THE EXCHANGE:

Sharing Knowledge, Inspiring Solutions

2025
EDITION 12

ARCKP

Alberta Regional Caribou Knowledge Partnership

Connecting Alberta's forest sector and policy makers to accessible and relevant scientific information is key to advancing woodland caribou conservation efforts across the province. To facilitate this, the Alberta Regional Caribou Knowledge Partnership (ARCKP) provides regular knowledge exchange, keeping our partners and stakeholders up to date on the research and information they need to make important forest management and policy decisions.

Credit: Mercer Peace River Pulp Ltd.

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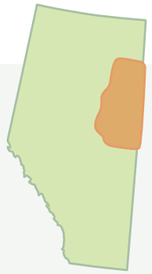
Composite effects of forest harvest and seismic lines influence the re-establishment of trees and shrubs

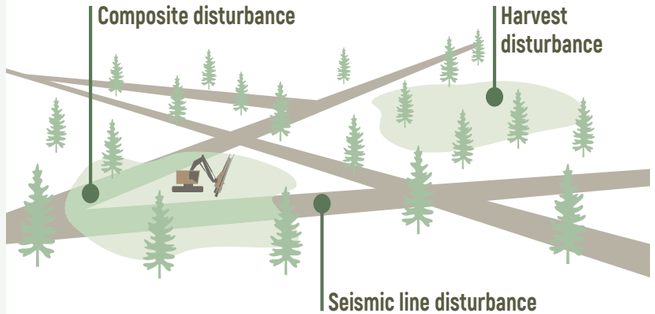
Although they have a narrow footprint, the abundance of seismic lines crisscrossing the landscape makes them the highest contributor to forest fragmentation in Alberta's boreal forests, putting woodland caribou at risk. To support caribou populations, restoration of forested habitat has been identified as a key long-term tool.

The prevalence of seismic lines means they often overlap with other forest disturbance types such as forest harvesting, creating a '*composite*' disturbance type. Researchers call this overlap a composite disturbance because it does not have a simple additive impact. Think of how adding iron and carbon can create an entirely new material — steel — that has different and more complex properties than would be expected from the combination of ingredients. Similarly, the way harvest and seismic line disturbances recover is more unique than what would be expected. This new research is investigating whether forest harvesting "erases" seismic lines and how the interaction of these disturbances impacts species composition.



Study area

Researchers collected data from 15 mesic upland sites in northeast Alberta in 2022. They focused on locations where standard harvesting with variable stand retention overlapped existing seismic lines. Data on the presence and density of a variety of tree and shrub species were collected for harvested and mature forest plots both on and off seismic lines.

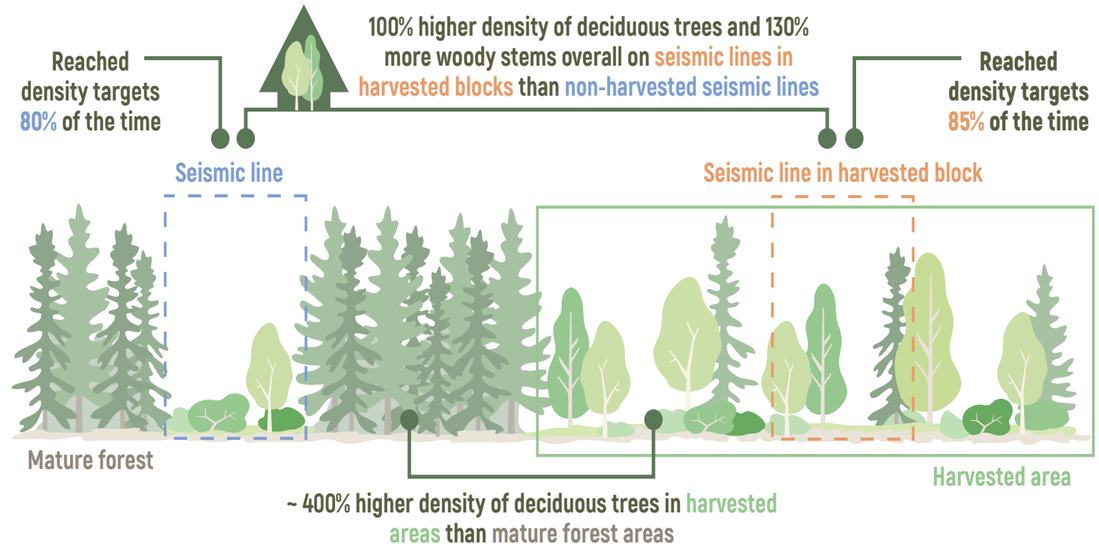


The overlap of forest harvesting and seismic lines can facilitate forest restoration but also influences species composition

