PROACTIVE CARIBOU PROTECTION THROUGH LINEAR RESTORATION

A White Paper

October 2015
INTRODUCTION

Many of the Woodland Caribou herds in Alberta are in decline and facing pressure from the cumulative impacts of habitat alteration from both human and natural sources\(^1\). Environment Canada released a recovery strategy for Woodland Caribou, boreal populations in 2012 and mandated the provincial/territorial governments to have range specific recovery plans in place by 2017. With the approaching deadline, there is risk of federal intervention and ultimately the potential for resource development restrictions in critical caribou habitat areas. Caribou recovery is complicated and involves multiple factors including increasing and maintaining the amount of functional habitat, improving the quality of existing habitat, and predation control. Although the situation is complex, opportunities exist for industry to be proactive and engaged in caribou recovery. Being proactively involved can help mitigate the risk of government imposed restrictions and strengthen a company’s social license. This white paper explores the various recovery tactics for caribou and focuses particularly on linear restoration of legacy conventional seismic lines as a significant opportunity for industry to be involved in the restoration of functional habitat.

BACKGROUND

The Woodland Caribou (\textit{Rangifer tarandus caribou}), Boreal population ("boreal caribou") is designated as threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and listed under the federal Species at Risk Act (SARA)^2\. In 2012 under SARA, Environment Canada released a recovery strategy with a goal of achieving self-sustaining local populations in all boreal caribou ranges across Canada, which it deems both technologically and biologically feasible. The strategy outlines a number of risks to local populations across Canada including habitat alteration from human activities and natural disturbances. These factors can have cumulative impacts (e.g. predation rate increase from habitat alteration) putting significant pressure on some of the local populations.

There are 12 boreal caribou ranges in Alberta, only one of which is deemed stable.


Federal Targets Have Been Set for Habitat Intactness

The recovery strategy lists undisturbed range habitat as a key driver to recovering boreal caribou populations. Environment Canada has suggested a management threshold of 65% undisturbed habitat to help increase the probability of self-sustaining populations. Currently the level of disturbance in boreal caribou ranges varies across Canada, with the situation in Alberta considered critical. Many of the ranges overlap with resource rich areas for the forestry and oil & gas industries and are currently well below the recommended management threshold. Of the 12 boreal caribou ranges in Alberta only one is estimated to be stable, 10 are in decline or are decreasing, and the status of the remaining range is unknown.

The Risk of Government Intervention with Inaction

Beyond habitat intactness, the federal recovery strategy does not outline range specific measures to help achieve a goal of self-sustaining populations. Range planning has been tasked to the provincial/territorial governments with a deadline for action plans set for 2017. Should the caribou population situation deteriorate further in Alberta, or if the range plans are delayed in their release, there is the risk of the federal government intervening and issuing an Emergency Order for the Protection of Woodland Caribou, which could significantly affect the forestry and oil & gas industries in the province.

What an Emergency Protection Order Could Mean

In 2013, the federal government issued an Emergency Order for Protection of the Greater Sage-Grouse. In this case, an Emergency Order for the Protection of the Greater Sage-Grouse was issued, affecting 167,000 hectares in southeast Alberta and southwest Saskatchewan. This order effectively restricts any new development in the affected areas and seasonally restricts operations of existing oil wells. Boreal caribou ranges cover over 13 million hectares in Alberta and should an emergency order occur for any number of the ranges in the province, the impacts to the resource industry would be significant.
What Can Companies Do

Opportunities exist for industry to be proactive and engaged in caribou recovery. Proactive options for caribou recovery can help caribou populations, further a company’s social license and potentially mitigate the risk of new government imposed restrictions.

Proactive Options for Caribou Recovery

There are a variety of options available for boreal caribou recovery. A report by the Athabasca Landscape Team (ALT) in 2009 outlined two primary strategies:

1. Restoration of functional habitat, where options include:
   - Designating exclusion zones protected from further development
   - Coordinated reclamation efforts
   - Best management practices for development activities (e.g. footprint minimization options)

2. Mortality management, where options include:
   - Controlling predators such as wolves (e.g. wolf population control)
   - Cow-calf penning (enclosures during critical life stages) or other fencing

The ALT report concluded that a combination of both habitat restoration measures and mortality management strategies are required in order to successfully recover boreal caribou populations in the Lower Athabasca region of Alberta. Although both are needed, mortality management strategies can be a large undertaking for one company to successfully implement. However, a number of companies have implemented functional habitat restoration options which have provided them with a significant opportunity to be proactively involved in the recovery of caribou habitat.

