the intergenerational transfer of traditional ecological knowledge and increasing Indigenous-led research capacity, self-determination, and training. This study will engage Inuit youth in each Nunatsiavut community to assist with conducting interviews and will also engage master's level Inuit graduate students who will each focus on a complimentary set of study objectives over the three years of the study. To help ensure findings are implemented, Inuit graduate students will work in close collaboration with Nunatsiavut Government resource and wildlife managers to explore how Indigenous knowledge can guide contemporary species management planning. This study is funded by ArcticNet / Polar Knowledge Canada.

Charting a Path for Respectful and Collaborative Mapping and Modelling of Caribou (*Rangifer tarandus*) Between Indigenous Knowledge Systems and Western Science Approaches: A Systematic Map of Global Best Practices

Amanda Dookie¹, Kimberly Klenk², Jacquelyn Saturno², Samuel Haché¹, Alana Westwood²

¹Canadian Wildlife Service, Environment and Climate Change Canada, ²School of Resource and Environmental Studies, Dalhousie University

Intensification of natural resource extraction and climate change is increasingly affecting the boreal forest and populations of boreal caribou. Spatial mapping and ecological forecasting can help to inform decision-making and management of wildlife and natural resources, however inclusion of Indigenous knowledge is less common. Historically, Western scientific research on wildlife and resource management has excluded and marginalized Indigenous voices and perspectives, and efforts to bridge Indigenous knowledge with western scientific methods have failed to properly include, credit and empower Indigenous peoples in ecological research. In our study, we introduce a systematic mapping approach to examine global peer-reviewed and gray literature involving spatial modelling and mapping of all caribou subspecies that leveraged Indigenous knowledge to determine what methods and approaches have been taken to bridge Indigenous and Western science knowledge. We quantified methods, approaches, and trends, and evaluated if or how research supported Indigenous self-determination by ranking documents against the 'Six Rs of Indigenous Research'. We discuss lessons

learned to help build respectful relationships and research coproduction, and present recommendations to help guide Western researchers working in future collaboration with Indigenous knowledge holders and communities. As peer-reviewed articles generally did not perform highly on our scorecard, we challenge researchers to defy common scholarly conventions and better explain their positionality, worldviews, and approaches to collaboration with Indigenous partners.

Seasonal and Spatial Drivers of Muskox (*Yutthéjéré*; *Ovibos moschatus*) Occurrence on the Southern Edge of Their Range

Christine Dunbar¹, Brad Woodworth², Jan Adamczewski², Jennifer Baltzer¹, Frances Stewart¹

¹Wilfrid Laurier University, ²Government of the Northwest Territories

Canada's north is changing rapidly due to climate change and other anthropogenic disturbances, altering habitat availability and the distribution and abundance of resident species. Whereas most ungulates in North America are predicted to move north with climate-induced habitat change, muskox (*Yutthéjéré*; *Ovibos moschatus*) on the mainland of the Northwest Territories (NWT) have been expanding their range south of the tree line into the boreal forest. My research uses photos from camera traps to quantify seasonal muskox-habitat associations across a boreal-tundra transitional region on the East Arm of Great Slave Lake (Tu Nedhé), specifically Thaidene Nënë Indigenous Protected Area, NWT. I ask whether muskox occurrence varies spatially and temporally across habitats and have investigated if muskox select habitat

based on predation pressures, land cover classes, or due to thermoregulating needs. I found that predation from grizzly bears and gray wolves are the main driver influencing muskox distribution in TDN, as well as terrain ruggedness and shrub land cover. This information will support management and conservation as muskox begin occupying habitats south of the tree line.

Influence of Shrub Expansion on Caribou Movement

Claire Ethier¹, Isla Myers-Smith¹, Mike Sutor², Kathleen Orndahl³, Cole Burton¹

¹University of British Columbia, ²Yukon Government, ³Northern Arizona University

Climate change is transforming caribou (*Rangifer tarandus*) habitat across the north. One of the most significant impacts is shrubification, where shrubs become established at higher latitudes and elevations. The Fortymile caribou herd (FMCH), which is central to Tr'ondëk Hwëch'in cultural continuity and food sovereignty, is experiencing population declines and range contraction. Like many migratory caribou herds, the FMCH fluctuates in abundance over decades, but its recent peak of in 2017 was short-lived and far below its historical maximum. Although population cycles are natural, climate-driven vegetation change may now be limiting the herd's ability for recovery. Migration is a critical driver of population abundance but it is unclear whether these vegetation changes are limiting movement. To address this, we are evaluating how climate-driven shrub expansion influences habitat patch dynamics, connectivity, and movement. Drone surveys are being repeated at 33 sites first sampled in 2018. In 2025, twelve ~30

Demographic Response of Southern Mountain Caribou to Maternity Penning - Investigating the Factors Influencing Sex Allocation of Calves

Zana Everett¹, Chris Johnson²

¹University of Northern British Columbia, Nîkanêse Wah tzee Stewardship Society, Mitacs,

²University of Northern British Columbia

The Nîkanêse Wah tzee Stewardship Society, a collaboration between Saulteau and West Moberly First Nations, was established in 2014 to prevent the extirpation of the Klinse-Za population of southern mountain caribou in northern British Columbia. The population has grown significantly after a decade of maternity penning, predator management, habitat restoration, and Indigenous-led stewardship efforts. However, a male-biased sex ratio among calves born in the maternity pen has persisted. Sex determination in ungulates, in particular caribou (*Rangifer tarandus caribou*), is not well understood. We will use long-term demographic data from maternity pens to investigate the biological, ecological and environmental factors that influence sex allocation in calves. Since 2014, 163 calves have been born in the Klinse-Za maternity pen. This dataset, combined with monitoring data from free-ranging caribou, will be used to examine the relationship between calf sex, maternal body condition, environmental variation, and other ecological factors - including penning itself. These findings will enhance our understanding of sex ratio dynamic and the resulting implications for population growth of captive woodland caribou. Results can potentially inform conservation practices, such as supplementary feeding or strategic selection of females for penning or captive breeding. In addition to direct benefits for the Klinse-Za herd, this work may inform the operation of

other maternity pens, captive breeding programs and the conservation of small, wild caribou populations.