Forest harvesting reduces plant competition on seismic lines, allows more sunlight to reach the ground, and creates areas of disturbance on the soil surface which can all promote tree regeneration. In contrast, many legacy seismic lines struggle to regenerate naturally. This research showed that when seismic lines overlapped with harvest, they had **130% more woody stems** when compared to lines through the adjacent non-harvested forest. Forest harvesting promoted natural regeneration on seismic lines, even when natural regeneration was limited on adjacent unharvested lines — effectively 'erasing' the seismic line footprint and replacing it with a new type of disturbance that recovers differently than either harvested areas or seismic lines. Approximately **85% of the harvested seismic lines** reached provincial density targets compared to **80% of lines that were not harvested**. Clear-cutting along seismic lines seems to support tree regeneration through soil scarification, reduction of competition, and improvement of light availability and soil temperature.

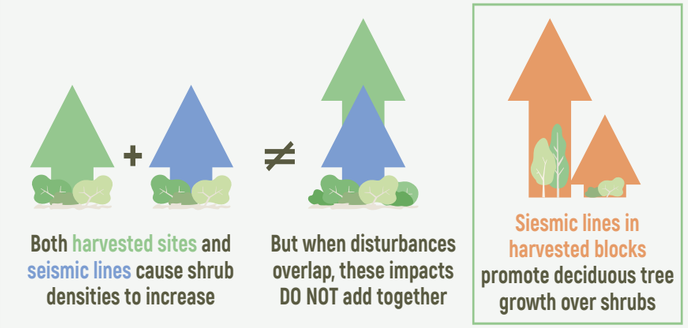
Moving Forward

Further research is needed to determine which silvicultural practices are most effective at promoting restoration on lines and what to avoid. For example, using seismic lines for in-block temporary roads can increase soil compaction and might reduce the potential 'erasure' of the disturbance. Alternatively, exploring more ecosystem-based forest management approaches could help restore seismic lines while reducing changes to species composition.



Although the two overlapping disturbances promoted regeneration, they also changed the composition of plant species. Overall, 43% of the variation and types of species found together could only be explained by the unique impact of the overlapping disturbances. The main changes observed included an increase in deciduous tree stem density and lower than expected shrub abundance.

Understanding the impacts of composite disturbances can help inform restoration planning



Forest harvest cannot be considered a perfect solution for restoring seismic lines in caribou habitat since harvesting itself is a disturbance to caribou habitat. However, the fact that harvesting does promote recovery on seismic lines makes harvesting important to consider when making restoration planning decisions. Harvesting can help contribute to the restoration of lines that are otherwise not being restored or are a lower priority.

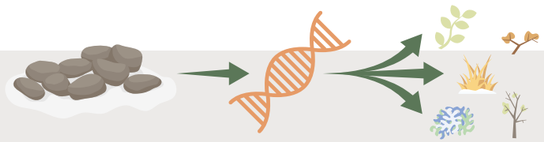
Viliani, L., and Nielsen, S. E. 2025. Composite effects of forest harvests and seismic lines influence re-establishment of trees and shrubs in Alberta's mesic upland boreal forest. Forest Ecology and Management, 580. https://doi.org/10.1016/j.foreco.2025.122506

Winter diet of five ungulates in west-central Alberta

In west-central Alberta, industry, natural disturbances, and climate change influence available vegetation. Disturbances can convert mature forests into early seral stands, and this in turn changes the composition of the plant community. This vegetation change is known to attract ungulate species like moose and deer into caribou habitat, altering predator-prey dynamics and negatively impacting caribou populations. Obtaining a better understanding of caribou diets and how they overlap with other ungulates could help inform land management and caribou conservation.

