CPAWS
CANADIAN PARKS AND WILDERNESS SOCIETY
NORTHERN ALBERTA

# Alberta's Caribou:

## A Guide to Range Planning
## Vol. 1: Northeast Alberta

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## Vol. 1: Northeast Alberta

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*The best time to plant a tree was 20 years ago.*
*The second best time is now.*

– Chinese Proverb

Caribou - P Mather

# *Table of Contents*

Mossy Boreal - M Berkman

# Introduction

Boreal woodland caribou (*Rangifer tarandus caribou*) are an iconic Canadian species: they have provided sustenance to Aboriginal communities for thousands of years, their silhouette graces our 25 cent coin, and they are a symbol of a healthy forest. Despite their iconic status, however, boreal woodland caribou are in trouble – especially in Alberta. Currently listed on the federal *Species at Risk Act*[1] Schedule 1 as "threatened," industrial development pressures have disrupted their habitat in Alberta's boreal forest, destroying important intact landscapes that are essential to their survival and making them more vulnerable to predation from wolves and bears.

Caribou are indicators of intact forest ecosystems. They thrive in large tracts of intact forest and rely mainly on a diet of lichen, which takes decades to grow in forest ecosystems. Caribou are an "umbrella" species due to their large home ranges that span multiple habitats. Therefore, protecting caribou and their habitat benefits the whole forest and all other boreal species that live in it.[2]

This document is a ground-level look at boreal woodland caribou in northeastern Alberta: their status, their habitat, the pressures they face, and what is needed for their recovery in this province. It is intended to guide those working on creating robust, scientifically-sound range plans designed to bring Alberta's boreal woodland caribou back from extremely low population numbers. This document synthesizes current science and range planning knowledge on boreal woodland caribou with herd-level understanding in northeast Alberta. Our hope is that it inspires the province of Alberta to better protect this important animal by creating solid, evidence-based range and action plans.

Volume one of this three-part series specifically addresses boreal woodland caribou ranges in northeastern Alberta – the Red Earth, West Side Athabasca River ("WSAR"), East Side Athabasca River ("ESAR"), Richardson, Cold Lake, Nipisi, and Slave Lake boreal woodland caribou ranges. Two more reports will be released by CPAWS Northern Alberta over the course of 2016: the Little Smoky ranges report, and a report on northwestern ranges.

# Boreal Woodland Caribou in Alberta

## Life history and Habitat Requirements

Boreal woodland caribou (hereafter referred to as caribou) are a relatively long-lived, medium-sized ungulate. Females do not reach reproductive maturity until around 3 years of age, and only have one calf per year.[3] Their low reproductive rate leaves them at a disadvantage compared to the higher reproductive rates of moose and deer, both of which reach reproductive maturity at as young as one year of age and are capable of producing twins or triplets.[4] This difference in reproductive capability becomes important when predation increases, as it results in a drastic downward population response in comparison to other, more productive prey species.

Caribou live in large areas of mature forest dominated by *Picea marianus* (black spruce) and *Pinus* spp. (pine) trees with extensive peatland coverage.[5,6] These areas provide prime substrate for *cladina* lichens which make up a majority of boreal woodland caribou diet during the winter season.[7] The cause of caribou decline in Alberta is not due to a nutritional deficit – there are high pregnancy rates in boreal woodland caribou in Alberta but low recruitment into the population.[8] This is indicative of an adequate food supply. Rather, the most likely cause of the drastic decline in Alberta's caribou is high calf mortality– the result of increased predation due to climate change and habitat disturbance which has increased predator numbers and allowed predators better access to caribou habitat. [9,10,11]

1 *Species at Risk Act, SC 2002,* c 29.*SC 2002 c 29*, 2002.
2 Orphé Bichet et al., "Maintaining Animal Assemblages through Single-Species Management: The Case of Threatened Caribou in Boreal Forest," *Ecological Applications* 26, no. 2 (2016): 612–23, doi:10.1890/15-0525.
3 The Alberta Woodland Caribou Recovery Team, "Alberta Woodland Caribou Recovery Plan," 2005, 44.
4 Brian Ransom, "Reproductive Biology of White-Tailed Deer in Manitoba," *The Journal of Wildlife Management* 31, no. 1 (1967): 114–23.
5 Corey J. A. Bradshaw et al., "Winter Peatland Habitat Selection by Woodland Caribou in Northeastern Alberta," *Canadian Journal of Zoology* 73, no. 8 (1995): 1567–74, doi:10.1139/z95-185.
6 Glen S. Brown et al., "Predicting the Impacts of Forest Management on Woodland Caribou Habitat Suitability in Black Spruce Boreal Forest," *Forest Ecology and Management* 245, no. 1–3 (2007): 137–47, doi:10.1016/j.foreco.2007.04.016.
7 James Schaefer and William Pruitt, "Fire and Woodland Caribou in Southeastern Manitoba," *The Wildlife Society* 74, no. 8 (1992): 2337–50.
8 Philip D Mcloughlin et al., "Declines in Populations of Woodland Caribou," *Source: The Journal of Wildlife Management* 67, no. 4 (2003): 755–61, http://www.jstor.org.
9 Ibid.
10 A. David M Latham et al., "Movement Responses by Wolves to Industrial Linear Features and Their Effect on Woodland Caribou in Northeastern Alberta," *Ecological Applications* 21, no. 8 (2011): 2854–65, doi:10.1890/11-0666.1.
11 Hannah W McKenzie et al., "How Linear Features Alter Predator Movement and the Functional Response.," *Interface Focus* 2, no. 2 (2012): 205–16, doi:10.1098/rsfs.2011.0086.

## Issues and threats

The decline of boreal woodland caribou in Alberta can be attributed to loss and fragmentation of their boreal habitat leading to altered predator-prey dynamics. Caribou have low tolerance for human disturbance in their habitat; they avoid predation through spatial separation from other ungulates and need large tracts of undisturbed habitat to maintain self-sustaining populations.[12] Within caribou ranges, disturbances, such as roads, seismic lines, well pads, cut blocks, and mining operations may have a relatively small actual footprint but can cause greater functional habitat loss due to caribou avoidance and increased predator usage, which changes natural predator prey relationships.[13,14,15,16]

Anthropogenic changes to the landscape due to industrial activity (seismic lines, pipelines, well pads, cut blocks and other disturbances) have decreased available habitat for boreal woodland caribou and allowed increased predator access – the direct cause of caribou mortality in Alberta.[17,18,19,20] Predators such as wolves use human-created roads, seismic lines, and trails, allowing access into the forest for more efficient hunting and increasing the vulnerability of caribou.[21,22] At the same time, industrial disturbance within the boreal forest has removed mature forest preferred by caribou and created an abundance of new growth forest – creating more suitable habitat for primary prey species such as moose. Newer vegetative growth in combination with climate change and increasing temperatures in the north are also resulting in more habitat for white tailed deer.[23,24] The result is a population increase in alternate prey species in Alberta's boreal forest which has raised the carrying capacity for predators within boreal woodland caribou range.[25] Declining boreal woodland caribou numbers have not had a negative effect on wolf populations as they make up an insignificant portion of wolf diet;[26] however, the increase in primary prey populations has led to greater incidental predation on caribou by wolves and other predators.[27,28]

## Current Legal Status

Boreal woodland caribou populations in Alberta have been in decline since the 1940s.[29] In 1987 the Alberta *Wildlife Act*[30] identified boreal woodland caribou as "threatened," and they were legally designated as such in Schedule 6 of that act in 1997. Boreal woodland caribou were federally listed as threatened on Schedule 1 of the *Species at Risk Act* ("SARA") in 2003.[31]

## The Federal Recovery Strategy and Range Planning

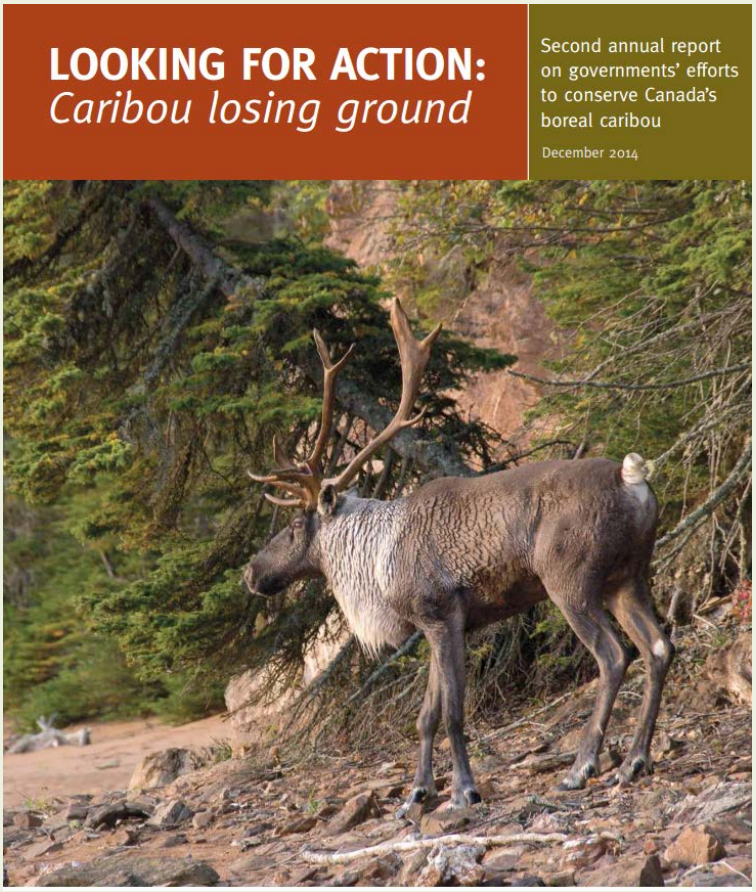
The listing of boreal woodland caribou on Schedule 1 of SARA in 2003 led to the creation of the 2012 *Recovery Strategy for the Woodland Caribou (Rangifer tarandus caribou), boreal population, in Canada* (the "Recovery Strategy").[32] The Recovery Strategy is a Canada-wide review of the health of boreal woodland caribou herds and provides the legal impetus