Community-Based Monitoring in Chief Drygeese Territory - Tłichàdii Kq "Our Wildlife House"

Carmen Hamel¹, Bruno Croft², Charlene Liske²

¹University of Alberta, ²Yellowknives Dene First Nation

The Bathurst caribou herd has declined to critically low levels, posing urgent challenges for the Yellowknives Dene First Nation (YKDFN), and other Indigenous Peoples whose cultural identity, food systems, and governance are deeply connected to caribou. While multiple stressors—including warming temperatures, wildfire and predation—contribute to this decline, community members identify the winter road as intensifying pressures in the fall-winter months. These corridors fragment and degrade critical habitat, disrupt migration pathways, and increase access (i.e., illegal hunting). Within this context, the lack of regulation and enforcement of activity on the present winter road, and further stresses anticipated from a proposed all-weather road, pose governance challenges.

Satellite collaring and landscape-scale monitoring are important but insufficient for understanding and responding to localized impacts associated with road networks and human activity. In response, this paper advances an Indigenous-led community-based monitoring (CBM) framework focused on road-related impacts within Chief Drygeese Territory. The framework emerges from a multi-day workshop held in Ndilq in December 2024, which brought together Elders, harvesters, youth, leadership, and technical experts. It outlines the Chief Drygeese Tłichàdii Kq Monitoring Program, grounded in Dene laws,

knowledge systems and land-based practices. The monitoring program would integrate Indigenous Knowledge and scientific methods, such as cultural and participatory mapping, wildlife cameras use and analysis, road-checkpoint surveys, as well as on-the-ground monitoring of human disturbance and caribou movement. The work contributes to a broader discussion and literature on community-based monitoring of barren-ground caribou in the circumpolar Arctic - emphasizing its critical role in adaptive management of infrastructure projects, caribou conservation and the revitalization and continuity of Dene culture and well-being.

Unlocking Ice Patch Archives: Ancient DNA Metabarcoding Reveals Caribou Diet Across 4,000 Years

Carson Hedberg¹, Tyler Kartzinel¹, Josh Miller², Christian Thomas³

¹Brown University, ²University of Cincinnati, ³Yukon Department of Tourism and Culture

Caribou (*Rangifer tarandus*) have declined precipitously across their circumpolar range over the past century, in part due to climate-driven habitat changes. Effective management must navigate an uncertain future for this culturally significant ungulate; however, reliance on modern or short-term data provides only a limited perspective on species ecology, particularly when assessing responses to long-term processes such as climate change and ecosystem transition. The past offers critical insight into species responses to global change, linking fossil records with contemporary conservation challenges. This research integrates modern and paleoecological data from the ice patch record of southern Yukon to investigate the dietary flexibility of northern mountain woodland

caribou under varying climatic conditions. For millennia, caribou have used these cryogenic features for relief from insect harassment, depositing dung preserved within ice layers. In 2025, we collected a transect from the Gladstone Ice Patch and recovered more than 50 dung pellets, ranging from several hundred to over 4,000 years old. To examine dietary trends, we extracted and sequenced plant and fungal DNA using a fecal metabarcoding approach. Modern dung samples were also collected to compare the summer diet of the contemporary Aishihik herd with those of the past. Preliminary results demonstrate exceptional DNA preservation, highlighting the potential for expansion to other ice patches. These data reveal how caribou vary their diet in response to environmental change and identify key summer forage resources supporting long-term persistence.

Tracking Winter Movements: Spatial Strategies of Ontario's Co-occurring Caribou Ecotypes

Amaan Leacock¹, Rachael Derbyshire¹, Art Rodgers², Jennifer Shuter², Brent Patterson³, Christina Prokopenko⁴, Michel Laforge⁵, Frances Stewart⁶, Quinn Webber¹

¹University of Guelph, ²OMNRF, ³Trent University, ⁴University of Manitoba, ⁵Lakehead University, ⁶Wilfrid Laurier University

There are two distinct ecotypes of caribou (*Rangifer tarandus*) in Ontario: boreal (sedentary) and eastern migratory, that differ in behaviour, habitat use, and seasonal movements. The geographic ranges of these ecotypes overlap, though they occupy distinct ecological niches, exhibiting strong seasonally influenced spatial segregation patterns. Although the two ecotypes are known to segregate spatially during calving and summer, little is known about their space use in winter. In

early winter, eastern migratory caribou migrate from their calving/summer ranges along the Hudson Bay coastline, south into the boreal forest, where they presumably come in contact and share space with boreal caribou. Despite this assumption, little is known about whether habitat selection varies for the two ecotypes in winter, or whether they have different predation avoidance strategies during winter. Our research aims to quantify differences in habitat selection between caribou ecotypes to inform conservation strategies under increasing landscape disturbance, particularly in Ontario's Ring of Fire region. Using extensive GPS collar data from ~475 individuals collected between 2009-2015 and 2018-2024, integrated step selection functions (iSSFs) will be used to model fine-scale habitat selection relative to environmental covariates such as forest cover, wetlands and elevation. Moose and wolf GPS data will be used to produce risk landscapes for each species, to estimate how caribou respond to predators and apparent competitors. Our project will advance understanding of the ecological mechanisms underpinning caribou ecotype spatial use and resilience. Our results will provide critical insight for species-at-risk management and for mitigating the impacts of expanding northern resource development.

