



THE EXCHANGE:

Sharing Knowledge, Inspiring Solutions



2022
EDITION 5

PHOTO: ELSTON DZUS



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.

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Comparing alternative silviculture systems for caribou coexistence

Forest planners face complex decisions at every stage of the harvesting process. From the shape of the harvest block, to which trees are removed, to what post-harvest treatments are applied, planners need to carefully consider what silviculture system to apply to achieve a desired forest stand and structure. These decisions determine the extent and configuration of the harvest footprint, what type of vegetation is likely to regenerate on the site, and how different boreal species are likely to respond.

The conventional harvesting system in Alberta is clearcut with retention. This system is designed to mimic the patterns of wildfire but can have several negative impacts on woodland caribou. Active harvest operations can prevent woodland caribou from using the area, and the loss of mature forest stands can reduce habitat available for woodland caribou and reduce lichen availability on the landscape for long periods of time. In the years after harvest, a flush of young leafy browse can boost moose and deer populations, supporting a greater number of predators like wolves. Legacy road networks can also provide predators easier access into woodland caribou habitat.

Silviculture systems that mitigate industrial footprint and the promotion of browse could benefit woodland caribou and support a more sustainable working landscape. However, alternative silvicultural systems come with a suite of trade-offs, which can include increased access needs, higher operational costs and noise disturbance. A recent review funded by the Alberta Regional Caribou Knowledge Partnership draws on research and experience from other jurisdictions to identify silviculture systems and treatments that could potentially reduce the impact of forest harvest on caribou while remaining economically viable.

Silviculture systems were assessed in the context of:



Maintenance of **desirable caribou habitat attributes**.



Minimizing forage availability for other ungulates to facilitate lower predator populations.



Minimizing the extent and duration of access into caribou habitat.

Several key economic and operational trade-offs were also considered:



Extent of disturbance.



Access.



Operational costs.

The review identified several alternative systems with the potential to improve outcomes for woodland caribou as summarized in the following table.

Reading the table:



Saturated arrows indicate stronger impact and/or evidence.



Faded arrows indicate the impact or evidence is less strong.



Green arrows indicate a positive effect for caribou (e.g., increased habitat, decreased access)



Brown arrows indicate a negative effect for caribou (e.g., increased browse, decreased habitat)

SILVICULTURE SYSTEM



CARIBOU HABITAT



BROWSE



ECONOMICS



ACCESS



CLEARCUT AND SEED TREE

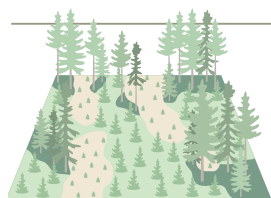


Efficient and cost-effective.



Access and disturbance can be minimized by using a single-entry and aggregated harvesting.

NOTES: Post harvest treatments may mitigate the growth of browse. Seed tree systems unlikely to benefit caribou and not well suited to Alberta's tree species.



SHELTERWOOD



More efficient than single-tree selection but requires additional pre-planning costs.



Access requirements vary by number of entries. In-block roads/skid trails can be temporary or permanent.

NOTES: High levels of retention likely required to maintain caribou habitat. Windthrow is a significant concern.



UNDERSTORY PROTECTION

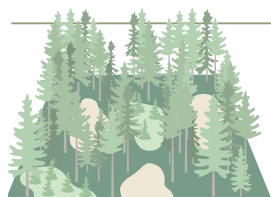


More efficient than single-tree/group selection but additional pre-planning and monitoring costs. Potentially increased AAC at forest level.



Final entry eventually required when understory matures. Roads can potentially be deactivated between entries.

NOTES: Conifer volume growth is accelerated without the use of site preparation, planting or tending with herbicides.



GROUP SELECTION

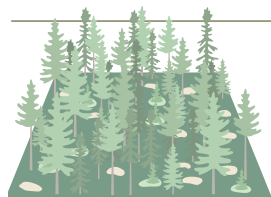


More efficient than single-tree/group selection but additional pre-planning costs. Re-entry required for subsequent harvests.



