THE EXCHANGE:

Sharing Knowledge, Inspiring Solutions







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Linear features shrink wolf home ranges

As anyone who has hiked off-trail can confirm, a route littered with obstacles takes more energy to travel than a straight, open path. So, if given the choice between the two, you would likely choose the easier route. The same applies

to wolves and linear features in Alberta's boreal forests. Linear features like seismic lines and roads allow wolves to travel more efficiently and gain easier access into woodland caribou habitat – contributing to caribou declines. How these changes affect wolf home range size, however, is not well understood.

Animals generally make decisions that optimize the energy they gain from food vs the energy spent acquiring it. Home range size – the area in which an animal lives and conducts its day-to-day activities – reflects these decisions. Ecological theory tells us that individuals with more food usually have smaller home ranges, as they do not have to travel far to get the food they need. For wolves, which are territorial, smaller home ranges means more wolves can "pack into" an area of land, increasing wolf density.

The effects of linear features is reflected in how wolves use landscapes, and has important implications for caribou conservation. New research by Dickie et al. (2022) reveals how increased access to prey, facilitated by linear features, can influence wolf home range size.

The authors investigated two hypotheses:

Does a more efficient search, which requires less energy, enable wolves to "make do" with fewer prey and stick to a smaller area?



The study used GPS data from 142 wolves distributed over >500,000km2 across B.C., AB and SK. Young forage plants support more moose, so the authors used landscape productivity as a proxy for moose density.

Wolf home range size was affected by not only prey density, but also by how the landscape influenced access to those prey. Home range size decreased as linear feature density increased, suggesting that easier access to prey via linear features allows wolves to "make do" with less space. All else being equal, smaller home ranges mean that more wolves can "pack" into an area – increasing the number of wolves within a specific landscape (e.g., a caribou range).



More linear features = higher wolf density

In less productive landscapes that support fewer prey, linear features have a more pronounced effect on wolf home range size. These include areas with vast peatlands, where caribou traditionally seek refuge from predators and where the potential for linear features to increase wolf density is a key concern.



In less productive landscapes with fewer prey: LINEAR FEATURES HAVE A **STRONGER EFFECT**



In more productive landscapes with more prey: LINEAR FEATURES HAVE A WEAKER EFFECT



Linear features not only facilitate wolf travel, but can shrink the area wolves need to survive, especially when in peatlands where resources for wolves are scarce. Previous research has suggested that restoration of linear features could benefit caribou by reducing wolf hunting efficiency. These findings indicate that restoration could deliver a double-whammy by also reducing regional wolf density.

Dickie, M., R. Serrouya, T. Avgar, P. McLoughlin, R. S. McNay, C. DeMars, S. Boutin, and A. T. Ford. 2022. Resource exploitation efficiency collapses the home range of an apex predator. *Ecology:* e3642.

Considering alternative silvicultural systems in Alberta

Sustainable forest harvest is not as simple as the number of trees removed – where and how those trees are harvested is just as important. Is the harvest conducted via a clearcut, or is the cut spread out over a greater area? What is the shape of the harvest area and how are retention patches designed? What kind of road network is needed to access the harvest? These decisions come with a suite of trade-offs, with different harvest strategies favouring different species and involving different economic and operational challenges.

A silviculture system is a guiding framework for harvest methods and actions that help forest planners achieve a desired forest stand and structure. With caribou populations in decline throughout Alberta, selecting the right silviculture system is important to contributing to recovery efforts. A recent review funded by the Alberta Regional Caribou Knowledge Partnership draws on experience from other jurisdictions and studies to identify potential systems that could reduce the impact of forest harvest on caribou. Through this review, the authors identified key considerations and trade-offs that impact the successful design and implementation of an alternative system.

Choosing the right silvicultural system

The predominant harvesting system in Alberta is a clearcut system with retention, designed to emulate the wildfires that naturally disturb boreal forests. However, this system results in significant loss of woodland caribou habitat, replacing mature conifer stands with young vegetation. Alternative systems, including partial harvest systems that remove smaller groups of trees rather than an entire stand may help maintain current caribou habitat while still allowing for some level of harvest.

To support caribou populations, alternative systems in this review were assessed in the context of:



Maintenance of desirable caribou habitat attributes through minimal loss of habitat or more rapid habitat recovery.



Minimizing the extent and duration of access into caribou habitat, to reduce the pressures from primary prey, predators and people on caribou.



Minimizing forage availability for other ungulates to reduce primary prey and associated predator populations.



A suite of economic and operational indicators.