Linear Restoration to Restore Functional Caribou Habitat

The ALT report lists a current lack of functional habitat to support long term recovery of boreal caribou as a critical item. Broad-scale functional habitat, as defined by Environment Canada, is dependent on location and seasonal requirements, but is primarily mature coniferous forests undisturbed by human activity and fires. Alberta’s landbase has been fragmented from years of resource exploration and development in addition to natural disturbances that have left a significant footprint on the landscape. In recent years, there have been ongoing improvements in exploration techniques that have allowed for faster recovery of the forest. However, legacy conventional seismic lines have been slow to re-vegetate on their own, especially in lowland conditions, leaving a substantial mark on the landscape. Some of these legacy seismic lines have remained on the landbase for well over 30 years, creating corridors that result in increased caribou predation. There are currently no government regulations in place requiring restoration of these historic seismic lines, presenting a significant opportunity for industry to go above and beyond what is legally required and restore these linear features within boreal caribou ranges to increase functional habitat. Going above current regulatory requirements will not only improve social license, it also allows for additionality should the government pursue conservation offset policy.

Seismic line restoration in lowland conditions has only been operationalized within the last five years in Alberta. In 2011, in collaboration with the Government of Alberta and the Grand Prairie Regional College, a number of companies designed a pilot program to test the feasibility of winter tree planting in northern Alberta. With the success of this pilot, seismic line restoration in lowland conditions became much

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Additionality: Actions taken that go beyond business as usual. Under a proposed conservation offset policy, the environmental outcome must be one that would not be otherwise achieved under current practices.
more feasible. In areas that are extremely wet, winter planting allowed for easier access into areas previously inaccessible in summer months. The Algar Habitat Restoration Program, under the Landscape Ecological Assessment & Planning (LEAP) framework was launched soon after the success of the winter planting pilot. Co-developed by Silvacom and a group of oil sands companies, LEAP projects to-date have restored over 370 km of linear footprint within caribou habitat in Alberta.

**IMPLEMENTING A LINEAR RESTORATION PROGRAM**

1. Strategic to Tactical Planning

To have a successful linear restoration program, a significant amount of time needs to be spent in the planning phase. It is imperative that site-level restoration treatments are directly connected to larger strategic landscape goals such as restoring functional caribou habitat. A state of the art restoration program also tracks additional ecosystem services added to the landbase through restoration, for example: water quality, timber supply, and carbon sequestration, among others. This allows for program level thinking, where a basket of goods is tracked and accounted for, rather than focusing on a single objective. This type of holistic management is being applied more often, as seen in the Northern Gateway pipeline and the Trans Mountain pipeline approval processes through the National Energy Board as well as Play-based Regulation in Alberta.

A restoration plan can be developed for an area of interest with basic inventory information, however it becomes difficult to understand whether the program will actually achieve the strategic objectives set out. Modeling is an effective way of analyzing the long term implications of the timing and location of management actions (e.g. linear restoration) to increase the ability of meeting the overall objectives. It can add assurance to the success of the program by modeling results under multiple scenarios to improve confidence in long-term outcomes. Modeling also provides a trajectory that results can be measured against to ensure landscape objectives will be met. Strategic to tactical planning is a process used in the LEAP framework to link the future landbase to the current condition under multiple management alternatives.
Selecting a Model: Simulation vs Optimization

There are various modeling tools that exist to facilitate this analysis and models should be carefully selected to fit the specific project at hand. There are two basic kinds of modeling platforms: simulation and optimization.

Simulation platforms will project forward actions taken today for a given set of parameters that could be stochastic (random) or deterministic in nature. The advantage of a simulation platform is that the results are often straightforward to interpret, however it can be a trial and error approach to determine the best scenario or set of actions to achieve a strategic goal.