Access requirements higher but vary by number of entries. In-block roads/skid trails can be temporary or permanent.

NOTES: Group selection using small openings has been used to maintain arboreal lichens in British Columbia, but also led to increased habitat use by moose.



SINGLE-TREE SELECTION

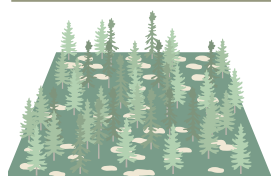


Additional planning, marking, site supervision, and specialized skills/machinery typically required.



Extensive road network typically required. Access may be required indefinitely for repeated entries.

NOTES: Single-tree selection or thinning treatments may accelerate development of old-growth stands and maintain or even promote lichen.



DIAMETER-LIMIT CUTTING

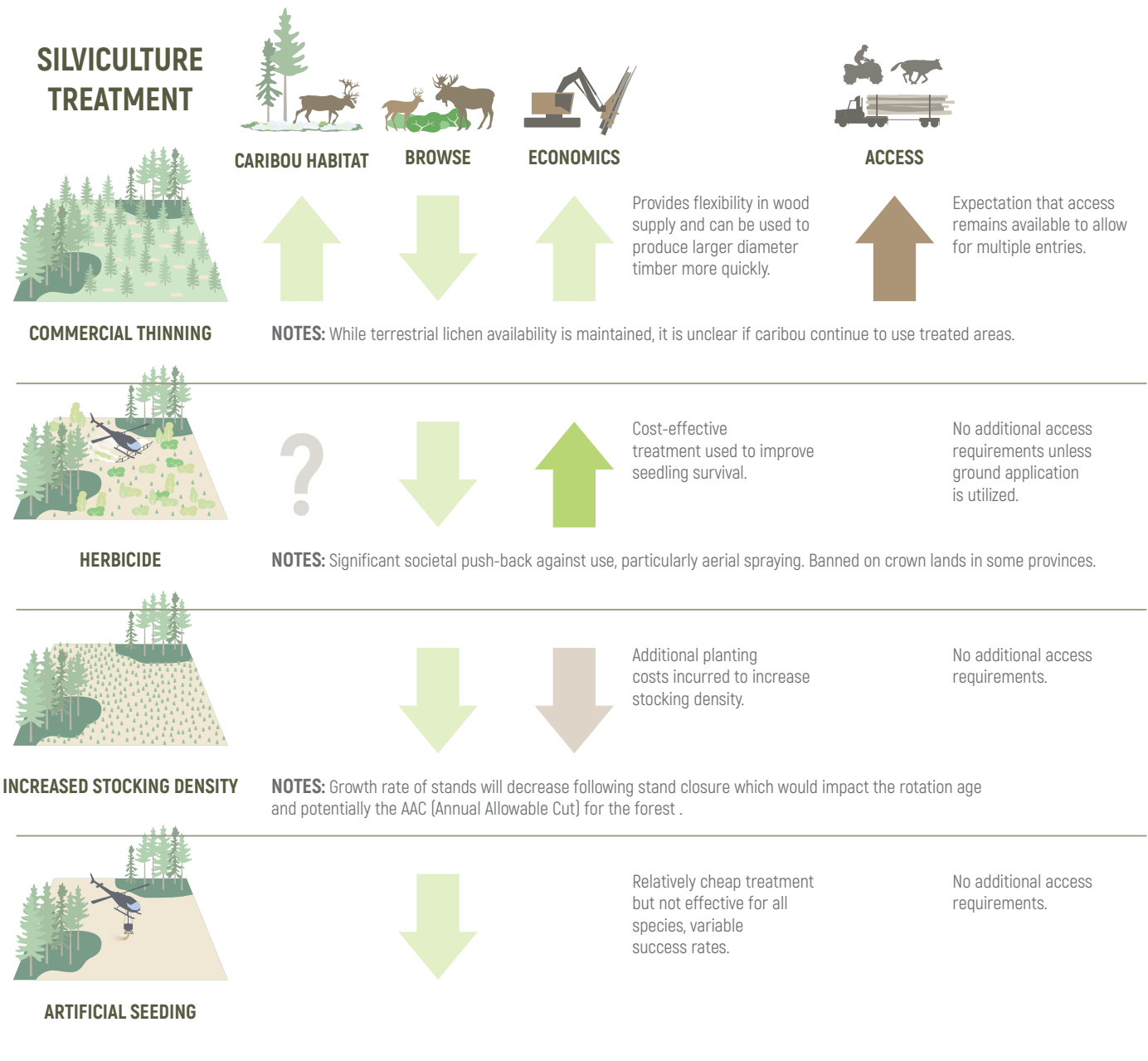


Additional planning, marking, site supervision, and specialized skills/machinery typically required. Typically short (e.g. 15-20 year) cycles.



Extensive road network typically required. Access may be required indefinitely for continuous cover forestry.

NOTES: Used primarily in Quebec and Ontario. Some indication that cutblocks in the Quebec diameter-limit system (known as CPPTM) are avoided by caribou but frequented by moose.



The success of a given system is highly dependent on local site conditions, and forest planners should consider what approach is best suited for their region. A large-scale field trial that replaces planned clearcuts with alternative systems would enable a better understanding of each system’s advantages and trade-offs and help open the door to adaptive land management and coexistence with caribou. For more detailed information on each of the alternative systems considered, read the full FORCORP report at <https://arckp.friresearch.ca/content/project-reports>.