Creating New Models - And Updating Old Ones - To Assess Boreal Caribou Habitat Suitability in Québec and Ontario

Mathieu Leblond¹, Amanda E Martin¹, Scott Moran¹, Maisy Roach-Krajewski¹

¹ECCC

Habitat suitability models (HSMs) can help with the management and conservation of wildlife, i.e., by helping identify high-quality areas for protection, or prioritizing restoration. In 2014,

Leblond and collaborators (Biological Conservation 177: 100-108) published a HSM for boreal caribou in Québec, which has been widely used for land planning. This model, based on expert opinion, assigned weights to various habitat categories, including mature conifer forests used by caribou for foraging and shelter, as well as cutblocks and regenerating stands which increase predation risk. The model also considered zones of influence of human infrastructure. Here, we present 1) an update of the model with the most recent environmental data in Québec, and 2) a repurposing of the model to fit the equivalent, but not identical, environmental data available in Ontario. In Québec, the update required moving the model to the R statistical environment, and making the code compatible with new ecoforest and road data. In Ontario, the model was re-built from the ground up (without modifying its underlying structure) to accommodate Ontario's Forest Resource Inventory, roads, and mine layers. This poster will present final results from both models. It will be an opportunity to share it more broadly, so that potential users from eastern Canada may use it for the management of boreal caribou habitat.

Reducing Caribou Mortality by Vehicle Collisions on Highway 40: Pilot Project of a Virtual Fence in West-Central Alberta

Stephanie Leonard¹, Chantelle Bambrick², Laura Finnegan³

¹Aseniwuche Winewak Nation of Canada,

²Foothills Landscape Management Forum, ³fRI Research

The Aseniwuche Winewak Nation (AWN) started a grassroots stewardship program called the Caribou Patrol in 2012 in response to declining caribou populations in their

Traditional Territory. In addition to enhancing awareness and education, the Caribou Patrol conducts road patrols during seasonal migrations across Highway 40 where caribou are at high risk of vehicle collisions. In May 2022, two bull caribou were hit and killed by vehicles within Highway 40's caribou corridor. In response, AWN and the Foothills Landscape Management Forum (FLMF) sought input on what other mitigation measures could be implemented on Highway 40 to reduce caribou mortality. One of the measures that was identified in the feasibility study conducted by WSP Canada Inc. was a virtual fence. Virtual fencing devices are installed on posts on alternating sides of the roadway in approximately 25m intervals. The devices are triggered in sequence by headlights as the vehicle approaches along the road. The light trigger causes each device to emit a combination of sound and flashing light stimuli that alert animals and in turn "reduces the startling effect". In studies done in Australia and Tasmania, there was a 50% reduction in total roadkill rate of small mammals. Because virtual fencing is an evolving technology, there are no available studies or trials conducted on caribou, to date. A trial of virtual fencing in the A la Pêche caribou range is imminent. This collaboration includes AWN, Government of Alberta's Transportation and Economic Corridors, academic guidance from fRI Research's Caribou Program, and the FLMF.

Cree-Led Approaches to Caribou Conservation: Adaptive Management, Youth Involvement and Knowledge-Sharing

Adèle Michaud¹, Jane Voyageur¹, Maya Longpre-Croteau¹, Stephanie Varty²

¹Cree Nation Government, ²Cree Trapper's Association

Caribou (atihkw; Rangifer tarandus caribou) hold deep cultural, ecological, and social significance for Cree people of Eeyou Istchee. In the context of ongoing population declines of both woodland and migratory caribou, the Cree Nation is taking action through a range of initiatives.

This poster presents an overview of current and emerging Cree-led caribou conservation actions in Eeyou Istchee, with a particular emphasis on adaptive management during periods of caribou decline. It reflects ongoing discussions to limit harvest on migratory caribou of the Leaf River herd, a precautionary approach aligned with long-standing Cree conservation principles and relationships with caribou and the land.

The poster also highlights a youth-focused initiative, Winter harvest in the face of caribou and moose decline: relying on other traditional foods, a youth land camp aimed at learning to harvest alternative species when caribou harvesting is limited. During this excursion, participants will share discussions with Elders, insuring the transmission of traditional knowledge of the land, values, and practices. A documentary project is currently underway to capture this gathering.

In parallel, the Cree Nation Government is conducting a feasibility study on the potential development of caribou husbandry program in Eeyou Istchee as a Cree-led conservation tool to support the long-term persistence of woodland caribou.

Together, these initiatives illustrate an evolving approach to caribou stewardship that integrates culture, youth engagement, and innovation while responding to environmental uncertainty through adaptive management.

Working Together Towards Applied Outcomes for Caribou and Sustainable Forestry in Alberta

Terra Lottermoser¹, Tom Habib², Nicole Galambos²

¹Director of the Alberta Regional Caribou Knowledge Partnership, ²ARCKP Steering Committee

How we are working together as a partnership between forestry and government to fund research towards applied outcomes, and the changes we have made to incorporate important components such as Knowledge Exchange to create more on the ground change. We will highlight the challenges and opportunities of working as a partnership on a challenging and contentious topic, that of working towards caribou conservation in the context of sustainable forestry.

Exploring the Changing Availability of Western Arctic Caribou and Community Implications

Caitlin Luby¹, Todd Brinkman¹, Kim Jochum², Ophélie Couriot¹

¹University of Alaska Fairbanks, ²National Park Service

In the Northwest Arctic region of Alaska, caribou (*Rangifer tarandus*) are a vital source of food and culture for people of the region, however management of the Western Arctic Caribou Herd (WACH) involves diverse user groups, advocates, and government agencies. Efforts to monitor the herd using GPS satellite radio collars and aerial surveys have estimated population and migration metrics since the

mid-90's, but fewer efforts have been undertaken to explore the relationship between the changing herd and the availability of caribou to communities in the region. Therefore, the research objectives for this project use a mixed methods approach to, 1) quantify how the availability of caribou to local communities has changed over space and time as the WACH population size and distribution has changed, and 2) assess the implications of those changes on community food security by using data sources that include public testimony from 1993-present and community subsistence harvest surveys. By integrating and synthesizing existing knowledge of caribou both biologically and culturally, and returning that analysis to communities and land managers, this interdisciplinary social-ecological systems (SES) approach is reconstructing the history of availability of caribou while expanding understanding of the WACH SES to identify crucial availability knowledge gaps and help inform management decisions of the herd. Overall, we aim to better understand food security needs and help with planning in the region. Our research began during fall 2024 and is expected to be completed during summer 2026.