Key systems and treatments considered

Several alternative systems have the potential to improve outcomes for caribou, though not every system is appropriate for all parts of Alberta. The success of each system is highly dependent on forest type, site productivity and the level of access they require, and should be adapted to local conditions. The systems and treatments reviewed include:



CLEARCUT



SEED TREE



SHELTERWOOD



UNDERSTORY PROTECTION



GROUP SELECTION



COMMERCIAL THINNING



SINGLE-TREE SELECTION



HERBICIDE



DIAMETER-LIMIT CUTTING



SITE PREPARATION



INTENSIVE SILVICULTURE



STOCKING DENSITY



ARTIFICIAL SEEDING

Conventional



Alternative systems



Key trade-offs to consider

Economic and operational realities must also be assessed when considering implementation of alternative systems. The review identified several key trade-offs:

- **Extent of disturbance:** To maintain harvest volumes, adoption of these systems risks spreading disturbances across a greater amount of caribou habitat.
- Access: By spreading out disturbance, many of these systems also require more road access compared to conventional clearcut with retention. Additional road networks add to the human disturbance footprint and provide predators easier access into caribou habitat, which may outweigh any potential benefits to caribou.
- **Operational costs:** Compared to clearcutting, alternative systems involve additional costs and/or remove less timber volume per unit area, increasing relative harvest costs. This can impact the feasibility of alternative systems depending on the local context.

There are no "silver-bullet" solutions for a sustainable working landscape, but a richer understanding of the trade-offs and opportunities of alternative silvicultural systems can make it more achievable. Future issues of *the Exchange* will explore the findings and recommendations from the project report in more detail.

To learn more, read the full report at: arckp.friresearch.ca/content/project-reports

Minimizing impact to lichens during harvest

Lichens are an essential winter food for woodland caribou. However, the lichen mats that often carpet mature boreal forest stands are highly sensitive to disturbance. In some cases, the damage from forestry operations negatively impacts existing lichens. In other cases, thinning the forest canopy changes light and moisture conditions leading to greater lichen abundance over time. Managing lichens for caribou habitat is, therefore, a complex juggling act requiring forest planners to carefully consider how their operations can impact lichen. A recent report from West Fraser synthesizes the current knowledge of lichen management in caribou habitat and outlines best management practices to protect lichens during operations.

Lichens are sensitive to ground disturbance

Undamaged lichen mats are more likely to thrive and act as a source of propagules (spores/fragments) for new lichens. Minimizing ground disturbance during harvest operations will help keep lichen mats healthy and intact. Site preparation/scarification should be avoided in stands that are optimal for lichen (>15% lichen cover) where lichens are highly sensitive. Harvesting in the winter on top of the snowpack can also reduce the impact on lichen, though timing should be planned carefully to not disturb caribou occupying their winter range.

Minimizing ground disturbance may also reduce proliferation of aspen trees. Aspen are prone to suckering following damage to their roots and/or stems, which can contribute to more unwanted browse which attracts moose, deer and predators.



OPTIMAL LICHEN SITES (>15% LICHEN COVER) open canopy with poor, well-drained soils







Debris can smother lichens

Lichens are also easily smothered and damaged by woody debris. Taking steps to reduce debris can reduce damage and improve caribou access to lichen. Whole-tree harvesting can help reduce debris accumulation compared to delimbing and processing the tree on site. Cut trees should also be removed during precommercial thinning rather than left on-site. When it comes to retention, windthrow of retained trees can contribute to smothering of lichens and retention patches should be designed to help minimize blowdown.

Design a site-specific harvest strategy

Choosing the appropriate strategy for a given harvest site means asking some key questions: Is the site within current or possible future caribou range? Can the site support lichen over time? What is the goal for the site?

Depending on the site conditions, lichens may remain dominant over time or be gradually overtaken by feathermosses as part of a successional sequence. Planners may therefore, need to decide between conserving lichen for use by woodland caribou today or putting the site on a trajectory to support lichens in the future. More information on lichen/feathermoss site types and planning for lichen on the landscape can be found in Issue 3 of *The Exchange*.



OPTIMAL LICHEN SITES

RECOMMENDED: conserve lichens today. STAND-LEVEL DEFERRAL

ALTERNATE: Conserve lichens today as much as possible. **PARTIAL CUT/COMMERCIAL THINNING**



ALTERNATE: Restore lichens in 20-30 years VARIABLE RETENTION



MODERATE LICHEN SITES

RECOMMENDED: Maintain lichen for the next ≥20 years PARTIAL CUT/COMMERCIAL THINNING





MOSS DOMINATED SITES

RECOMMENDED: Manage for other woodland caribou habitat values VARIABLE RETENTION





Managing lichen availability for caribou is a complex challenge, but strategic choices in harvest strategy and technique can enable forest managers to maintain or restore lichens over time. Future issues of the *Exchange* will explore other considerations for lichen management, including prescribed burning and herbicide use.

McLoughlin, G., S. Odsen, and M. Pyper. 2021. Lichen Management in Woodland Caribou Habitat: A summary of the research and the opportunities to sustain woodland caribou winter forage. Report. West Fraser – Hinton Wood Products. Hinton, AB.

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-theground 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.



OUR VISION

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



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 Kristy Burke at kristy@fuseconsulting.ca or visit arckp.friresearch.ca





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



ARCKP Partners -----



























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