The impact of aggregated harvest in three regions of Alberta

Designing harvest approaches to meet both ecological and socioeconomic needs is a complex balancing act. Aggregated harvest is currently the required approach in woodland caribou habitat for Forest Management Plans in Alberta. To date, there have been few studies that have assessed the outcomes of aggregated harvesting for woodland caribou, socioeconomics and a range of forest species.

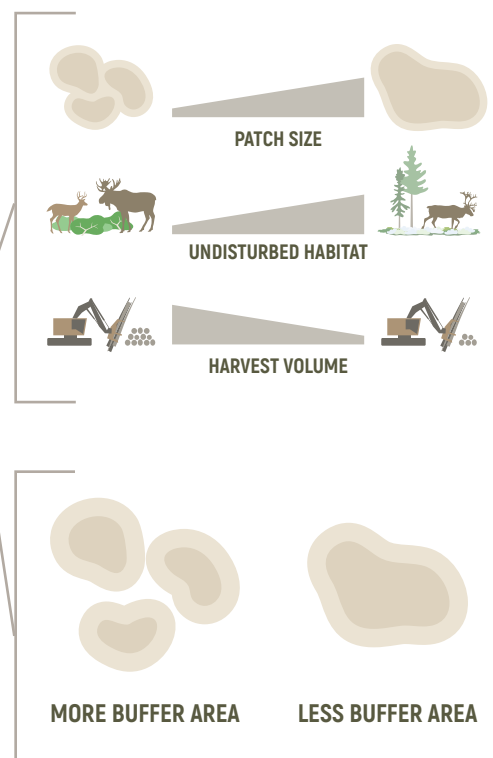
When it comes to woodland caribou planning, forest harvest disturbance includes the footprint of the harvest blocks, the road networks and a 500m buffer. Historical harvest techniques applied in Alberta – where blocks are not aggregated – result in disturbance spread out across the region. Clustering harvest blocks together and in larger patches can reduce the disturbance by reducing the total area of the disturbance buffers. In theory, this enables a similar amount of harvested area while increasing the portion of intact, undisturbed habitat on the landscape.

However, aggregated harvest strategies come with complex trade-offs. Aggregated harvest blocks can intensify impacts to species at the local scale, with fewer habitat islands to create habitat variation. From a socioeconomic perspective, aggregated harvesting may have lower operational costs, but also generally results in less wood volume overall due to stands being harvested at non-ideal successional stages.