From Field to Freezer: Insights From Non-invasive Sampling to Establish a Caribou Cryobank

Gabriela Mastromonaco¹, Vanessa Luzuriaga-Aveiga¹, Jennifer Franks¹, Helen Bateman-Jackson¹, Virginia Wolfe¹, Paula Mackie¹

¹Toronto Zoo

Maintaining genetic diversity is critical for the long-term persistence of threatened populations. In southern Ontario, several boreal caribou (*Rangifer tarandus caribou*) herds exhibit signs of genetic erosion, inbreeding, and reduced connectivity, making them

increasingly vulnerable to extinction under rapid environmental change. In collaboration with Indigenous communities that harvest caribou, we piloted non-invasive, post-mortem methods for collecting viable reproductive and fibroblast cells. Samples were transported under optimal temperature and timeline regimes necessary for successful cryopreservation. Post-thaw viability assessments were performed to evaluate their potential use in future conservation breeding programs through assisted reproductive technologies. To complement this work, we developed the first genotype-based studbook for zoo-housed caribou across Canada. This database provides a baseline for managing ex situ populations and identifying genetically suitable individuals for recovery goals of wild caribou populations. By integrating cryobanking, genomic tools, and Indigenous collaboration, this work presents a proactive framework for caribou conservation. This approach not only safeguards valuable genetic resources for future use but also creates opportunities to connect ex situ and in situ management strategies. However, ensuring the quality and viability of samples during collection, handling, and transportation remains a key logistical and technical challenge that must be addressed carefully.

Insect Outbreaks as a Key Driver of Habitat Selection in Boreal Caribou

Emy Maltais¹, Martin Barrette², Daniel Fortin³

¹Université Laval, Department of Biology - Centre for Forest Research (CEF), ²Ressources naturelles et forêts, Gouvernement du Québec, ³Université Laval

Habitat selection is a key ecological process by which animals respond to environmental variability, enabling them to modulate the

effects of natural and anthropogenic disturbances on fitness. Boreal caribou (*Rangifer tarandus caribou*), a threatened species, are particularly affected by boreal forest disturbances. While the impacts of fire and logging are well documented, those of spruce budworm (SBW, *Choristoneura fumiferana*) remain poorly understood. A winter study suggested that SBW outbreaks may increase caribou predation by wolves (*Canis lupus*) by improving habitat for moose (*Alces alces*), an alternative prey. However, the year-round influence of SBW on this system has not been evaluated. In this study, we analyzed GPS telemetry data to characterize caribou habitat selection across landscapes with varying SBW outbreak intensity. Caribou consistently avoided areas strongly affected by SBW throughout the year, with the strongest avoidance occurring during calving and autumn. Avoidance was also more pronounced at higher latitudes, indicating spatial variation in response to SBW outbreaks. These results suggest that SBW outbreaks shape caribou distribution by altering habitat selection, with response strength showing anisotropic spatial variation and cyclic temporal patterns. Ongoing analyses will evaluate SBW effects on habitat selection of moose and wolves and incorporate this information into predictive models of caribou distribution. Understanding how SBW influences habitat use and predator-prey dynamics provides key insights for the conservation of declining boreal caribou populations amid increasingly frequent SBW outbreaks.

Mapping the Menu: How Prey Distributions Influence Wolf Habitat in Northern Ontario

Samantha McFarlane¹, Julia Sunga¹, Kevin Kelly², Alex MacPhail², Frances Stewart³

¹ECCC - Canadian Wildlife Service, ²SENSR, ³Wilfrid Laurier University

Despite being one of Canada's most widespread large carnivores, grey wolves (*Canis lupus*) remain poorly studied in the northernmost parts of their range, and information, including on their distribution, abundance, and habitat associations from remote regions is generally lacking. In Ontario's Far North, information on wolves is especially limited due to their large home ranges, cryptic nature, and the logistical challenges of working in this remote area. Existing records of wolves in this region are largely derived from opportunistic citizen observations, which are often biased toward areas of human activity such as settlements, rivers, and winter roads. Since 2019, the Canadian Wildlife Service has conducted wildlife surveys across a large portion of Ontario's Far North, including aerial surveys for caribou, trail camera deployments, and autonomous recording units for migratory bird monitoring. Across these programs, incidental detections of wolves and wolf sign have been recorded, providing the first broad-scale observations of wolves across this vast and understudied region. These new observations demonstrate that grey wolves are widespread across northern Ontario in both the boreal shield and Hudson Bay Lowlands ecozone. Data is being used to estimate minimum pack size, minimum wolf abundance and model habitat associations. These incidental data highlight the utility of a range of survey methods for gathering information on wolves in remote landscapes, without additional survey costs.