12 Elston H Dzus, *Status of the Woodland Caribou (Rangifer Tarandus Caribou) in Alberta*, *Environment*, 2001.
13 S J Dyer et al., "Avoidance of Industrial Development by Woodland Caribou," *Journal of Wildlife Management* 65, no. 3 (2001): 531–42, doi:10.2307/3803106.
14 A R C James and A K Stuart-Smith, "Distribution of Caribou and Wolves in Relation to Linear Corridors," *Journal of Wildlife Management* 64, no. 1 (2000): 154–59, doi:10.2307/3802985.
15 Piotr Weclaw and Robert J Hudson, "Simulation of Conservation and Management of Woodland Caribou," *Ecological Modelling* 177 (2004): 75–94, doi:10.1016/j.ecolmodel.2003.12.052.
16 Paula Rae Oberg, "Responses of Mountain Caribou to Linear Features In a West-Central Alberta Landscape," *Wildlife Ecology and Managment.* (University of Alberta, 2001), doi:10.1017/CBO9781107415324.004.
17 Stuart-smith et al., "Woodland Caribou Relative to Landscape Patterns in Northeastern Alberta 61, no. 3 (1997): 622–33.
18 F F Mallory and T L Hillis, "Demographic Characteristics of Circumpolar Caribou Populations: Ecotypes, Ecological Constraints, Releases and Population Dynamics," *Rangifer* 10, no. 10 (1998): 49–60, doi:10.7557/2.18.5.1541.
19 James and Stuart-Smith, "Distribution of Caribou and Wolves in Relation to Linear Corridors."
20 Dyer et al., "Avoidance of Industrial Development by Woodland Caribou."
21 James and Stuart-Smith, "Distribution of Caribou and Wolves in Relation to Linear Corridors."
22 Latham et al., "Movement Responses by Wolves to Industrial Linear Features and Their Effect on Woodland Caribou in Northeastern Alberta."
23 Steeve D Côté et al., "Ecological Impacts of Deer Overabundance," *Annual Review of Ecology, Evolution, and Systematics* 35, no. 2004 (2004): 113–47, doi:10.2307/annurev.ecolsys.35.021103.30000006.
24 Latham et al., "Invading White-Tailed Deer Change Wolf-Caribou Dynamics in Northeastern Alberta," *Journal of Wildlife Management*, 2011, doi:10.1002/jwmg.28.
25 Ibid.
26 Latham et al., "Wolves, White-Tailed Deer, and Beaver: Implications of Seasonal Prey Switching for Woodland Caribou Declines," *Ecography* 36, no. 12 (2013): 1276–90, doi:10.1111/j.1600-0587.2013.00035.x.
27 Ibid.
28 P. Weclaw and R.J. Hudson, "Simulation of Conservation and Management of Woodland Caribou."
29 Alberta Wilderness Association, "Woodland Caribou History," 2015, https://albertawilderness.ca/issues/wildlife/caribou/#parentHorizontalTab4.
30 *RSA 2000, c W-10*
31 *SC 2002, c 29*
32 Environment Canada, *Recovery Strategy for the Woodland Caribou (rangifer Tarandus Caribou), Boreal Population, in Canada*, *Update*, 2012, doi:10.2307/3796292.

for provinces to implement plans for each caribou herd's habitat or "range." All provinces are required under the Recovery Strategy to produce range plans that outline how 65 percent of boreal woodland caribou habitat will be restored to undisturbed habitat and maintained undisturbed over time, and how the land and activities within the range will be managed for habitat protection. These provincial range plans are due by October of 2017.[33]

No herds in Alberta are currently self-sustaining (Figure 1).

## *CPAWS' Annual Reviews*




The Canadian Parks and Wilderness Society (CPAWS) has been conducting annual reviews of progress by federal, provincial, and territorial governments to protect and recover Canada's remaining boreal woodland caribou populations since 2013. These annual reviews track five types of actions in each of Canada's Provinces and Territories:

1. Actions that conserve boreal caribou habitat;
2. Development of range plans;
3. Actions that are precursors, or in support of the first two actions;
4. Locations of activities that are being planned or implemented to identify gaps in protection; and
5. Steps taken by the federal government to ensure the federal Recovery strategy is being implemented.

See the full report for details on all of the Province's and Territories' activities.[34]


**Figure 1. All of the boreal woodland caribou herds in Alberta have been assessed as not likely to be self-sustaining.[35]**

33 Ibid.
34 Canadian Parks and Wilderness Society, "2015 Update: Boreal Woodland Caribou Conservation in Canada," 2015.
35 CPAWS Northern Alberta, "Caribou & You," accessed December 7, 2015, http://cpawsnab.org/campaigns/caribou.

The Recovery Strategy assessed that it is biologically and technically feasible for all herds in this province to become self-sustaining if robust, habitat-protecting range plans are designed. In order to reach self-sustaining status, each herd needs 65 percent of their "critical habitat" to remain undisturbed, which gives the herd a 60 percent chance of recovery to self-sustaining status.[36]

The Recovery Strategy defines "critical habitat" as the habitat necessary for the species to acheive its life processes. Boreal woodland caribou use the whole range over time for their life processes, meaning the entire range is important and should be managed with conservation as the primary goal. Caribou require large tracts of undisturbed habitat in order to become self-sustaining because they use spatial separation as a predator avoidance strategy.[37] When habitat becomes fragmented or destroyed this strategy no longer works. The Recovery Strategy incorporates a 500 meter buffer around all anthropogenic disturbances to account for functional habitat loss due to avoidance in its measurement of disturbance in a range.

# Boreal Woodland Caribou Management

## History of Management Planning

Caribou populations have been declining in Alberta since large scale anthropogenic disturbances started occurring 70 years ago. The drastic decline of this iconic species has been recognized by the province since 1978 as an issue that requires government attention and action.[38] Boreal woodland caribou were among the first 12 species identified as endangered or threatened in Alberta in the *Wildlife Act*[39] released in 1987.[40] Since 1978 many working groups, environmental non-governmental organizations, and planning teams have been working on finding a solution to declining caribou populations in Alberta. This has resulted in a solid foundation of information and many solution plans for Alberta's boreal woodland caribou.

The following list identifies, in chronological order, the many documents and plans created in Alberta since 1978 that focus on boreal woodland caribou in Alberta:[41]

- 1978 Caribou Management Outline for Alberta (Recreation, Parks, and Wildlife Department)
- 1981 Proposal to Designate Alberta's Caribou as a Threatened Species (Fish and Wildlife)[42]
- 1981 Alberta discontinues licensed hunting of woodland caribou
- 1986 Woodland Caribou Provincial Restoration Plan (Fish and Wildlife)[43]
- 1991 Procedural Guide for Petroleum and Natural Gas Activity on Caribou Range (Alberta Energy Forestry, Lands and Wildlife)[44]
- 1993 Strategy for Conservation of Woodland Caribou in Alberta (Fish and Wildlife)[45]
- 1996 Alberta's Woodland Caribou Conservation Strategy (Alberta Woodland Caribou Conservation Strategy Development Committee)[46]
- 2005 Alberta Woodland Caribou Recovery Plan (Fish and Wildlife)[47]

36 Environment Canada, *Scientific Assessment to Inform the Identification of Critical Habitat for Woodland Caribou (Rangifer Tarandus Caribou), Boreal Population, in Canada*, *Update*, 2011, doi:http://www.sararegistry.gc.ca/document/default_e.cfm?documentID=2248.
37 Dale R. Seip, "Factors Limiting Woodland Caribou Populations and Their Interrelationships with Wolves and Moose in Southeastern British Columbia," *Canadian Journal of Zoology* 70, no. ii (1992): 1494–1503, doi:10.1139/z92-206.
38 Recreation Parks and Wildlife Division, "Caribou Management Outline for Alberta," 1978, 4.
39 *RSA 2000, c W-10*
40 Fish and Wildlife Historical Society, *Fish, Fur, and Feathers: Fish and Wildlife Conservation in Alberta 1905 - 2005*, 2005.
41 Alberta Wilderness Association, "Woodland Caribou History."
42 Bloomfield, M and M. Sword, "Proposal to Designate Alberta's Caribou as a Threatened Species," 1981.
43 Alberta Forestry Lands and Wildlife, "Woodland Caribou Provincial Restoration Plan," 1986, 74.
44 Alberta Energy Lands and Wildlife, "Procedural Guide for Petroleum and Natural Gas Activity on Caribou Range," 1991, 4.
45 Alberta Fish and Wildlife Services, "Strategy for Conservation of Woodland Caribou in Alberta" (Edmonton, Alberta, 1993).
46 Alberta Woodland Caribou Conservation Strategy Development Committee, "Alberta's Woodland Caribou Conservation Strategy," 1996, 58.
47 The Alberta Woodland Caribou Recovery The Alberta Woodland Caribou Recovery Team, "Alberta Woodland Caribou Recovery Plan."

- 2009 Alberta Caribou Committee Recommendations to the Deputy Minister of Sustainable Resource Development for the Athabasca Caribou Landscape (Alberta Caribou Committee)[48]
- 2009 Athabasca Caribou Landscape Management Options Report (Athabasca Landscape Team)[49]
- 2011 A Woodland Caribou Policy for Alberta (ESRD)[50]
- 2012 Federal Recovery Strategy for Woodland Caribou – Boreal population (Environment Canada)[51]
- 2012 and 2015 A Methodological Framework For Caribou Action Planning In Support Of The Canadian Boreal Forest Agreement (Canadian Boreal Forest Agreement)[52]
- 2013 Alberta Caribou Action and Range Planning Project (Government of Alberta)[53]

While there have been ample plans created to manage the threatened boreal woodland caribou there has been continued decline in their populations (Figure 2).

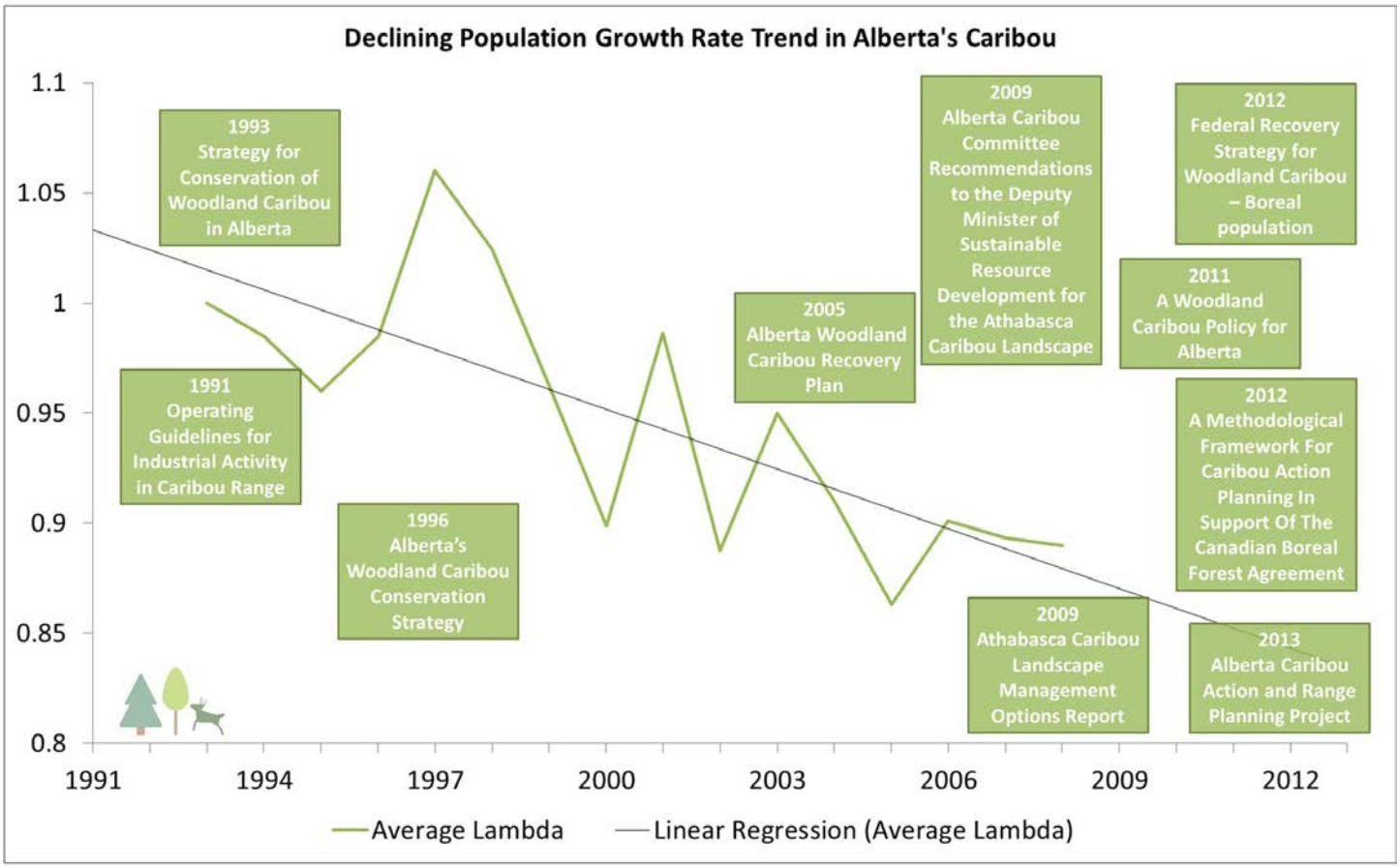



**Figure 2: The average population growth rate (lambda; λ) for all Alberta's boreal woodland Caribou herds from May 1993 to April 2009. A value of 1.0 is a stable population, values greater than 1.0 indicate population growth, and a value less than 1.0 indicates population decline. Caribou population lambda data taken from Status of the Woodland Caribou (Rangifer tarandus caribou) in Alberta: Update 2010[54]**