To better understand these trade-offs and which strategies are most effective at achieving caribou habitat objectives and forest sector viability, the ARCKP funded a study that modeled a suite of harvest scenarios across three regions in Alberta: Berland, Chinchaga, and Wandering River. The scenarios tested different harvest block sizes ranging from small 2.5 ha patches to very large >10,000 ha patches. They also tested a variety of timing options, including consistent even flow entry into woodland caribou ranges and restricting entry to ranges to certain decades. Each scenario was conducted over a 100-year planning horizon.

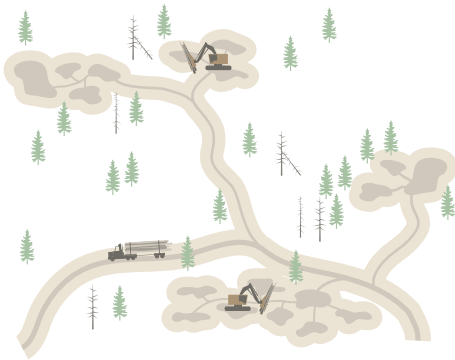
The study found notable trade-offs to aggregated harvest approaches:

- Caribou habitat objectives cannot be achieved while maintaining business-as-usual harvest levels in any of the regions. Some reduction in harvest level is necessary to achieve the >65% undisturbed target.
- Larger harvest patches correspond with greater undisturbed habitat, but reduced harvest volume.
- Aggregated harvest significantly reduces the amount of forestry buffer disturbance in caribou ranges and increases the proportion of biophysical habitat.
- No region could achieve >65% undisturbed habitat earlier than 80 years into the modelling scenario.
- In Berland and Chinchaga, the more heavily disturbed regions, only the scenario directing the model to meet the >65% undisturbed habitat successfully achieved the target. In Wandering River, which has a smaller active landbase, especially in woodland caribou range, multiple scenarios were able to achieve the target.

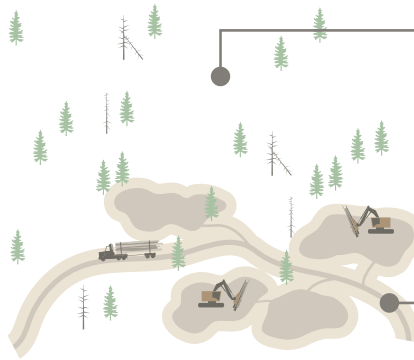


The study revealed several additional takeaways:

NON-AGGREGATED HARVEST



AGGREGATED HARVEST



1. Harvest volume per ha usually decreases, because more stands are harvested when they are younger or older than ideal, and other stands are never harvested.

2. Aggregated harvest produces a smaller buffered area and less road disturbance.



4. Larger harvest patches more closely emulate natural wildfire patterns.



3. At a regional scale, habitat for other species tends to increase, but impacts are "all or nothing" at a local scale.

While aggregated harvest involves important trade-offs, the specific impacts to harvest volume and habitat objectives depend on the amount and configuration of active landbase in the region. The following pages present a more detailed breakdown for each of the three regions studied.



Credit: Mercer Peace River Pulp Ltd.

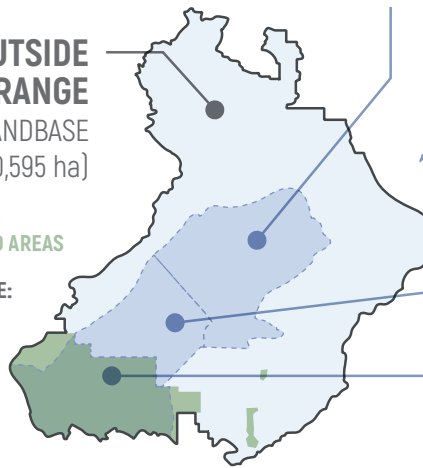
BERLAND

OUTSIDE CARIBOU RANGE

51% ACTIVE LANDBASE
(670,595 ha)