Collaborative Caribou Management in Action

Gilly McNaughton¹, Tina Giroux-Robillard¹

¹Beverly and Qamanirjuaq Caribou Management Board

The Beverly and Qamanirjuaq caribou herds remain vital to the food security, culture and way of life of Dene, Cree, Inuit, and Métis communities across the Northwest Territories, Nunavut, Manitoba, and Saskatchewan. Safeguarding these herds requires collaboration across jurisdictions, cultures, and knowledge systems. The Beverly and Qamanirjuaq Caribou Management Board (BQCMB), established in 1982, is a co-management body that unites Indigenous organizations, governments, and agencies to guide conservation and address threats to these herds. In 2023, the BQCMB released its new 10-year Caribou Management Plan, *Caribou is Life*, shaped by Indigenous Knowledge and science, and grounded in shared responsibility. The Plan's vision is for Beverly and Qamanirjuaq caribou to continue sustaining present and future generations. Its goals focus on conserving caribou and habitat, supporting community well-being, and strengthening cooperative governance. Priority strategies include reducing cumulative impacts of industrial development and climate change, supporting respectful harvest practices, strengthening herd monitoring, and promoting youth engagement and intergenerational knowledge transfer. The Plan also emphasizes the urgent need for cooperative action among communities, governments, and industry to address pressures no single party can resolve alone. This poster will highlight how the BQCMB's *Caribou is Life* Plan demonstrates collaborative caribou management in practice - bridging knowledge systems, centering Indigenous leadership, and advancing

conservation of a shared and essential resource across a vast and changing landscape.

Quantifying Apparent Competition Dynamics on an Abandoned Road Network in Northern Ontario Using Camera Traps

Seung-Il Lee¹, Adam Algar², Brent Patterson³, Michel Laforge¹, John Fryxell⁴, Mate Misir¹

¹Department of Natural Resources Management, Lakehead University, Thunder Bay, Ontario, Canada, ²Department of Biology, Lakehead University, Thunder Bay, Ontario, Canada, ³Wildlife Research Monitoring Section, Ontario Ministry of Natural Resources, Peterborough, Ontario, Canada, ⁴Department of Integrative Biology, University of Guelph, Guelph, Ontario, Canada

Woodland caribou (*Rangifer tarandus caribou*) populations are in decline, largely due to changing predator-prey dynamics exacerbated by anthropogenic disturbance. Industrial activities such as logging, mining, and energy exploration create extensive networks of linear features (e.g., roads and seismic lines) that promote early seral stands and increase suitable habitat for moose (*Alces alces*). Elevated moose densities can support higher wolf (*Canis lupus*) populations, intensifying predation pressure on caribou through disturbance-mediated apparent competition (DMAC). Linear features may also facilitate more efficient wolf movement, increasing predator-prey encounter rates. We investigated evidence of DMAC within a decommissioned road network in northeastern Ontario by evaluating how temporal partitioning, and vegetation regrowth influenced interactions among wolves, moose, and woodland caribou. We hypothesized that regenerating seral vegetation

would attract moose and subsequently increase wolf use through opportunistic predation. Subsequently, we hypothesized that caribou would not be as abundant on these sections of the road network. Using data collected from 129 camera traps, structural equation modeling was used to assess direct relationships among environmental and vegetation conditions, moose and wolf abundance, and the downstream consequences on caribou abundance on decommissioned forestry roads. Several observed variables associated with ecological drivers were evaluated to identify potential mechanisms underlying predator-prey dynamics on the road network. As anthropogenic footprints continue to expand across Canada's North, understanding how environmental conditions modify predator-prey dynamics in disturbed areas is critical for effective wildlife management.

Mapping Climate Vulnerability Pathways for Woodland Caribou

Joseph Molina¹, Chris Johnson¹

¹University of Northern British Columbia

Caribou (*Rangifer tarandus*) are vulnerable to climate change, though the mechanistic pathways and their magnitude are uncertain. Predictions of future climate are inexact and demographic and distributional effects may occur through multiple pathways related to changes in habitat, physiological response, greater prevalence of disease, and altered predator-prey dynamics. We conducted a systematic review of published studies that quantified or described climate-related effects on woodland caribou across North America. Our synthesis integrated findings from across boreal and subboreal regions to identify consistent pathways, interacting stressors, and persistent uncertainties. From this evidence, we developed a set of Directed Acyclic Graphs

(DAGs) to formalize hypothesized causal relationships connecting climate drivers to ecological outcomes. This causal framework moves beyond narrative synthesis, providing a structured foundation for expert elicitation and further quantitative modeling of climate vulnerability for caribou. Results of our study will help clarify key mechanisms, and associated magnitude, and inform conservation approaches that may mitigate the effects of changing environmental conditions.

Impact of Roads on Arrival of Barren-ground Caribou (*Rangifer tarandus*) at the Calving Grounds

Sagnik Nandy¹, Nicole Barbour², Ophélie Couriot³, Benjamin Larue⁴, Allicia Kelly⁵, James Hodson⁵, Eliezer Gurarie⁶

¹State University of New York, College of Environmental Science and Forestry, Syracuse, New York, USA, ²Towson University, Department of Biological Sciences, ³University of Alaska Fairbanks, Institute of Arctic Biology, ⁴Département de Biologie, Université Laval, ⁵Department of Environment and Climate Change, Government of the Northwest Territories, ⁶State University of New York, College of Environmental Science and Forestry

Barren-ground caribou (*Rangifer tarandus*) travel hundreds of kilometers to reach their calving grounds each spring. High site fidelity and temporal synchrony are critical life strategy adaptations as delayed arrival or failure to arrive can lead to negative outcomes for adult and calf survival. In light of increasing development pressure throughout the Arctic, the effects of linear infrastructure, such as roads, on arrival timing of caribou is of critical concern. Several seasonal ice roads accessing mines and communities and a few all season roads servicing large mines are within areas used by caribou from the Bluenose East, Beverly, and

especially the Bathurst herd, which has undergone drastic declines in recent decades. Using 18 years of GPS collar data from adult female caribou (2008-2025) we investigated whether road encounters disrupt the precise timing of caribou arrival on calving grounds. We quantified road-crossing behavior and time spent near roads at multiple spatial scales and recorded arrival times and likely calving events at the calving grounds. We found that interaction with roads caused delayed arrival to calving grounds. Our findings suggest that road development - such as the proposed Arctic Security Corridor - may disrupt the timing of caribou arrival on their calving grounds, a key life history event. Potential implications on population dynamics require careful conservation planning in the region.