Optimization platforms, on the other hand, can determine the best course of action to take today to meet a given objective in the future (e.g. which lines to restore for the least cost and the most functional habitat benefit). This allows for cost-effective approach to planning, not easily attainable in simulation platforms. Optimization model formulation can be more complicated (e.g. linear programming, mixed integer programming, simulated annealing) and the results can be more difficult to interpret, yet it creates a strong link between strategic objectives and tactical planning.

Selecting Model Inputs: Raster vs Vector

Another key characteristic to consider when selecting a model is the type of data it uses to represent the landscape. Many models use raster data inputs; grids of pixels with a predefined scale that represent landbase features. Raster-based models are effective when large data sets are being used for high level strategic analysis since they are often faster and more efficient to run at this level. The challenge is linking raster datasets to the tactical level information as resolution may be too coarse to be meaningful. For example, it is difficult to estimate restoration requirements (e.g. how many trees to plant, total kilometres restored, etc.) when employing a coarse raster dataset because the pixelated cells will not accurately reflect the physical characteristics of the landbase. Alternatively, vector-based inputs maintain full spatial resolution of the dataset allowing the model to be scaled between the strategic and tactical levels comfortably. This level of detail becomes essential when operationalizing a linear restoration program in the field. It also provides more confidence in the modeling results, as inputs are tangible and as close to the physical landbase as possible.

Selecting the Right Areas: Core Habitat Expansion vs Historic Lease Footprint

As part of the planning process, determining whether restoration will occur on or off-lease is critical. The two primary options are focused on expanding core caribou habitat in areas outside of high development activity or focused on restoration on the company’s lease. Both options have separate benefits. Focusing on core caribou habitat areas is beneficial when the areas are away from primary activity. The caveat is that these areas are often remote, creating access and logistics challenges that can add a significant cost to a restoration program.

Restoration on-lease can present cost savings with existing access and infrastructure already in place. The limitation of restoring land close to development activities is that the benefit to caribou long-term is usually less than off-lease restoration. The area restored may be developed in the future, and even with conservation easements in place, it does not stop neighbouring leases from developing close to the restoration site. In effect, this can cause conservation “islands”, where habitat is not contiguous. However, there is still great value in adding to the overall intactness of caribou habitat both for populations and for an organization’s contribution as it relates to social license.
Selecting Lines: Using Fieldwork vs Remote Sensing

Once an area for restoration is selected, an optimization or simulation model is used to select specific lines for treatment. If using an optimization platform, modeling will prioritize lines for restoration based on company specific goals (e.g. caribou habitat, old growth, etc.). Then, once modeling is complete, lines should be field verified to ensure the treatment prescribed is correct (e.g. winter planting or natural regeneration protection). Alternatively, a highly detailed land inventory, like Silvacom’s Comprehensive Automated Land Inventory (CALI) can be used to estimate the number of trees required for restoration, help develop access plans, communicate areas of concern to operators, and refine site-level treatment prescriptions. Leveraging inventories like CALI will help lower the cost of the restoration program as less time is needed in the field.

2. Getting it Done – Linear Restoration Techniques

There are a variety of techniques that have been piloted in Alberta for linear restoration including:

- **Deactivation techniques** to reduce human and predator access
- **Re-vegetation techniques** to restore vegetation cover and ecosystem function

Deactivation

Deactivation techniques are primarily aimed at mortality management by controlling predator access within caribou habitat areas. Research has shown that linear features are heavily used by wolves to travel, helping increase caribou predation risk. Deactivation techniques involve creating movement or line of sight barriers to help reduce ease of predator access through caribou habitat. Techniques that have been used include:

- **Blocking direct access** to unused seismic lines from main access corridors with berms, coarse woody material or a combination of both. This method deters human access, however it does not necessarily deter other predators such as wolves.
- **Blocking intersections of seismic lines.** This method is intended to minimize long distance travel and line of site for predators.
- **Tree tipping to block line of sight.** This method is intended to minimize line of sight, however it may be a short term solution as the trees will eventually fall over. This will, over time, add coarse woody material to the site and may promote natural re-vegetation in the future.