PARKS AND PROTECTED AREAS

ACTIVE LANDBASE:
AREAS AVAILABLE
FOR POTENTIAL
HARVEST



LITTLE SMOKY RANGE

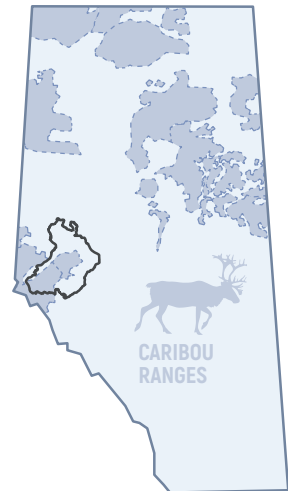
49% ACTIVE LANDBASE
(151,104 ha)

A LA PECHE WINTER RANGE

60% ACTIVE LANDBASE
(99,574 ha)

A LA PECHE SUMMER RANGE

0% ACTIVE LANDBASE



HARVEST LEVELS

BUSINESS-AS-USUAL HARVEST LEVELS WILL NOT ACHIEVE CARIBOU HABITAT OBJECTIVES

Regardless of aggregation targets or constraints, **harvest volume per hectare begins to decline steadily at year 50-60.**

To achieve the federal target of >65% undisturbed habitat, harvest would need to be reduced:

CONIFER HARVEST



81% OF BASELINE LEVEL
37% OF BASELINE WITHIN CARIBOU RANGES

DECIDUOUS HARVEST

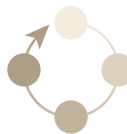


96% OF BASELINE LEVEL
38% OF BASELINE WITHIN CARIBOU RANGES



UNDISTURBED HABITAT

Disturbance targets for both the Little Smoky and A La Peche caribou ranges could only be achieved in one scenario, where very large patches are targeted in caribou range to force a >65% undisturbed outcome.



AGGREGATING HARVEST IN TIME

When harvest in caribou range is aggregated temporally, available undisturbed habitat drops considerably in following decade.

Harvesting a similar amount from the caribou range in each decade appears to be a better approach.



EFFECTIVENESS OF ROAD RESTRICTION

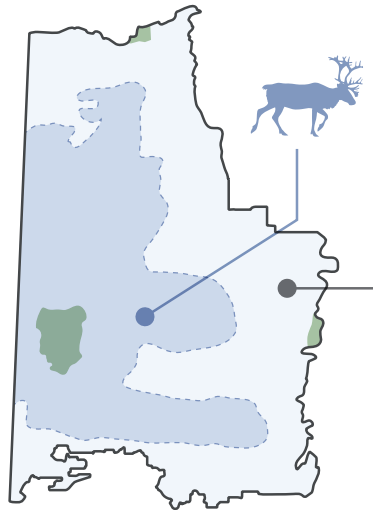
Because patches of active landbase are more concentrated in the Berland region, less roads are required to access harvest blocks. Instead of road restrictions, **controlling harvest patterns is more effective at achieving habitat objectives in this region.**



CHINCHAGA

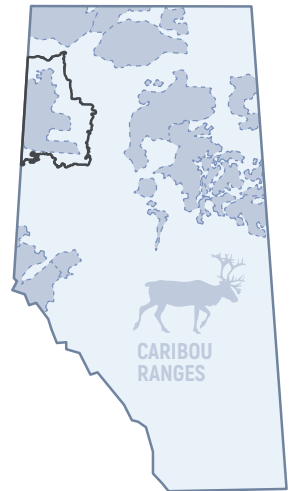
PARKS AND PROTECTED AREAS

ACTIVE LANDBASE:
AREAS AVAILABLE FOR
POTENTIAL HARVEST



CHINCHAGA
34% ACTIVE LANDBASE
(597,121 ha)

OUTSIDE CARIBOU RANGE
42% ACTIVE LANDBASE
(881,184 ha)



HARVEST LEVELS

BUSINESS-AS-USUAL HARVEST LEVELS WILL NOT ACHIEVE CARIBOU HABITAT OBJECTIVES

Regardless of aggregation targets or constraints, **harvest volume per hectare begins to decline steadily at year 50-60.**

To achieve the federal target of >65% undisturbed habitat, harvest would need to be reduced:

CONIFER HARVEST



78% OF BASELINE LEVEL
51% OF BASELINE WITHIN CARIBOU RANGES

DECIDUOUS HARVEST



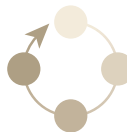
88% OF BASELINE LEVEL
52% OF BASELINE WITHIN CARIBOU RANGES



UNDISTURBED HABITAT

Disturbance due to forest harvesting increases in the near term for most scenarios due to historical avoidance and natural disturbances.