48 Alberta Caribou Committee Governance Board, "Alberta Caribou Committee Recommendations to the Deputy Minister of Sustainable Resource Development for the Athabasca Caribou Landscape," 2009.
49 Athabasca Landscape Team, "Athabasca Caribou Landscape Management Options Report," 2009.
50 Alberta Sustainable Resource Development, "A Woodland Caribou Policy for Albert," 2011.
51 Environment Canada, *Recovery Strategy for the Woodland Caribou (rangifer Tarandus Caribou), Boreal Population, in Canada*.
52 Antoniuk et al., "A Methodological Framework For Caribou Action Planning In A Methodological Framework for Caribou Action Planning In Support of the Canadian Boreal Forest Agreement."
53 Integrated Resource Management Planning Division and Resources Development Policy Division, "Alberta Caribou Action and Range Planning Project," 2013.
54 Alberta Sustainable Resource Development and Alberta Conservation Association, *Status of the Woodland Caribou in Alberta: Alberta Wildlife Status Report No. 30 (Update 2010)*, *Development*, vol. 30, 2010.

These plans have encouraged action, but there has been a lack of political will to actually implement measures that will provide Alberta's woodland caribou herds with management decisions and on-the-ground protection measures that they need to become self-sustaining herds. The goal of this document is to inspire provincial action by mapping the range of each caribou herd and synthesizing on-the-ground information for each herd.

## Decline in Boreal Woodland Caribou in Alberta

Boreal woodland caribou decline has been recognized in Alberta since 1978, and is continuing today. All of Alberta's boreal woodland caribou herds but one have declining populations. Risk assessments have found that all Alberta's herds are not likely to be self-sustaining[55] due to declining population trends and large amounts of disturbance caused by industry presence and wildfire (Figure 3, Table 1).

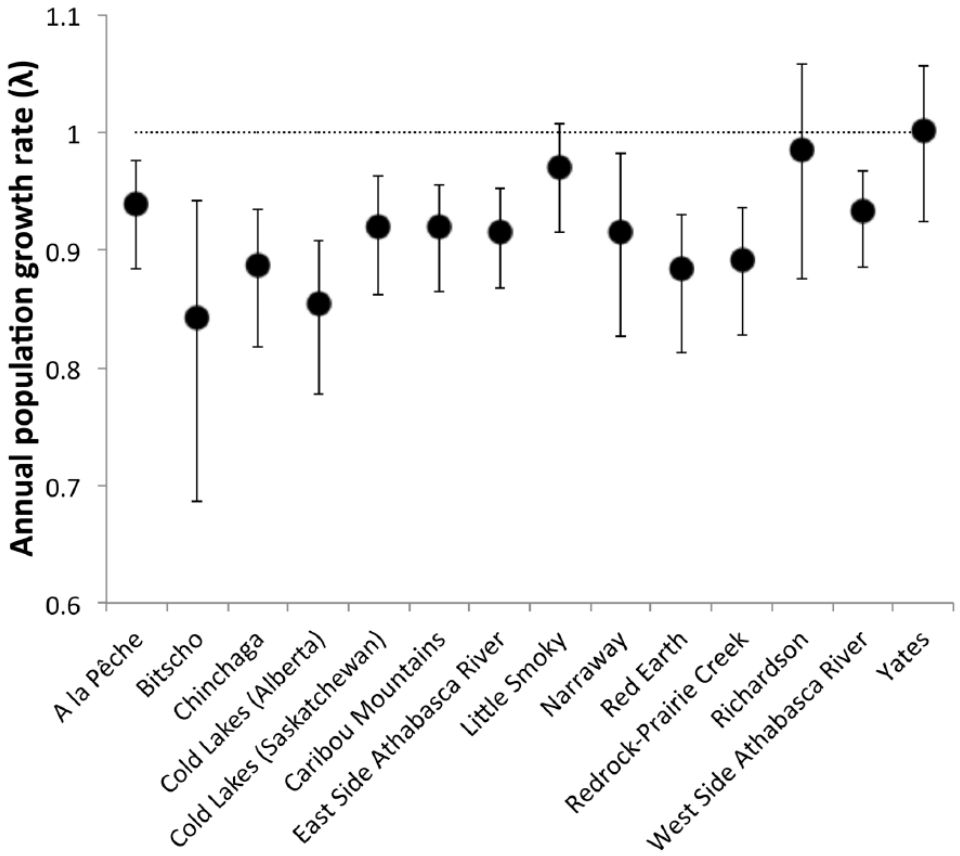



**Figure 3. Geometric mean annual population growth rates (lambda) and 95% confidence interval averaged across all years for 14 boreal woodland caribou populations in Alberta from 1994 to 2012. Note that sampling variation is not removed from these estimates. Figure taken from Hervieux et al (2013).[56]**

CARIBOU RUNNING - E SMITH

55 Environment Canada, *Recovery Strategy for the Woodland Caribou (rangifer Tarandus Caribou), Boreal Population, in Canada*.

56 Hervieux et al., "Widespread Declines in Woodland Caribou (Rangifer Tarandus Caribou) Continue in Alberta," *Canadian Journal of Zoology* 91, no. October (2013): 872–82, doi:10.1139/cjz-2013-0123.

**Table 1. Alberta boreal woodland caribou local population conditions, status, and habitat conditions.[57]**

| Caribou Herds | Population Size Estimate | Population Trend | Anthropogenic Disturbance (%) | Wildfire Disturbance (%) | Total Disturbance (%) | Risk Assesment |
|---|---|---|---|---|---|---|
| Chinchaga | 250 | Declining | 74 | 8 | **76** | Not Self-Sustaining |
| Bistcho | 195 | Declining | 61 | 20 | **71** | Not Self-Sustaining |
| Yates | 350 | Stable | 21 | 43 | **61** | Not Self-Sustaining |
| Caribou Mountains | 315-394 | Declining | 23 | 44 | **57** | Not Self-Sustaining |
| Little Smoky | 78 | Declining | 95 | 0.2 | **95** | Not Self-Sustaining |
| Red Earth | 172-206 | Declining | 44 | 30 | **62** | Not Self-Sustaining |
| West Side of Athabasca River (WSAR) | 204-272 | Declining | 68 | 4 | **69** | Not Self-Sustaining |
| Richardson | 150 | Not available | 22 | 67 | **82** | Not Self-Sustaining |
| East Side of Athabasca River (ESAR) | 90-150 | Declining | 77 | 26 | **81** | Not Self-Sustaining |
| Cold Lake | 150 | Declining | 72 | 32 | **85** | Not Self-Sustaining |
| Nipisi | 55 | Not available | 66 | 6 | **68** | Not Self-Sustaining |
| Slave Lake | 65 | Not available | 63 | 37 | **80** | Not Self-Sustaining |

A 50 percent decline in caribou populations across Alberta in the next 8-15 years has been predicted to occur if nothing changes in the way Alberta's landscape is managed.[58,59] Due to large scale human disturbance and wildfire within boreal woodland caribou habitat, no herds in Alberta currently meet the 35 percent disturbance threshold (or 65 percent of habitat undisturbed) set by the Recovery Strategy (Figure 4).

CLEARWATER RIVER - D DODGE

57 Environment Canada, *Recovery Strategy for the Woodland Caribou (rangifer Tarandus Caribou), Boreal Population, in Canada*.
58 Weclaw and Hudson, "Simulation of Conservation and Management of Woodland Caribou."
59 Ibid.

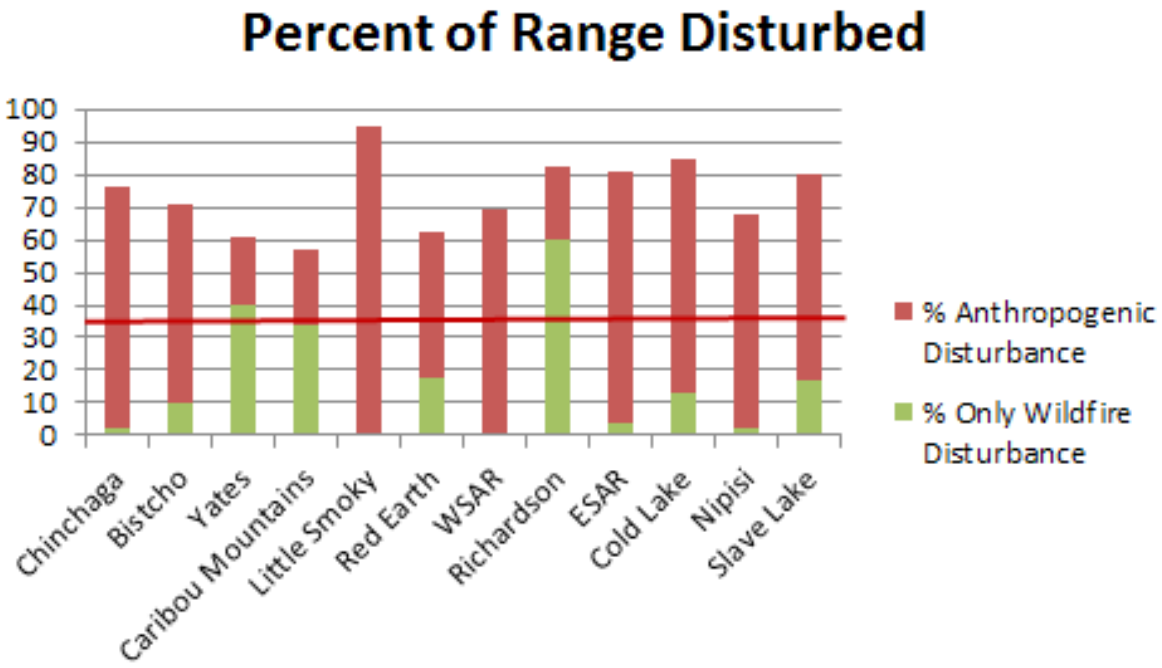



**Figure 4. Percent of each caribou range disturbed.[60] The red line indicates the maximum disturbance level (35 percent) in critical habitat, or range, allowed by the Recovery Strategy.**

The target disturbance limit of 35 percent disturbance in each range is estimated to give boreal woodland caribou herds only a 60 percent chance at becoming self-sustaining. If in-range development and resource extraction continue at a "business as usual" pace, with no forest restoration or access management measures in place in Alberta's boreal forest, then it is expected that boreal woodland caribou will be extirpated (lost) from this region within the next 40 -50 years.[61,62] Such drastic declines in boreal woodland caribou populations urge a quick response to the root problem.

CUTBLOCK - H HAMMOND

60 Environment Canada, *Recovery Strategy for the Woodland Caribou (rangifer Tarandus Caribou), Boreal Population, in Canada*.

61 Matt Carlson and David Browne, "The Future of Wildlife Conservation and Resource Development in the Western Boreal Forest," *Canadian Wildlife Federation*, 2015.