Caribou are widely considered to be forage specialists — feeding primarily on arboreal and terrestrial lichens, especially in winter months. However, recent studies have suggested that caribou may feed on a broader diversity of species than previously thought. There is significant value in both learning more about the specific diets of caribou in west-central Alberta and better understanding how the diets of caribou and other ungulates influence the ecological niche they occupy.

Study area

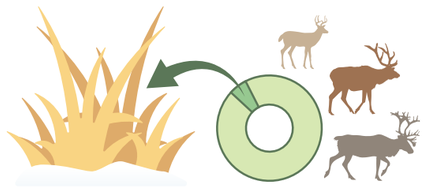


The research area covered 21 000 km^2 of west-central Alberta from Highway 16 to Grande Prairie. This experimental research used a DNA metabarcoding technique to analyze fecal samples from white-tailed deer, mule deer, moose, elk and caribou to try and determine the make-up of their winter diets and how similar they are to one another. Deer, moose, and elk pellets were collected from January to April of 2022. Since caribou are federally and provincially listed as threatened, caribou pellets from previous projects were used to overcome the difficulty of finding them. Caribou pellets were collected from January to April of 2016 and remained frozen until the analysis.

Caribou diets were not the most distinct

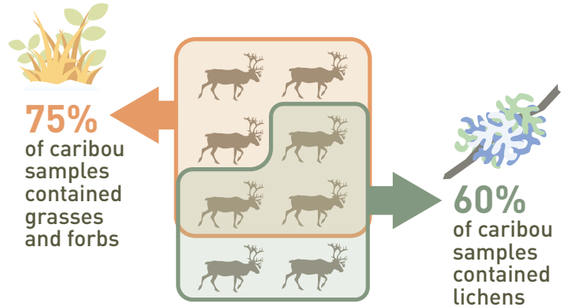
Overall, the ungulate diets overlapped considerably with forbs being universally consumed the most (53–82%) by all five ungulate species. However, some key differences were found between species:

DNA from shrubs and deciduous trees were found in all ungulate samples except caribou.



Although grass was found in more than 70% of samples for deer and caribou, it made up only a small portion of what was consumed for the sampled individuals. Deer, elk, and caribou shared a similar occurrence of grass species in their diet.

Moose had the most distinct diet with a large abundance of shrubs and deciduous trees whereas elk and caribou had the most similar diets.

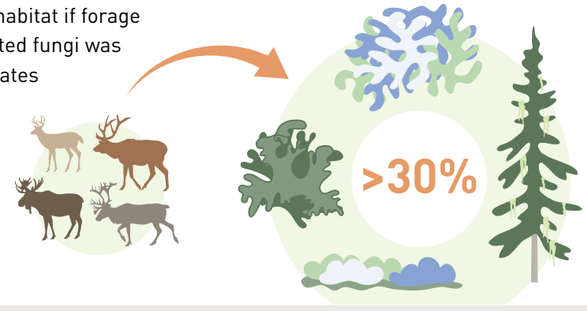


Sampled caribou had a more varied diet than expected

The sampled caribou pellets did not reveal a diet dominated by lichens like expected. 75% of the pellet samples had DNA from grasses and forbs and 60% had DNA usually associated with lichen fungi. However, the limited sample size (from 8 caribou) means these findings cannot be generalized across all caribou. Since a large focus of caribou conservation includes preserving and repopulating lichen habitats, it is important to understand whether caribou benefit from a broader diet or whether this diversification is an adaptation to limited resources.

Other ungulates rely on winter lichens as well

Although caribou are best known for their reliance on lichen species during winter, fungi associated with lichens was found in more than 30% of the samples for each ungulate species. This shows that deer, elk, and moose also use lichen for winter forage. Since other ungulates also consume lichens, they could potentially increase competition for lichen within caribou habitat if forage resources are scarce. However, diversity in lichen-associated fungi was also found across species — meaning that although ungulates other than caribou consume lichens, they are not always consuming the same species. Understanding whether other ungulates are directly competing for forage consumed by caribou will be a key consideration for future conservation and research efforts.