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Re-vegetation

Re-vegetation techniques are primarily aimed at functional habitat restoration and involve re-establishing tree cover on legacy seismic lines. Tree seeding, tree planting and scarification can all be used to promote re-vegetation. When planting or seeding trees, it is imperative that proper protocols are followed in order to maximize the probability of seedling survival and ensure re-vegetation success. These protocols include selecting appropriate species for site conditions, sourcing seed and seedlings from appropriate provincial seed zones and following proper handling and storage techniques to mitigate potential damage to seed and seedlings. Silvacom has developed a “Seedling Storage, Handling, Transportation and Planting Protocol” booklet to ensure best practices are followed.

All re-vegetation techniques will usually require some form of mechanical site preparation for trees to establish successfully. Mounding with an excavator is the most common technique. The creation of mounds acts as a barrier to access and encourage planted seedlings to establish successfully by keeping them above the water table in extremely wet areas.

Many legacy seismic lines that are not naturally regenerating are prevalent in lowland conditions, making access limited to the winter months. With sufficient frost, a machine can access the lines and create mounds for tree planters to plant trees. If there is minimal frost due to early snow or warm winter weather, a modified form of matting can be used to mitigate risk of machinery breaking through the ice and frost. This does, however, slow down productivity significantly. Other options to mitigate the risk in low-frost conditions, include freezing the lines before planting begins. This method can make it difficult for the machinery to efficiently dig mounds, especially if the freezing causes too much frost in the ground. To overcome this issue, Silvacom and project partners have developed a special mound technique called bar mounding.

Industry has shown a renewed interest in re-vegetation techniques as this form of restoration may give companies the opportunity to add to conservation offsets, should the government pursue this type of policy. By treating legacy seismic lines in core caribou habitat, industry may potentially receive offset credits for caribou habitat, while also adding a number of ecosystem services to the landbase.
Absence of Regulatory Standards

While there are a variety of linear restoration techniques, there are currently no regulatory standards identifying what constitutes a restored seismic line. There is currently a lack of provincial government direction pertaining to how tall vegetation must be, how many metres of a seismic line must be treated, and what treatments qualify for a line to be considered restored. Furthermore, there is currently no government mechanism in place to establish a form of protection following restoration.

3. Monitoring

The last component of a successful linear restoration program is monitoring. It is important to ensure the program has met the ecological goals set out in the planning process. In addition, it is an important feedback loop that can provide valuable information needed to adapt models and plans if treatments are found to have exceeded or fallen short of expectations.

Monitoring can be done with passive methods such as field tours and fly-overs. This provides basic and objective information on program performance. A more effective approach is to develop a monitoring program with scientific rigor. To do this, fixed plots of vegetation surveys and wildlife cameras are good starting points. To produce sound scientific results, it is important to accurately record the forest condition on a sample of lines before and after restoration occurs. Vegetation surveys usually consist of two parts: photos to visually capture the line’s condition, and vegetation and coarse woody material surveys to quantify its condition. Measurements should be taken, analyzed and reported at regular intervals.

Furthermore, with the technological improvements seen in remote sensing, there is also the possibility to use LiDAR and similar technologies to estimate the amount of regeneration on treated lines. This could significantly reduce the amount of time spent in the field and should be considered when developing a monitoring program.
CONCLUSION

Deadlines for caribou range plans in Alberta are imminent. Currently, there is a lack of certainty surrounding the direction regulatory agencies will take regarding caribou protection. It is in the best interest of industry to be proactive in managing for caribou, especially where they can make significant contributions through the restoration of functional habitat. Not only will restoration strengthen a company’s social license, should the government pursue conservation offset policy, industry may potentially receive offset credits for their restoration efforts, while also adding a number of ecosystem services to the landbase, such as water quality, carbon storage and timber supply.

There are many considerations when developing a linear restoration program. A carefully developed plan that uses modeling to select appropriate regions and seismic lines for treatment, as is done in the LEAP Framework, is essential to ensure that the program achieves the most ecological benefit for the effort invested. Site level treatment prescriptions are also important to consider and should include a combination of deactivation and re-vegetation techniques. Winter tree planting with coarse woody material placement is a verified option for achieving both functional habitat restoration and controlling the movement of predators within critical habitat areas. Lastly, no program should be considered complete without a monitoring plan to ensure that treatments in a particular area are performing as expected and helping meet landscape targets for boreal caribou.