62 Weclaw and Hudson, "Simulation of Conservation and Management of Woodland Caribou."

## Results: Mapping for Caribou Range Planning in Alberta

Achieving 65 percent undisturbed habitat in each range in Alberta will be a challenge. The landscape in all of Alberta's boreal woodland caribou ranges is dominated by industrial footprint and ongoing industrial activity. The mapping portion of this project provides detailed information for each range including the key industrial companies operating in caribou range and the amount of current disturbance. Using CPAWS' *Conservation Blueprint of Northern Alberta: Prioritizing areas for protected areas planning* (the "Conservation Blueprint")[63] as a mapping tool to guide on-the-ground range planning, this project outlines where 65 percent undisturbed habitat should occur for the benefit of caribou as well as all of the other species that call the boreal forest home. It also prioritizes areas to restore within the range so Alberta's boreal woodland caribou herds have the best chance at persisting on our landscape and becoming self-sustaining. A map of all of Alberta's caribou herds can be seen in Figure 5.

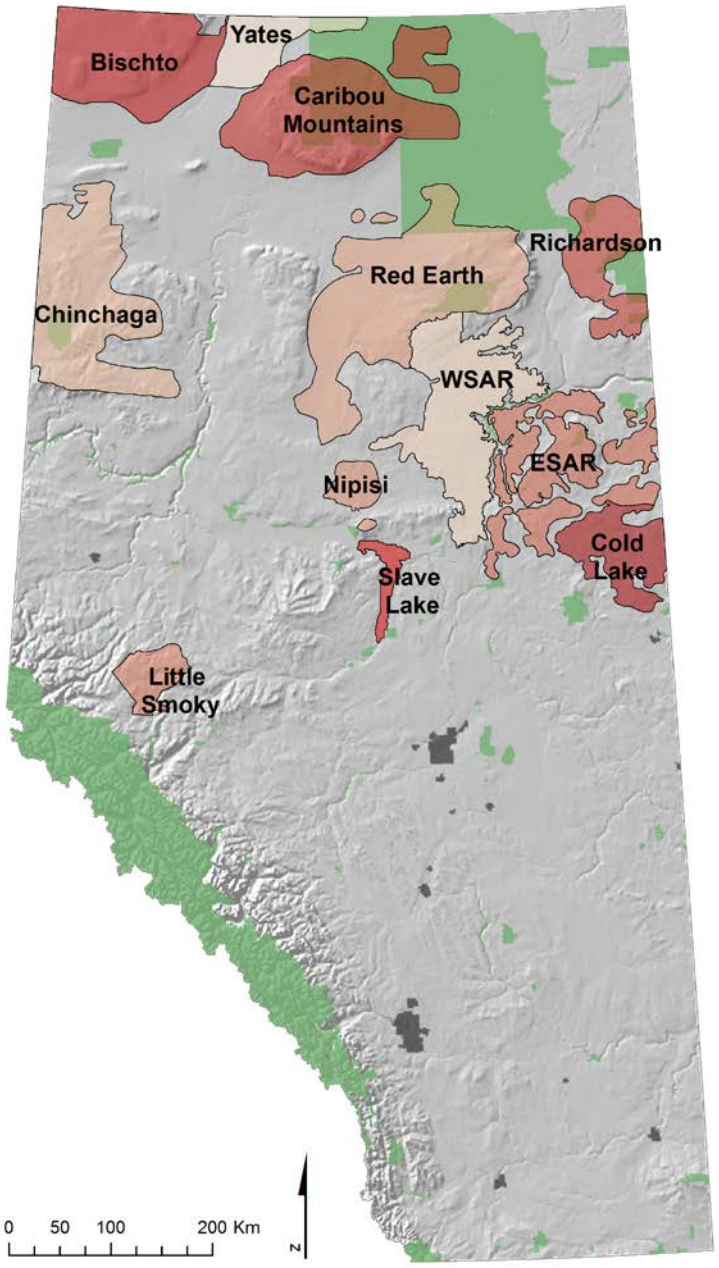



**Figure 5. Alberta's boreal woodland caribou ranges. Different colours were used to indicate the boundaries of the separate ranges.**

63 Danielle Pendlebury and Alison Ronson, "Conservation Blueprint of Northern Alberta: Prioritizing Areas for Protected Areas Planning," 2015.

Five mapping exercises were undertaken for all 12 boreal woodland caribou herds in Alberta in order to identify and illustrate what is needed for on-the-ground range planning in this province (Table 2).

**Table 2. Mapping Exercises undertaken for each range for On-the-ground details to inform range planning.**

| Mapping Exercises for On-the-ground Range Planning | Details |
|---|---|
| Industrial Activity | In order to identify who the industrial players are within each range, maps were created to show the amount of each range occupied by forestry and oil and gas activity. |
| Undisturbed Critical Habitat | Habitat that is currently undisturbed has been identified and activities likely to destroy critical habitat should be prevented. |
| Irreplaceability Value | Areas that can be considered irreplaceable on the landscape in a protected areas design and which have relatively lower socio-economic cost are identified. |
| Caribou Home Range (Telemetry Data) | Telemetry data points of collared female caribou and areas of overlapping female home ranges were mapped to ensure that the priority areas identified within each range are habitat that is beneficial for caribou. |
| Restoration and Protection Priority Areas | Irreplaceability is used to create priority zones within each range. The zonation approach was adopted in order to more efficiently use resources for restoration and protection. |

This document (volume one of three) focuses solely on the seven caribou herds in northeast Alberta.

Due to the spatial overlap of features in caribou ranges, each of the features have been drawn on the maps in the same order that they are seen in the legends.

## Industrial Activity in Caribou Ranges in Alberta

Disturbance of such great scale in northern Alberta is due to the amount of active industrial presence in the province. Forestry allocations, by way of Forest Management Agreements ("FMAs") or Forest Management Units ("FMUs"), and oil and gas allocations, by way of petroleum and natural gas ("PNG") leases or oilsands leases, are present in every boreal woodland caribou range. In order to identify the industrial players within each range, maps were created to show the amount of each range occupied by forestry and oil and gas industry. These maps are set out below as Figures 6 through 19; individual lease holders, number of leases held, and percent of range occupid by industrial tenures can be found in Appendix 1.

Logs waiting to be transported to the mill - D Pendlebury

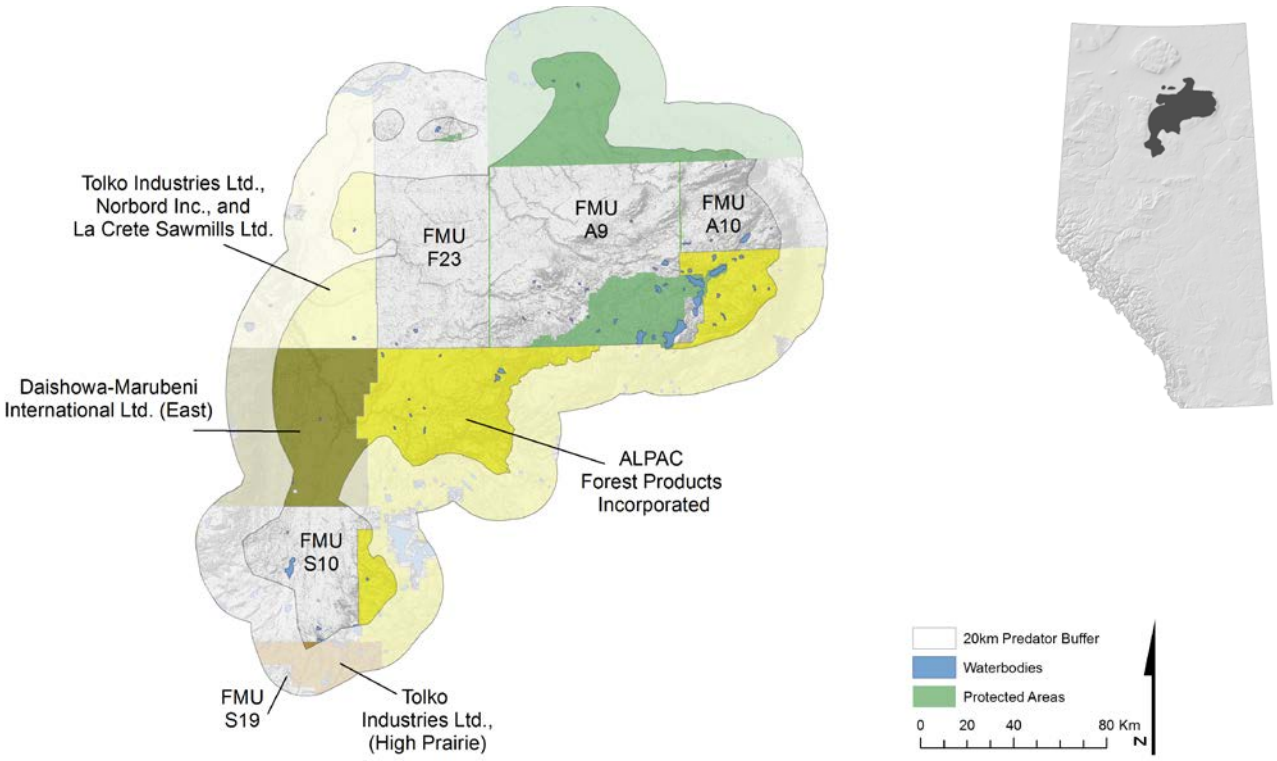



**Figure 6. Forestry within the Red Earth range. There are four FMA's covering 35.4% of the Red Earth caribou range and four FMUs. Three companies operate on FMUs within the range.**

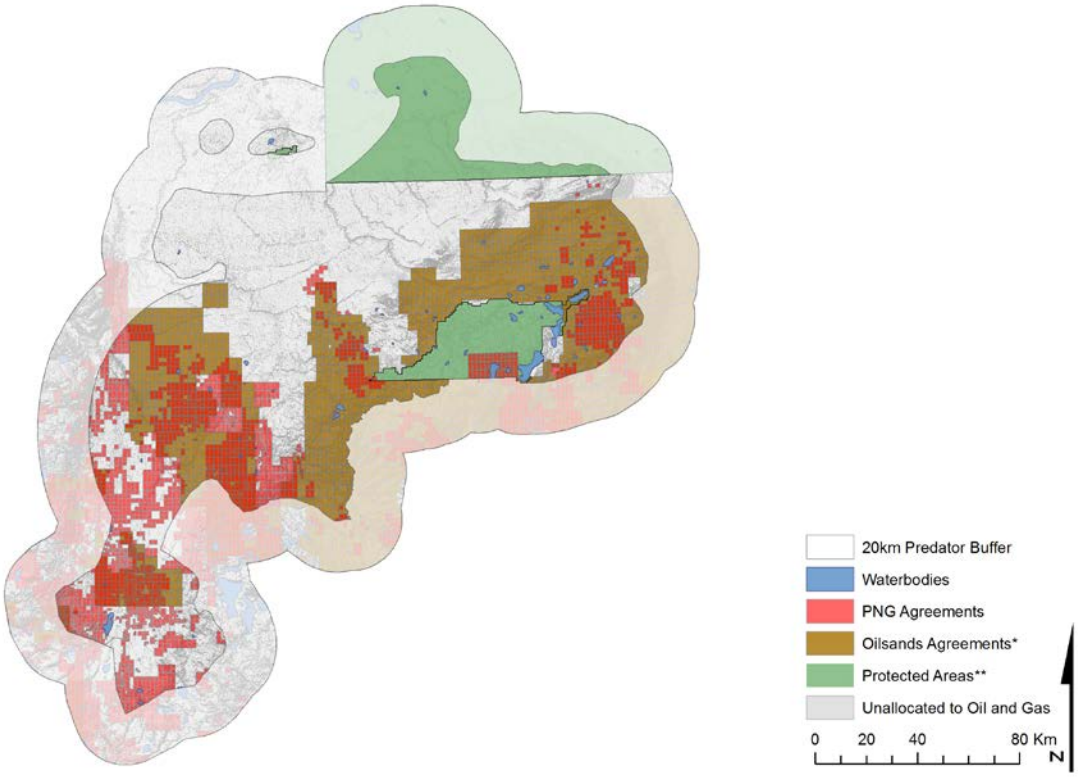



**Figure 7. Oil and Gas within the Red Earth range. There are 87 companies with PNG agreements covering 21.66% of the Red Earth caribou range, and 43 companies with oilsands agreements covering 35.89% of the range. *Oilsands agreements are drawn underneath PNG agreements; therefore, darker red indicates where both PNG and oilsands agreements exist. **Protected areas have been drawn under both PNG and oilsands agreements to show leases within protected areas. A black outline is used to indicate the boundary of the protected areas.**