None of the scenarios achieved the federal disturbance target before year 80.



AGGREGATING HARVEST IN TIME

When harvest in caribou range is aggregated temporally, available undisturbed habitat drops considerably in following decade.

Harvesting a similar amount from the caribou range in each decade appears to be a better approach.

EFFECTIVENESS OF ROAD RESTRICTION

Due to a more spread out active landbase, roads contribute significantly to disturbance in this region. **Road restrictions and controlling harvest patterns are both important** to achieving caribou habitat objectives.



BOTH ARE IMPORTANT

WANDERING RIVER

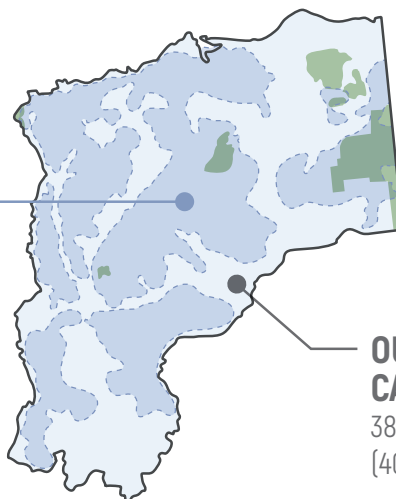


EAST SIDE ATHABASCA RIVER (ESAR) RANGE

18% ACTIVE LANDBASE
(212,486 ha)

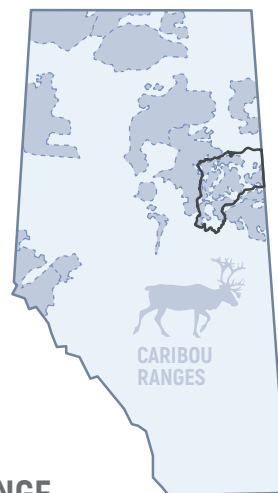
PARKS AND PROTECTED AREAS

ACTIVE LANDBASE:
AREAS AVAILABLE FOR
POTENTIAL HARVEST



OUTSIDE CARIBOU RANGE

38% ACTIVE LANDBASE
(407,752 ha)



HARVEST LEVELS

BUSINESS-AS-USUAL HARVEST LEVELS WILL NOT ACHIEVE CARIBOU HABITAT OBJECTIVES

Regardless of aggregation targets or constraints, **harvest volume per hectare begins to decline steadily at year 50-60.**



UNDISTURBED HABITAT

Disturbance due to forest harvesting increases in the near term for most scenarios due to historical avoidance and natural disturbances.

None of the scenarios achieved the federal disturbance target before year 80.

To achieve the federal target of >65% undisturbed habitat, harvest would need to be reduced:

CONIFER HARVEST

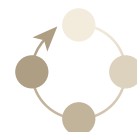


81-86% OF BASELINE LEVEL
28-45% OF BASELINE WITHIN CARIBOU RANGES

DECIDUOUS HARVEST



84-87% OF BASELINE LEVEL
33-54% OF BASELINE WITHIN CARIBOU RANGES



AGGREGATING HARVEST IN TIME

Temporal aggregation of forest harvest seems to be a reasonable strategy to meet caribou habitat objectives.



EFFECTIVENESS OF ROAD RESTRICTION

Due to a more spread out active landbase, roads contribute significantly to disturbance in this region. **Road restrictions and controlling harvest patterns are both important** to achieving caribou habitat objectives.