Future research is necessary to overcome limitations

This research was unable to identify differences in diet at the plant or fungal species level and could only make more general conclusions at the family or genus level, meaning the results should be considered preliminary. The DNA metabarcoding technique is efficient and has potential but more needs to be done to improve accuracy and ensure misclassifications of plant and fungal species are not occurring. Despite the limitations of this study, it serves as a clear foundation for future research into the diets of ungulates in Alberta.

Suzanne Stevenson, Chris J. Johnson, Laura Finnegan, and Roy V. Rea. 2025. Winter diet of five sympatric ungulates in west-central Alberta, Canada—inference from DNA metabarcoding of fecal pellets. FACETS. 10: 1-13. https://doi.org/10.1139/facets-2023-0195

ARCKP funded project

Transplanted lichen perform well in two-year trials

Terrestrial lichens are an important component of boreal caribou winter diets, and they are also highly vulnerable to disturbances. Harvest, fire and other disturbances physically damage or kill lichen on the forest floor and alter ground-level microclimate and competition. Lichen's low dispersal and growth rates result in very slow recovery after they are disturbed, even under ideal growing conditions.

Despite the importance of lichens and their low natural recovery following disturbance, they are not traditionally included in revegetation efforts (i.e., by "transplanting" lichen clumps or fragments onto a disturbed site). **This ARCKP-funded project examined the effects of substrate and fragment size on transplantation success, in the greenhouse and in the field.** Future issues will summarize the findings from other studies conducted as part of this project.

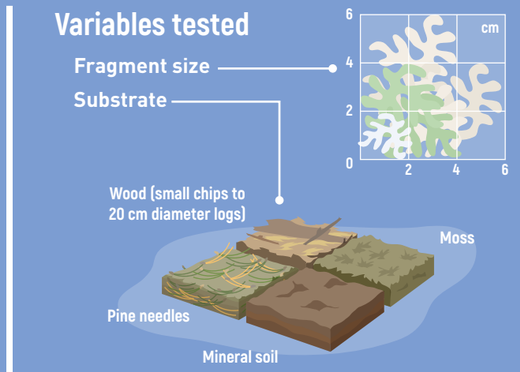
Greenhouse trial

Collected lichens were transplanted in a greenhouse using different fragment sizes and planting substrates. Their survival and health were monitored over two years.

Field trial

Collected lichens were transplanted in five conifer harvest areas in west-central Alberta, using different fragment sizes and planting substrates. Their survival and health were monitored over two years.

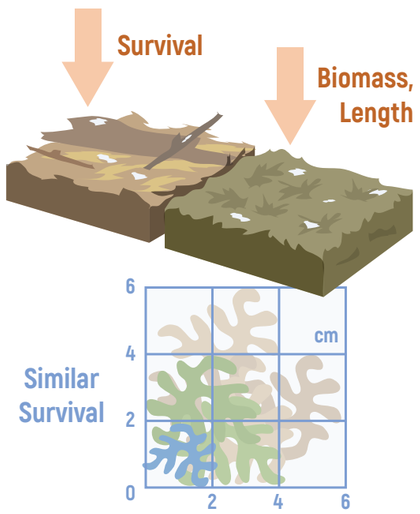
Variables tested

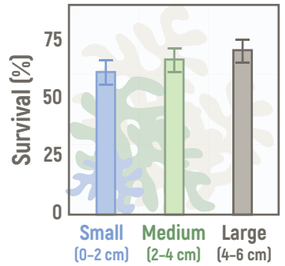


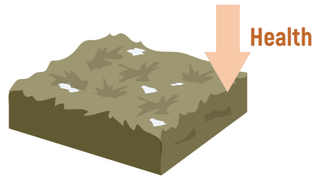
Transplantation outcomes in the greenhouse

Lichens transplanted onto wood and moss had the poorest performance. Overall lichen survival was lowest on wood (just under 60%), compared with survival ranging from 70–80% on the other substrates. Fragments transplanted onto moss lost both biomass and fragment length (through breakage). Unlike some other field studies where lichens performed well on live moss, this study used sterilized (dead) moss that may not have held moisture as well.

Smaller transplanted fragments survived as well as the larger fragments. Additionally, larger fragments lost more length during the trial, suggesting they were more prone to breakage. These findings suggest that small fragments may be suitable for lichen transplantation.