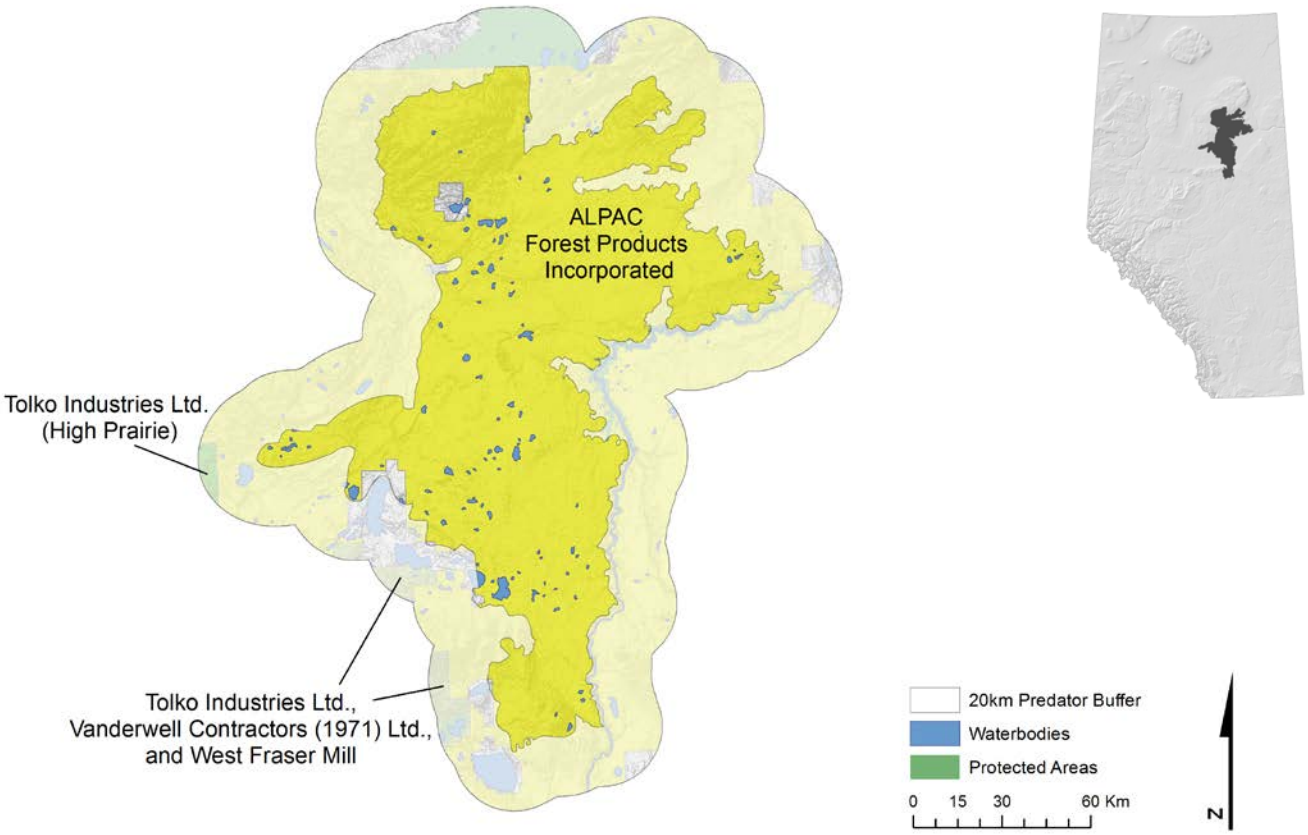



**Figure 8. Forestry within the West Side Athabasca range ("WSAR"). There is one FMA covering 98.43% of the WSAR.**

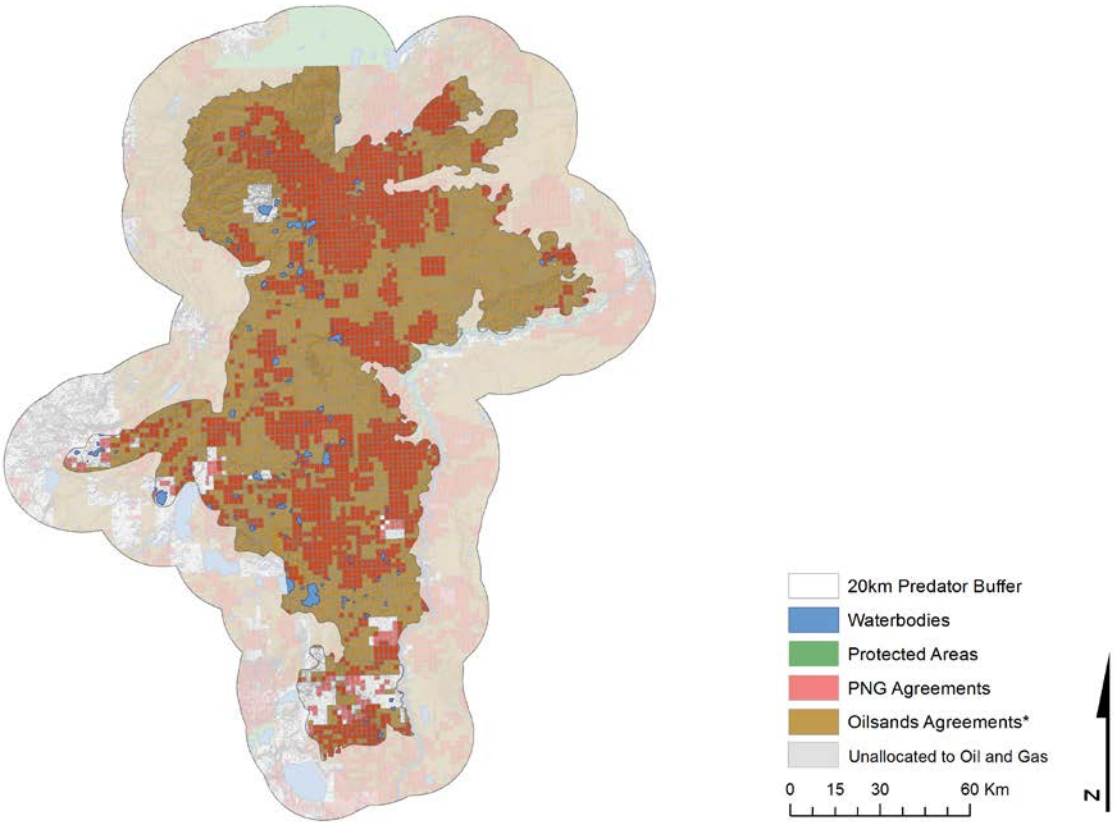



**Figure 9. Oil and Gas within the WSAR. There are 29 companies with PNG agreements covering 37.43% of the West Side Athabasca caribou range, and 59 companies with oilsands agreements covering 90.85% of the range. *Oilsands agreements are drawn underneath PNG agreements, therefore darker red indicates where both PNG and oilsands agreements exist.**

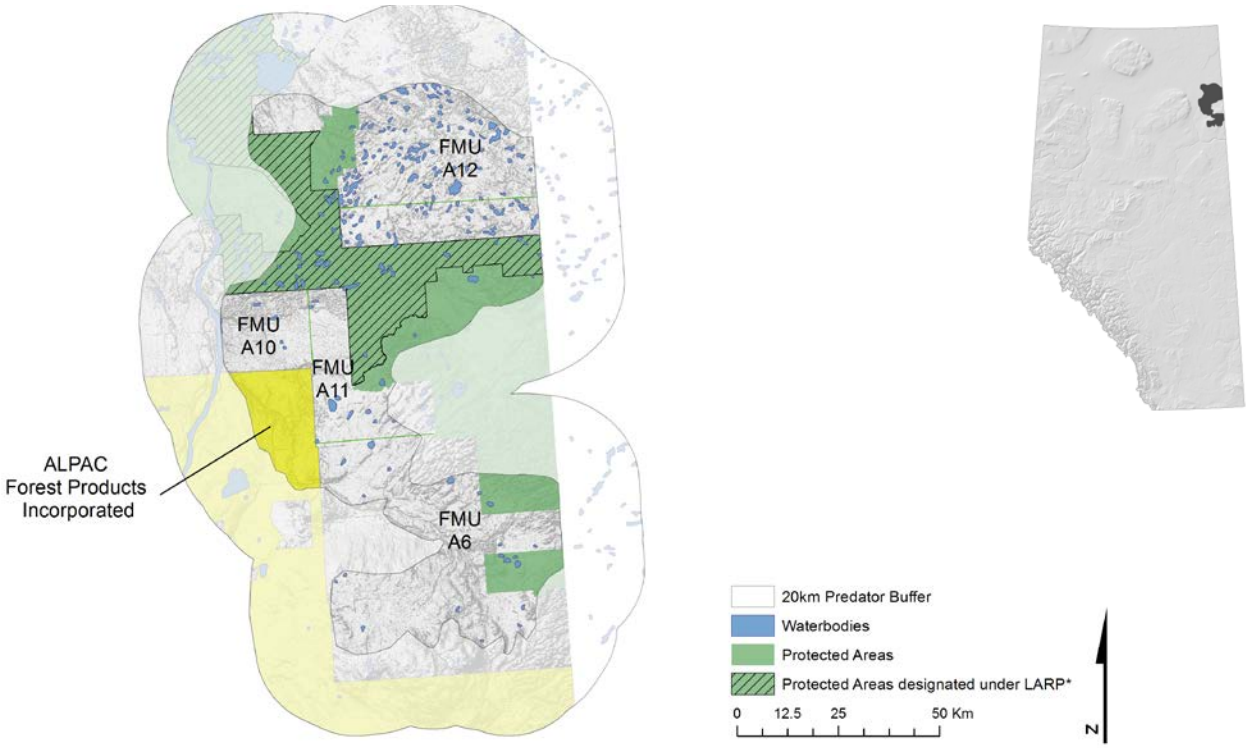



**Figure 10. Forestry within the Richardson range. There is one FMA covering 5.96% of the Richardson caribou range and four FMUs with 1 company operating within of the range. *Protected areas that were designated under the Lower Athabasca Regional Plan ("LARP") have not yet been passed by order in council.**