Using Acoustic Methods to Map Insect Relief Areas for Barren-ground Caribou

Megan Perra¹, Amélie Roberto-Charron², Jan Adamczewski³, Amanda Dumond⁴, Enis Berk Çoban⁵, Eliezer Gurarie¹

¹SUNY College of Environmental Science and Forestry, ²Environment Yukon, ³Government of the Northwest Territories-ECC, ⁴Kugluktuk Angoniatit Association, ⁵CUNY Brooklyn Graduate Center

The post-calving, early summer period is a vital period for caribou as they try to balance lactation and replenishing their body stores. Insect harassment is one of the greatest stressors at this time, as caribou move either rapidly, to distant relief areas, or massively aggregate to avoid oestrid flies, mosquitoes and black flies. All of these behaviors are at the cost of the ability of forage during the relatively short Arctic summer, and are possibly exacerbated by climate warming. The proposed Arctic Security Corridor will cut through the

summer range of the Bathurst caribou herd, and through areas shared by Bluenose East and Beverly populations, potentially limiting their access to insect relief areas. Using acoustic insect detections from stationary recorders, we have derived regional thresholds of insect activity based on wind, air temperature and soil wetness. These thresholds allow us to map insect activity across space and time and look at the timing and distribution of insect activity in the past. We have compared these maps to historic caribou land-use to see where caribou have aggregated when predicted activity is high, and used that information to map functional insect relief areas—i.e. areas that are actually used by caribou. Finally, we used animal-borne biologgers (audiologgers) that detect insect sounds and caribou activity to help validate our map of these relief areas. Combined, these methods contributed to a comprehensive map of functional insect relief habitat, with implications for the landscape-level functional connectivity required by caribou that may be disrupted by an all-season road.

Caribou Co-Management in the Gwich'in Settlement Area

Alissa Sallans¹, Steve Anderson¹

¹Gwich'in Renewable Resource Board

The Gwich'in Renewable Resources Board (GRRB), established under the Gwich'in Comprehensive Land Claim Agreement (GCLCA), serves as the main instrument of wildlife, fish and forest management in the Gwich'in Settlement Area (GSA). This poster will demonstrate the integrated and collaborative approaches GRRB employs in caribou management within the GSA.

The GRRB works collaboratively with Gwich'in harvesters to gather information about caribou populations, movement, habitats, and health to inform co-management decisions. This

presentation showcases how local harvest monitoring, Indigenous Knowledge (IK), and ecological fieldwork improve our understanding of caribou.

First, local harvest monitoring data from bi-annual Gwich'in Harvest Surveys will be presented, showcasing information collected by local Renewable Resource Councils (RRCs) about caribou harvesting patterns, population trends, and land-based observations of environmental changes across the GSA.

Second, using examples from GRRB's 2025 IK interviews about Northern Mountain Caribou habitat use, migration patterns, and population health observations will demonstrate how the GRRB incorporates Traditional and Local Knowledge systems into decision-making and address knowledge gaps.

Lastly, GRRB's role in supporting and leading scientific caribou research will be presented using examples from an upcoming multi-year GRRB-led research project. This project will focus on lichen surveys in the southern GSA to characterize important caribou winter habitat and a community-led fecal sampling program extending from the Sahtú Region into the GSA to identify Northern Mountain and Boreal Caribou herd boundaries and connectivity.

Caribou Monitoring at the Gahcho Kué Diamond Mine

Sandra Scott¹

¹De Beers Group

De Beers Canada Inc. (De Beers) operates the Gahcho Kué Mine (Mine), located 280 kilometers (km) northeast of Yellowknife, Northwest Territories (NWT). The Mine has comprehensive requirements for wildlife protection, environmental monitoring, indigenous involvement, and adaptive management. Following the coming into force of the NWT Wildlife Act in 2013, the mine

consolidated its wildlife programs into a Wildlife Management and Monitoring Plan (WMMP). The WMMP ensures compliance with the NWT Wildlife Act, Species at Risk Act, Migratory Birds Convention Act and Review Board measures and commitments. The WMMP consolidates years of regulatory commitments and operational experience into a structured framework aimed at minimizing mine-related impacts - especially on barren-ground caribou - and ensuring transparency and accountability throughout the life of the mine.

Investigating the Relationship Between Shifting Vegetation Seasonality and Migratory Caribou Movement

Jordan Seider¹, Isla Myers-Smith¹, Michael Suitor²

¹University of British Columbia, ²Department of Environment, Yukon Government

Arctic and sub-arctic ecosystems are experiencing fundamental shifts in the function and composition of ecological communities. Climate change is altering the phenology of northern species and reshaping vegetation composition and structure. These shifts have varying impacts on wildlife, but most evidence suggests that herds of migratory caribou will be disproportionately affected. Climate-driven changes to vegetation structure and phenology are likely to impact herd population dynamics and behaviour with changes having significant impacts on northern communities and Indigenous peoples with deep historical and cultural connections. My research explores the relationship between this vegetation change and the movement and behaviour of Porcupine Caribou across their range in the Yukon, Alaska, and NWT. Using caribou movement data, satellite remote sensing, time-lapse/motion sensor cameras, and field surveys, I will employ

state-space and resource selection models to: 1) examine whether caribou avoid areas with dense shrub cover, identifying how these changes may alter habitat use and behaviour and 2) analyse the mechanisms responsible for seasonal migratory movements in response to shifting vegetation phenology. These topics will address existing knowledge gaps and contribute to our understanding of the complex effects of climate change on ecological communities. These caribou are of significant conservation concern. Porcupine Caribou also represent iconic and culturally significant animals to the many Indigenous communities that rely on them. My research will utilise novel technologies and methods to address climate change effects on the herds directed by Indigenous communities within the framework of existing co-management structures.