BOTH ARE IMPORTANT

Vegetation control is a double-edged sword when it comes to lichen

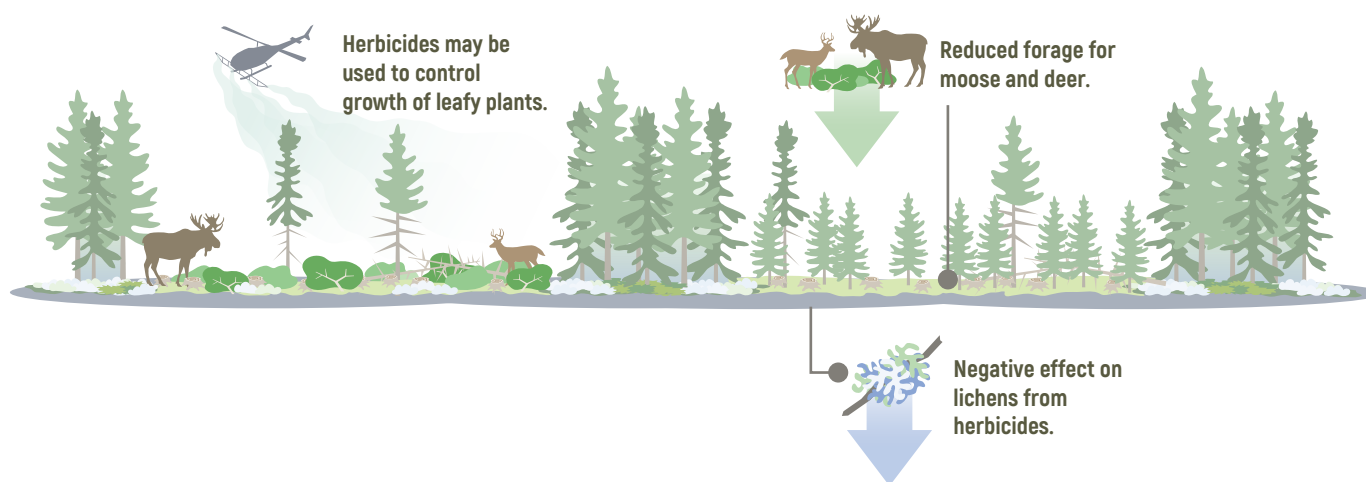
Lichens are critical to woodland caribou survival, providing important winter forage. Ground lichens are highly sensitive to disturbance, however, and forest planners should consider impacts to lichen when harvesting stands located in woodland caribou ranges.

Through thoughtful consideration of the short- and long-term goals for the site, it is possible to design a site-specific harvest strategy that supports lichen availability on the landscape. For instance, winter harvest on snowpack can reduce damage to existing lichen mats by minimizing ground disturbance. Likewise, in some sites, thinning the forest canopy can promote lichen growth. A recent report from West Fraser identifies some practices in addition to the choice of harvest strategy which can help promote lichen abundance on the landscape.

Where lichen protection is the goal:

Avoid herbicides

Conifer seedlings can often be outcompeted by fast-growing grasses and shrubs. To promote the growth of conifers after harvest and speed up forest growth after harvest, herbicides are sometimes used to control the growth of leafy plants. This reduction in browse could indirectly benefit woodland caribou by reducing moose populations, leading to fewer predators on the landscape. However, both glyphosate and 2,4-D have been associated with negative short- and long-term effects on the lichens woodland caribou rely on. Therefore, despite potential benefits in browse reduction, herbicides should be avoided in stands with abundant lichen where lichen conservation is a management goal.