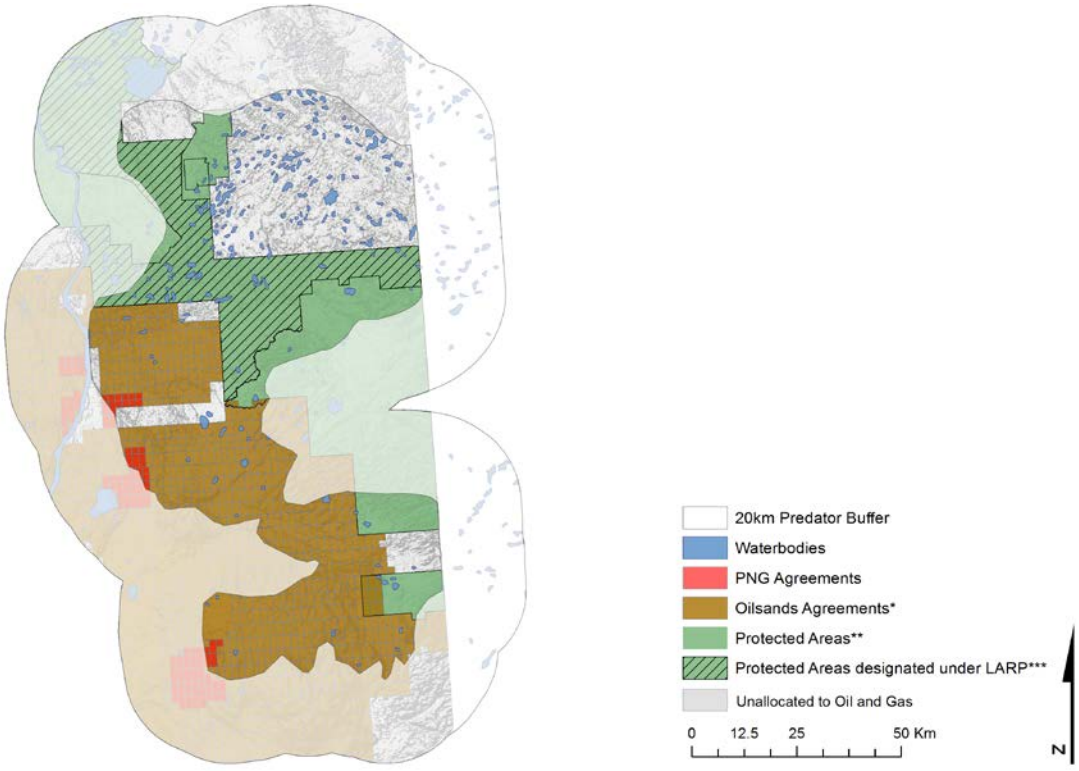



**Figure 11. Oil and Gas within the Richardson range. There are 2 companies with PNG agreements covering 1.13% of the Richardson caribou range, and 14 companies with oilsands agreements covering 38.37% of the range. *Oilsands agreements are drawn underneath PNG agreements, therefore darker red indicates where both PNG and oilsands agreements exist. **Protected areas have been drawn under both PNG and oilsands agreements to show leases within protected areas. A black outline is used to indicate the boundary of the protected areas. ***Protected areas that were designated under LARP have not yet been passed by order in council.**

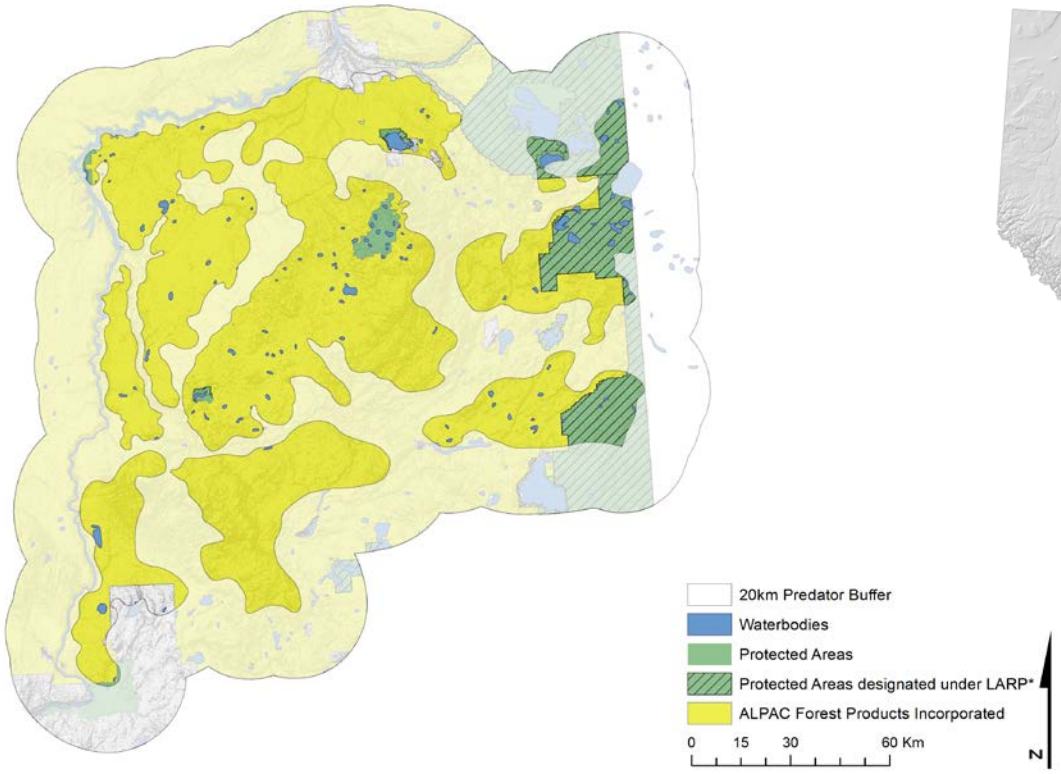



**Figure 12. Forestry within the ESAR range. There is one FMA covering 87.33% of the East Side Athabasca caribou range. *Protected areas that were designated under LARP have not yet been passed by order in council.**

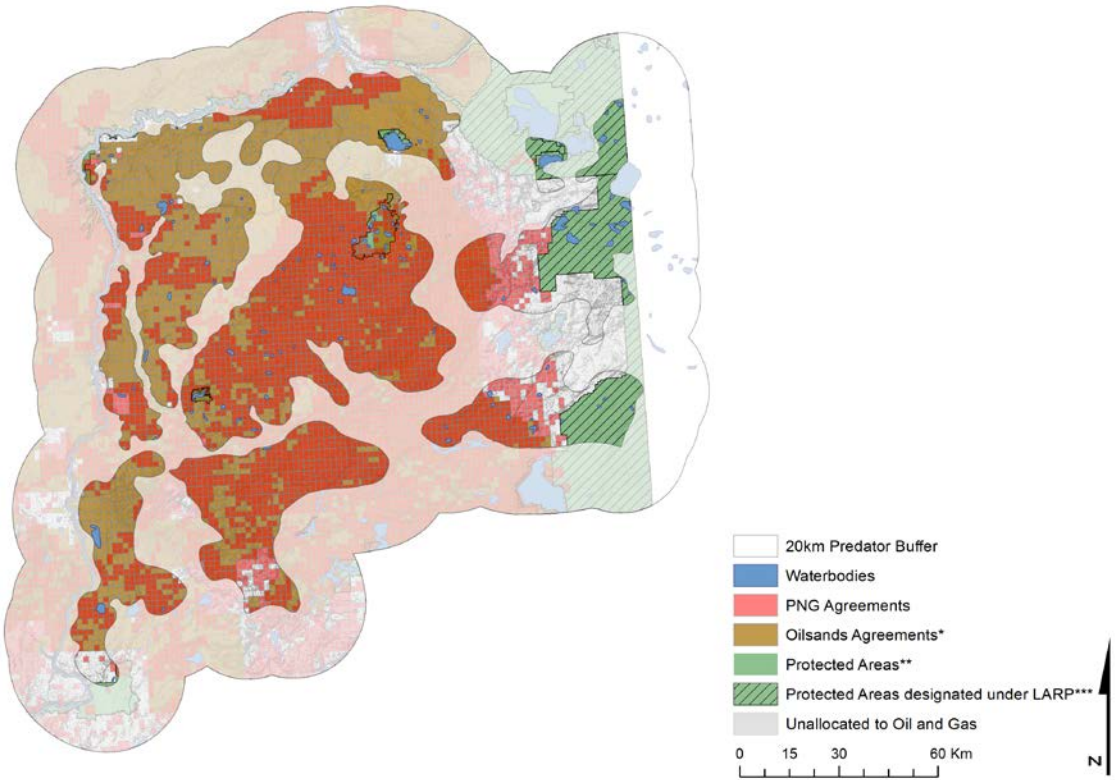



**Figure 13. Oil and Gas within the ESAR range. There are 39 companies with PNG covering 50.63% of the East Side Athabasca caribou range, and 46 companies with oilsands agreements covering 76.61% of the range. *Oilsands agreements are drawn underneath PNG agreements, therefore darker red indicates where both PNG and oilsands agreements exist. **Protected areas have been drawn under both PNG and oilsands agreements to show leases within protected areas. A black outline is used to indicate the boundary of the protected areas. ***Protected areas that were designated under LARP have not yet been passed through order in council.**

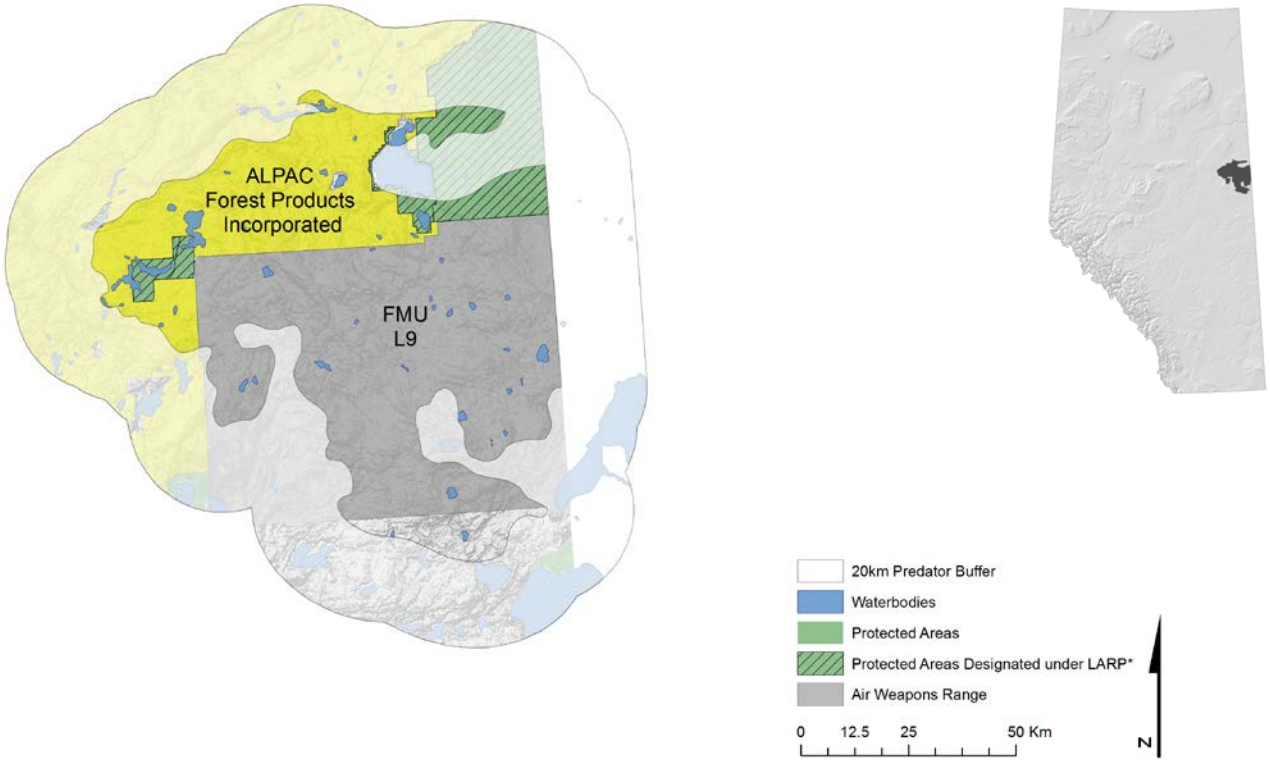



**Figure 14. Forestry within the Cold Lake range. There is one FMA covering 28.32% of the Cold Lake caribou range. *Protected areas that were designated under LARP have not yet been passed by order in council.**