Transplantation outcomes in the field

Larger lichen fragments (4-6 cm diameter) had roughly 10% higher survival than smaller fragments; substrate did not affect survival. Medium fragments (2–4 cm) had the highest coverage (21.9%) after two years. Notably, survival of the two most abundant species — *C. mitis* and *C. rangiferina* — was not affected by fragment size or substrate, with *C. mitis* performing particularly well in harvest areas (92% survival).

Almost all sampled lichen were considered "healthy" after two years, indicating that lichen that survived transplantation were doing well, despite some statistically significant differences (e.g., lower health on live moss and in areas with more moss cover). However, researchers observed that lichens on wetter microsites did poorly. Taken together, these results suggest that excessive moisture and/or moss competition may compromise transplantation success.

Implications: Avoid moss and favour medium-to-large fragments when transplanting

Together, these studies help fill important knowledge gaps regarding transplantation approaches for restoring terrestrial lichens in disturbed areas. The results from the two experiments suggest that larger fragments (4–6 cm) will likely have the greatest success in harvest areas, particularly if field technicians avoiding transplanting them on moss (live or dead) or wet microsites. However, medium (2–4 cm) fragments may be effective for transplanting the most abundant species, *C. mitis* and *C. rangiferina*, while being more operationally efficient, less prone to breakage, and achieving higher coverage than large fragments. Results from re-sampling of existing historical field trials and a hydroseeding trial will be shared in later issues of *The Exchange*.

Other experiments that will be covered in upcoming issues of The Exchange:

Historical Trials

Hydroseeding

Wang, D., R.S. Kong, M. Schulz, J.-M. Sobze. (2025). Examining the feasibility of terrestrial lichen transplantation and seeding technology for woodland caribou habitat restoration. Prepared for: Alberta Regional Caribou Knowledge Partnership (ARCKP). NAIT Boreal Research Institute and Portage College.

WHAT IS THE ARCKP?

Who we are, and what we do

Woodland caribou are a cultural and ecological icon of Alberta's forests. However, they are also a threatened species, and represent a significant conservation challenge. In response to this challenge, and to the additional challenge of managing woodland caribou across different ecosystems, the Government of Alberta and the province's forest sector formed the Alberta Regional Caribou Knowledge Partnership (ARCKP). Together, we are committed to finding on-the-ground solutions that balance forestry activities with woodland caribou conservation.

The ARCKP is an association of fRI Research and funded by the Forest Resource Improvement Association of Alberta (FRIAA) through the support of 12 forestry companies in Alberta. Together, these partners have contributed over $1 million per year for five years to address region-specific knowledge gaps in woodland caribou ecology.

fRI Research
Informing Land & Resource Management

ARCKP
Alberta Regional Caribou Knowledge Partnership

$1M / YEAR
for 5 years

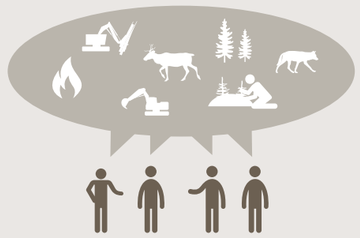
Forest Resource Improvement Association of Alberta (FRIAA)

Twelve Forestry Companies

Alberta Government

OUR VISION

A collaboration promoting self-sustaining caribou populations and a viable forest sector.



OUR MISSION

We support the development and sharing of innovative tools, techniques, strategies and understandable scientific knowledge to enhance sustainable forest management and caribou recovery efforts.

Have questions about the ARCKP?
Contact our network coordinator at ARCKP@fuseconsulting.ca or visit arckp.ca.

The ARCKP is funded by the Forest Resource Improvement Association of Alberta

Forest Resource Improvement Association of Alberta (FRIAA)

ARCKP Partners

ANC Timber Ltd. · Tolko · Alberta Government · Weyerhaeuser · Foothills Forest Products · Northland Forest Products Ltd. · Alberta Pacific Forest Industries Inc. · Mercer Peace River · Canfor · West Fraser · Boucher Bros. Lumber Ltd. · Vanderwell Contractors (1971) Ltd. · Millar Western

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For more information or to contact the ARCKP, visit arckp.ca

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