Níó Nę P'ęñę- Trails of the Mountain Caribou: A Living Plan for Caribou and Community Well-being

Manisha Singh¹, Catarina Owen², Jonathan Yakeleya²

¹Sahtú Renewable Resources Board, ²SRRB

Níó Nę P'ęñę- Trails of the Mountain Caribou is an Indigenous-led conservation initiative grounded in the relationships between Sahtú Dene and Métis peoples, shúhta goṛepę (northern mountain caribou), and the ancestral mountain homelands of the Mackenzie ranges. Developed through partnership between the ʔehdzo Got'ıñę Gots'ę Nákedı (Sahtú Renewable Resources Board), the communities of Tulít'a, Norman Wells, and Fort Good Hope, with support from Braiding Knowledges Canada, the program strengthens Dene laws, language, well-being, and land-based governance through community-driven stewardship and monitoring. For the

Shúhtaot'Iné, Níio Nę P'ęné is a living system of trails, waters, wildlife, and stories that shapes both caribou movements and human responsibilities. Guided by this understanding, the Níio Nę P'ęné Plan was created as a living governance framework supporting research, monitoring, and cultural resurgence in coexistence with caribou. This work has since expanded into the Níio Nę P'ęné Hub, linking communities across the Sahtú and Gwich'in regions, stretching west to Ross River, and extending south toward Nááts'ihch'oh and Nahanni National Park Reserves. The Hub advances long-term collaboration by weaving Indigenous knowledge with respectful, non-invasive scientific approaches. Current work focuses on understanding caribou habitat, movement, family relationships, and climate-driven pressures, while strengthening community capacity in land-based monitoring, mapping, and governance. Together, these efforts are generating a growing body of biocultural knowledge that affirms the significance of Níio Nę P'ęné for the well-being of both people and caribou. The initiative offers a powerful model for ethical, Indigenous-led, place-based conservation that can inform caribou recovery and stewardship across the North.

Why Didn't the Caribou Cross the Road?

Chris Johnson¹, [Angus Smith](#)^{1,2}

¹University of Northern British Columbia,

²University of British Columbia

Populations of barren-ground caribou have declined steeply due to the combined effects of climate change, natural fluctuations, human harvest, and industrial activities. For the Indigenous peoples that rely on caribou for subsistence and cultural continuity, this decline presents a grave threat to a way of life. Wildlife

managers are concerned about the potential effects of winter roads on the use of space by caribou. Roads, especially those with high levels of traffic, can act as semi-permeable barriers to movement by ungulates. In the central Northwest Territories, Canada, the Tibbitt to Contwoyto Winter Road services diamond mines located on the winter range of several populations of barren-ground caribou. Impeded movement could restrict the distribution or influence the habitats used by caribou during winter. We investigated the effect of traffic volume and other disturbance and environmental variables on the road-crossing decisions of caribou. We used GPS collars to monitor the location of caribou from 2018 to 2020 and contrasted observed and available road-crossing events. Of 62 collared caribou that were adjacent to the winter road (i.e., 5.2 km), only 33 crossed the road, for a total of 100 crossing events. Caribou rarely crossed the road when any level of traffic was present; the level of traffic, not the road right-of-way, was the underlying explanatory factor for that behavioural decision. Our results suggest that mitigation and associated monitoring should focus on strategies that minimize traffic volume or provide breaks in traffic when caribou are adjacent to winter roads.

Criteria and Indicators for Boreal Caribou Habitat Restoration Success

Tatyana Bond¹, [Jesse Tigner](#)²

¹National Boreal Caribou Knowledge Consortium, ²SwampDonkey

This poster or presentation would present a set of criteria and indicators (C&I) for caribou habitat restoration success that were developed by the National Boreal Caribou Knowledge Consortium's Habitat Restoration Working Group (HRWG). The (C&I) were developed and

refined through many discussions, both in-person and virtual, and reflect diverse Indigenous and non-Indigenous perspectives within and outside of in the HRWG. The criteria encompass a broad definition of “success” including functional and ecological criteria (e.g. decreased predator access, local growing conditions, connected resilient areas), process-related criteria (e.g. community involvement in habitat restoration work), socio-ecological criteria (e.g. having a harvestable surplus of caribou, healing of the land and all living things). For each criterion, the HRWG identified several core (i.e. nationally relevant) and supplementary indicators (i.e. those that are relevant in certain contexts), with associated metrics and thresholds where possible. The group distinguished which indicators are measurable or relevant at which scales, from national, to regional, to site-specific.

A Disconnect Between Legislation and Endangered Species Protection: Provincial Protective Measures Are Insufficient at Protecting Woodland Caribou (*Rangifer tarandus caribou*)

Lindsay Watson¹, Cole Burton¹

¹Department of Forest Resources Management, Faculty of Forestry, University of British Columbia

The continual decline of woodland caribou (*Rangifer tarandus caribou*) in British Columbia is worrisome with provincial legislation intended to protect them. It is necessary to evaluate the effectiveness of these actions by measuring population responses to management. I investigated (1) what proportion of protective measures overlap with herd ranges and (2) if population growth rates (λ) are correlated with the type and amount of

coverage. I used spatial data to overlap protective measures with herd ranges and population growth rates from Lamb et al. (2024). I used linear regression models and linear mixed models to explore the relationship between protective measure coverage and λ , with results showing no significant correlation. This suggests that management actions intended to protect caribou have failed to reverse their declines. This work was part of a preliminary study, with further research on this topic being continued in greater detail beginning in January 2026. A more in-depth spatial analysis will be conducted to assess the habitat conditions within protective zones, in addition to using camera trap data from recent deployments to assess caribou space use and species interactions in a landscape impacted greatly by forest harvest and climate change. This will be a multi-scale habitat assessment focusing on the efficacy of modified harvest zones within protective zones at protecting caribou.