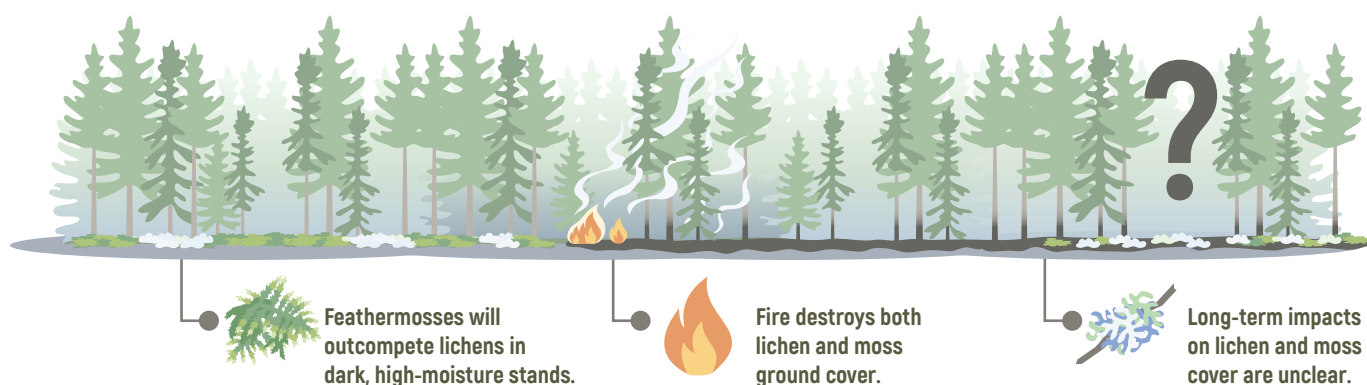


Avoid prescribed burning

Fire is destructive to ground lichens and the burning of a lichen-dominated stand could significantly impact short-term lichen restoration. While prescribed burning is a critical forest management practice for a variety of objectives, such as reducing wildfire risk, its use should be avoided in lichen-dominated stands.

The long-term impacts of fire on lichens, however, are less clear. In darker, higher moisture stands, feathermosses will outcompete lichens over time. By destroying moss cover and resetting the succession clock, fire may provide lichens the opportunity to proliferate once again. More research is needed, however, to understand the potential role of prescribed burning in moss-lichen succession dynamics.

Fire destroys lichen cover in the short term. In high moisture stands, long-term impacts to lichen-moss dynamics are unclear.



Encourage natural regeneration

Planting is widely used to achieve a more desirable stand composition and to meet reforestation requirements. However, planted stands tend to form a more closed forest canopy, while lichens generally benefit from a more open canopy. Left to regenerate on its own, a stand will tend to grow back in patches, allowing more light to reach the forest floor. Thus, natural regeneration can help promote greater lichen abundance. Lower planting densities or precommercial thinning may be used to encourage more open canopies where planting is necessary to meet reforestation requirements.

PLANTED STAND

More closed canopy reduces light levels.



NATURALLY REGENERATED STAND

Patchier canopy increases light levels.



Lichens are highly sensitive and respond to harvest in complex ways. While advances have been made in lichen management, more research is needed to understand the effects of harvest and stand management techniques through time and at greater scales. Through careful planning, however, land managers can choose strategies that reduce negative impacts to lichens and support the availability of this critical woodland caribou food.

Further Reading:

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-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.



OUR VISION

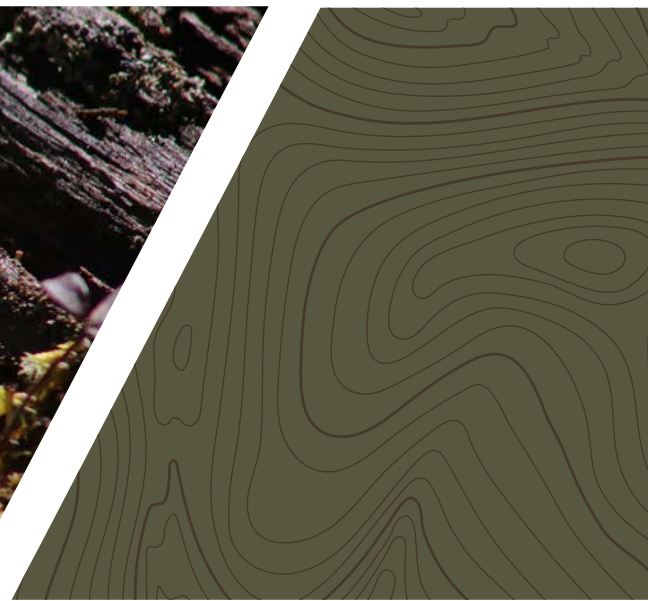
A collaboration promoting self-sustaining caribou populations and a viable forest sector.



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 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



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