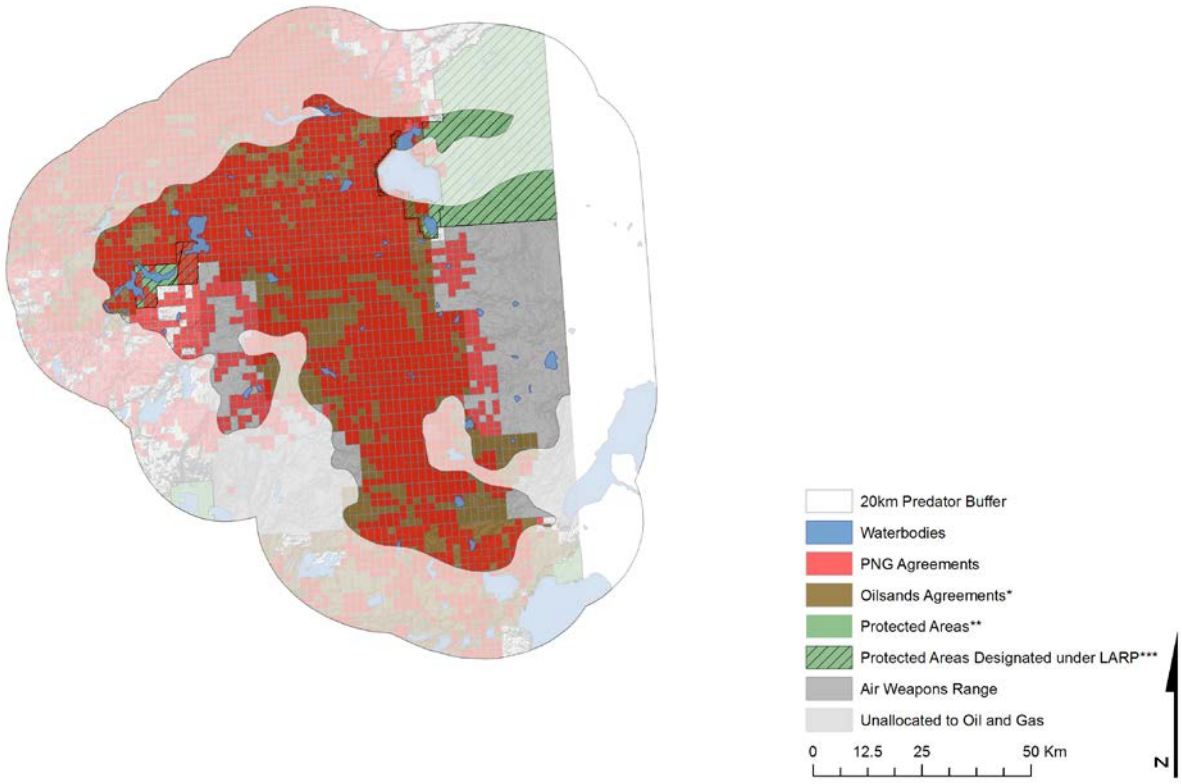



**Figure 15. Oil and Gas within the Cold Lake range. There are 19 companies with PNG agreements covering 56.43% of the Cold Lake caribou range, and 13 companies with oilsands agreements covering 62.61% of the range. *Oilsands agreements are drawn underneath PNG agreements, therefore darker red indicates where both PNG and oilsands agreements exist. **Protected areas have been drawn under both PNG and oilsands agreements to show leases within protected areas. A black outline is used to indicate the boundary of the protected areas. ***Protected areas that were designated under LARP have not yet been passed through order in council.**

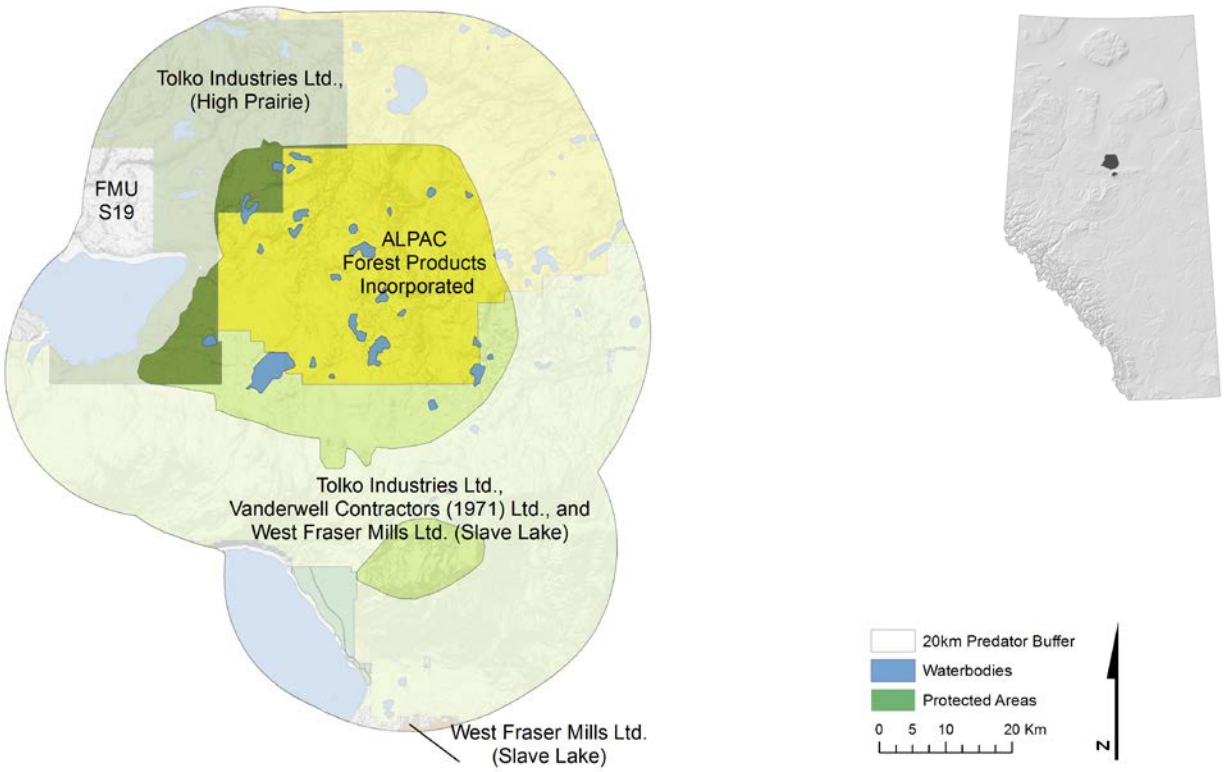



**Figure 16. Forestry within the Nipisi range. There are three FMAs covering 100% of the Nipisi caribou range**.

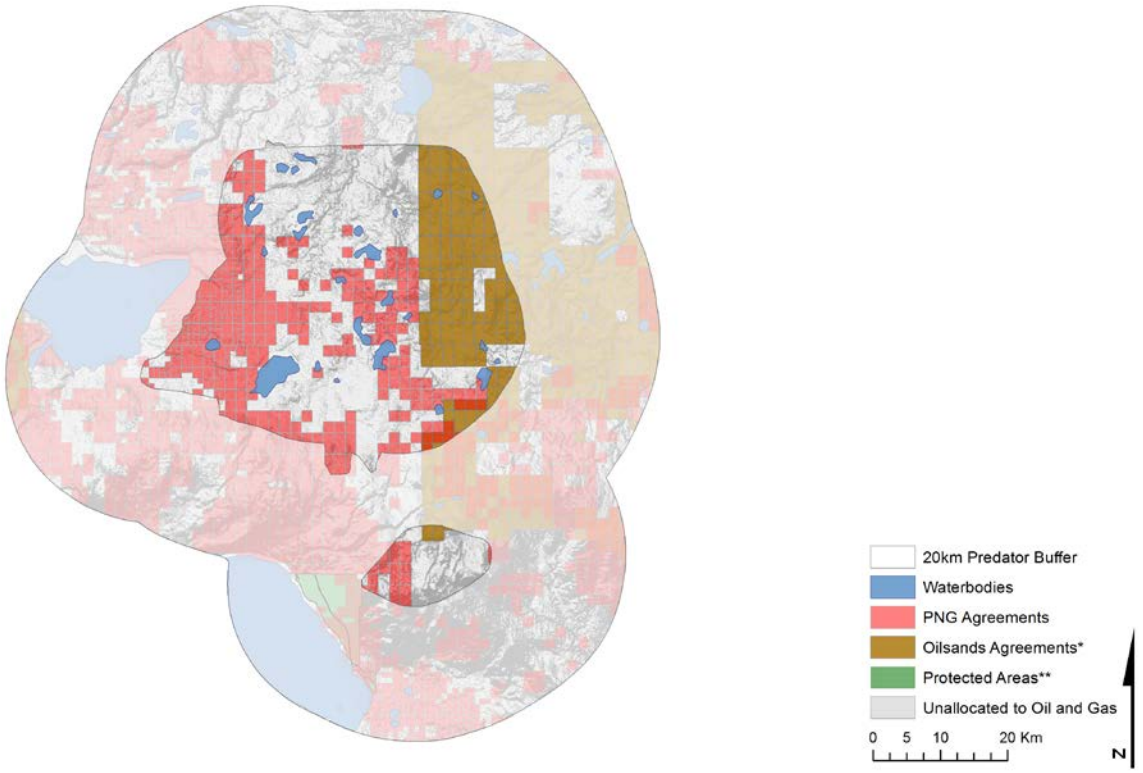



**Figure 17. Oil and Gas within the Nipisi range. There are 28 companies with PNG agreements covering 33.54% of the Nipisi caribou range, and 7 companies with oilsands agreements covering 19.37% of the range. *Oilsands agreements are drawn underneath PNG agreements, therefore darker red indicates where both PNG and oilsands agreements exist. **Protected areas have been drawn under both PNG and oilsands agreements to show leases within protected areas. A black outline is used to indicate the boundary of the protected areas.**