Traditional Use of Caribou by Ktaqmkuk Mi'Kmaq and Implications for Resource Governance

Zechariah Childs¹,

¹Newfoundland Office of the Regional Chief, AFN; Grenfell Campus, Memorial University of Newfoundland

Caribou have been a cornerstone of Mi'kmaq identity in Ktaqmkuk (Newfoundland) from time immemorial. Traditionally, caribou have been harvested following the principles of Netukulimk, which embody respect for ancestors and animals, ensuring that populations are sustained for seven future generations. However, since the onset of settler-colonial wildlife management, regulations have favoured the interests of outfitters and sport

hunters, as this industry quickly became a key driver of Newfoundland's economy. Therefore, Mi'kmaw perspectives were not considered, and access to caribou has been significantly limited.

This research will employ a decolonized Indigenous research paradigm, guided by the principles of Etuaptmumk (Two-Eyed Seeing), and community-based participatory research. With partnership from Qalipu First Nation (QFN), this study will use place-based, community-led interviews with Mi'kmaw hunters, Elders, and knowledge holders from Qalipu communities to determine the current relationship between Mi'kmaq and caribou, and the importance of traditional hunting and conservation practices. Questions for these interviews will be co-developed with QFN. As well, case studies of Indigenous-led and partnered wildlife management in Canada will be analyzed to identify promising practices that could be applied in Ktaqmkuk. Knowledge mobilization for this project will involve QFN with the aim of asserting greater sovereignty over the management of caribou and other culturally significant species.

Indicators of Nutrition and Reproduction in Female Woodland Caribou Receiving Supplemental Feed in British Columbia

Lauren Elviss^{1,2}

¹University of Northern British Columbia, 2
EcoLogic Consultants

Adequate nutrition is closely associated with animal survival, reproduction, and population growth. Supplemental feeding for caribou conservation began in 2014, with high quality

food pellets provided to free-ranging caribou in the Kennedy Siding herd each fall. The program's goal is to improve body condition, overwinter survival, and reproductive outcomes. Feeding combined with predator reduction has resulted in the herd growing by ~16% / year. To understand the effect of supplemental feeding on body condition and population growth among female caribou in the Kennedy Siding herd, I used body mass, visual body condition, fecal cortisol and triiodothyronine, and hair $\delta^{15}\text{N}$ to evaluate changes in physiological and nutritional condition over the feeding period and assess interannual variation in condition. I compared caribou with a weaned calf in the fall to those without to assess the effects of lactation and calf rearing on condition. I used fecal progesterone and GPS collar movement data to assess the potential effects of fall supplemental feeding on reproduction. My results suggest that females with calves may be more vulnerable to nutritional limitation compared to females without due to the nutritional costs of reproduction. I found differences in indicators of condition between years, highlighting the need to account for environmental conditions when considering nutrition. My results suggest that all caribou had the capacity to reproduce, regardless of age, body condition, or past reproductive status. My research represents some of the first longitudinal endocrine activity monitoring in woodland caribou and contributes to understanding the role of nutrition in conservation.

The Keeyask Caribou Coordination Committee: Using Traditional Knowledge and Science To Understand Project Effects on Caribou in Northern Manitoba

Rachel Boone^{1,2}

¹Manitoba Hydro, ²Keeyask Hydropower Limited Partnership

The Keeyask Caribou Coordination Committee (KCCC) is a collaborative effort of the Keeyask Hydropower Limited Partnership - Manitoba Hydro and four partner First Nations: Tataskweyak Cree Nation, War Lake First Nation, York Factory First Nation and Fox Lake Cree Nation. The Committee is a venue to share caribou monitoring results from the Keeyask Generation Project, learn about other caribou monitoring and research in the region, and communicate with provincial wildlife managers and others involved in caribou stewardship in northern Manitoba. The Project has been fully operational on the Nelson River since 2022.

Both traditional knowledge and technical science monitoring programs are being used by the Partnership to verify predictions made in the Project's environmental assessment and to assess the effectiveness of Project mitigation measures. Each of the four partner First Nations is leading their own Traditional Knowledge monitoring programs consistent with their own priorities and vision. Through the KCCC, the Partnership is working together to share knowledge and understandings of Project effects on caribou and find ways to bring this information together in a meaningful way.

A summary of construction-phase and early operation-phase monitoring results will be shared, including caribou use of summer calving habitat and winter migration patterns - both from the perspective of the First Nation

partners' traditional knowledge monitoring programs, as well as findings from the technical science studies. Caribou monitoring for the Project is ongoing into the operations phase.

The Reindeer Hypothesis and the De-Extirpation of Dawson Caribou

Doug Heard¹

¹University of Northern British Columbia

In 1900, Ernest Seton-Thompson identified and described a new species of caribou, *Rangifer dawsoni*, found exclusively on Graham Island, in the Haida Gwaii archipelago of British Columbia. The species' name, honored George Dawson, who was the first to write about those caribou. Dawson proposed that those caribou were likely post-glacial colonizers, arriving when sea levels were lower. As sea levels rose, they became isolated on the island. There has been general acceptance of that explanation, but many questions remain. Why is there no name, oral tradition, or evidence of caribou in the middens of the people who lived on Haida Gwaii? Why wasn't the first Dawson caribou recorded or collected until the late nineteenth century? What explains their extirpation around 1908, so soon after they were first documented? Considering their supposed ancestors are the largest *Rangifer* subspecies, why were Dawson caribou so small? Given that coastal mammals are often melanistic, why were they so pale? What caused their antlers to be misshapen, asymmetrical, and poorly developed? All of those questions are readily answered if wild caribou had never existed on Haida Gwaii, but were gelded Norwegian domestic reindeer, left behind by the Yukon Relief Expedition of 1898.

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