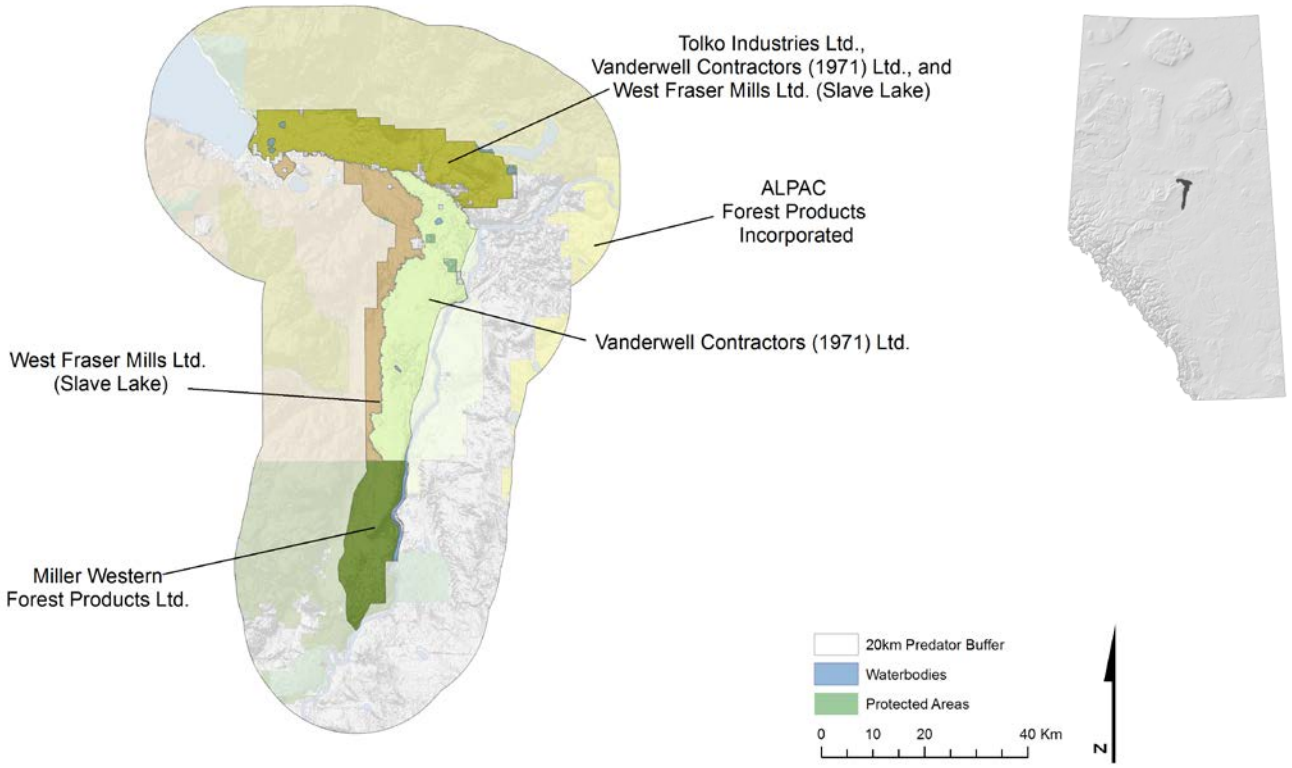



**Figure 18. Forestry within the Slave Lake range. There are four FMAs covering 95.67% of the Slave Lake caribou range.**

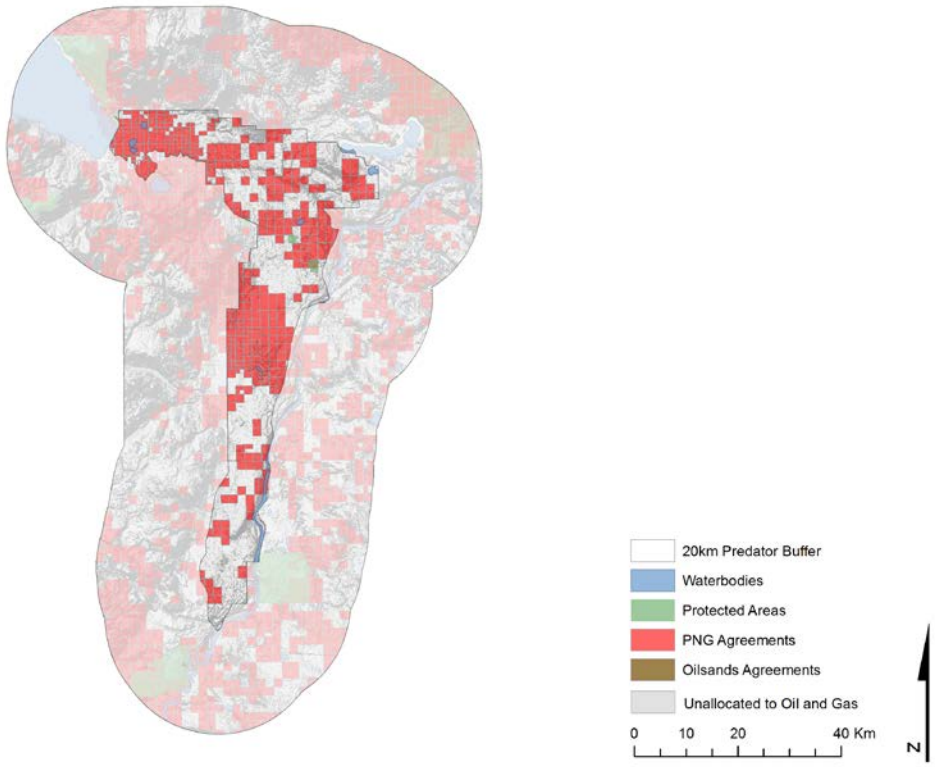



**Figure 19. Oil and Gas within the Slave Lake range. There are 24 companies with PNG agreements covering 46.69% of the Nipisi caribou range.**

## Undisturbed Critical Habitat in Boreal Woodland Caribou Ranges in Alberta

The federal Recovery Strategy defines critical habitat in each range as:

1. The area within the boundary of each boreal woodland caribou range that provides an overall ecological condition that will allow for an ongoing recruitment and retirement cycle of habitat, which maintains a perpetual state of a minimum of 65 percent of the area as undisturbed habitat; and

2. Biophysical attributes required by boreal woodland caribou to carry out life processes.[64]

Initially, in ranges with less than 65 percent undisturbed habitat, critical habitat is the existing habitat that over time would contribute to the attainment of 65 percent undisturbed habitat.[65]

The Recovery Strategy recommends that each herd have at least 65 percent of their range undisturbed to increase the likelihood of becoming self-sustaining. In Alberta, disturbance covers between 57 percent to 95 percent of each caribou range.[66]

The Recovery Strategy identifies activities that will likely destroy critical habitat as:

1. Activities that result in the direct loss of habitat, such as logging, or development in an area; and

2. Activities that result in the fragmentation of critical habitat such as the development of roads, pipelines, seismic lines and cut blocks.[67]

Every boreal woodland caribou range in Alberta contains forestry activity, oil and gas activity, or both – leaving ranges at risk to activities that will likely destroy critical habitat. Loss and fragmentation of critical habitat are the primary causes of decline in caribou, as they are processes which facilitate increased predation. In order to prevent further habitat loss or fragmentation in an already very disturbed landscape, it is recommended that these types of activities be prevented from occuring within undisturbed habitat immediately.

The following maps were created using the Alberta Biodiversity Monitoring Institute ("ABMI") Human Footprint map (2012)[68] and the Government of Alberta's historical wildfire perimeter spatial data.[69] Timber harvest areas were considered forestry disturbance; seismic lines, pipelines, well sites, and transmission lines were considered energy disturbance. All other human disturbance such as roads and rail were considered 'other' disturbance. Disturbed habitat was defined as all industry disturbance buffered to 500m and all wildfire disturbance in the last 40 years (1974 to 2014) without buffer, as per the Recovery Strategy.

Habitat that is currently undisturbed and should be protected from activities likely to destroy critical habitat has been identified and drawn in white with black dots for each range in Figures 20 through 26.

Linear Disturbance in the Boreal Forest - D Pendlebury

64 Environment Canada, *Recovery Strategy for the Woodland Caribou (rangifer Tarandus Caribou), Boreal Population, in Canada*.
65 Environment Canada, *Scientific Assessment to Inform the Identification of Critical Habitat for Woodland Caribou (Rangifer Tarandus Caribou), Boreal Population, in Canada*.
66 Environment Canada, *Recovery Strategy for the Woodland Caribou (rangifer Tarandus Caribou), Boreal Population, in Canada*.
67 Ibid.
68 AMBI, "ABMI Wall-to-Wall Landcover Map Guide Version 3," 2012, http://species.abmi.ca/pages/habitat/footprint-change.html.
69 Government of Alberta, "Historical Wildfire Perimeter Data: 1931 - 2015," 2016, http://wildfire.alberta.ca/wildfire-maps/historical-wildfire-information/spatial-wildfire-data.aspx.

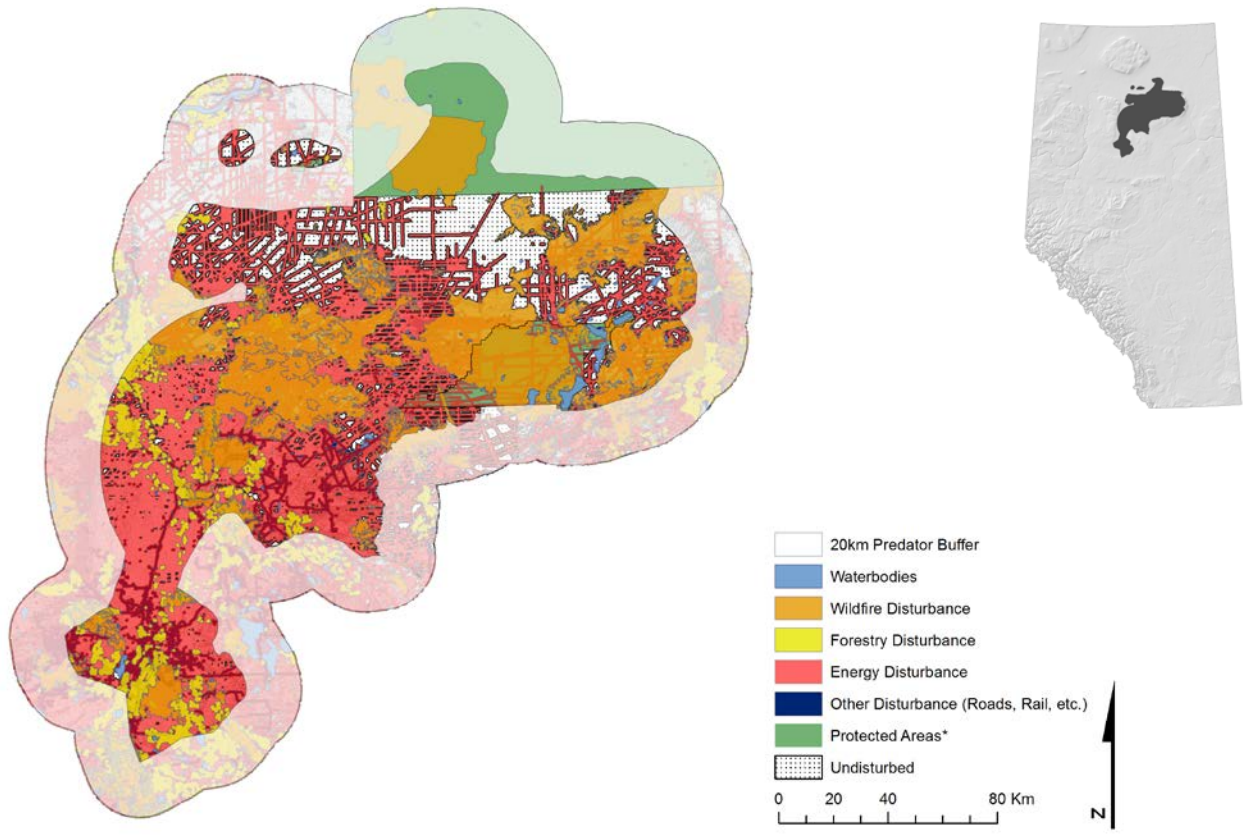



**Figure 20. Undisturbed habitat within the Red Earth range. *Protected areas have been drawn under disturbance. A black outline is used to indicate the boundary of protected areas.**

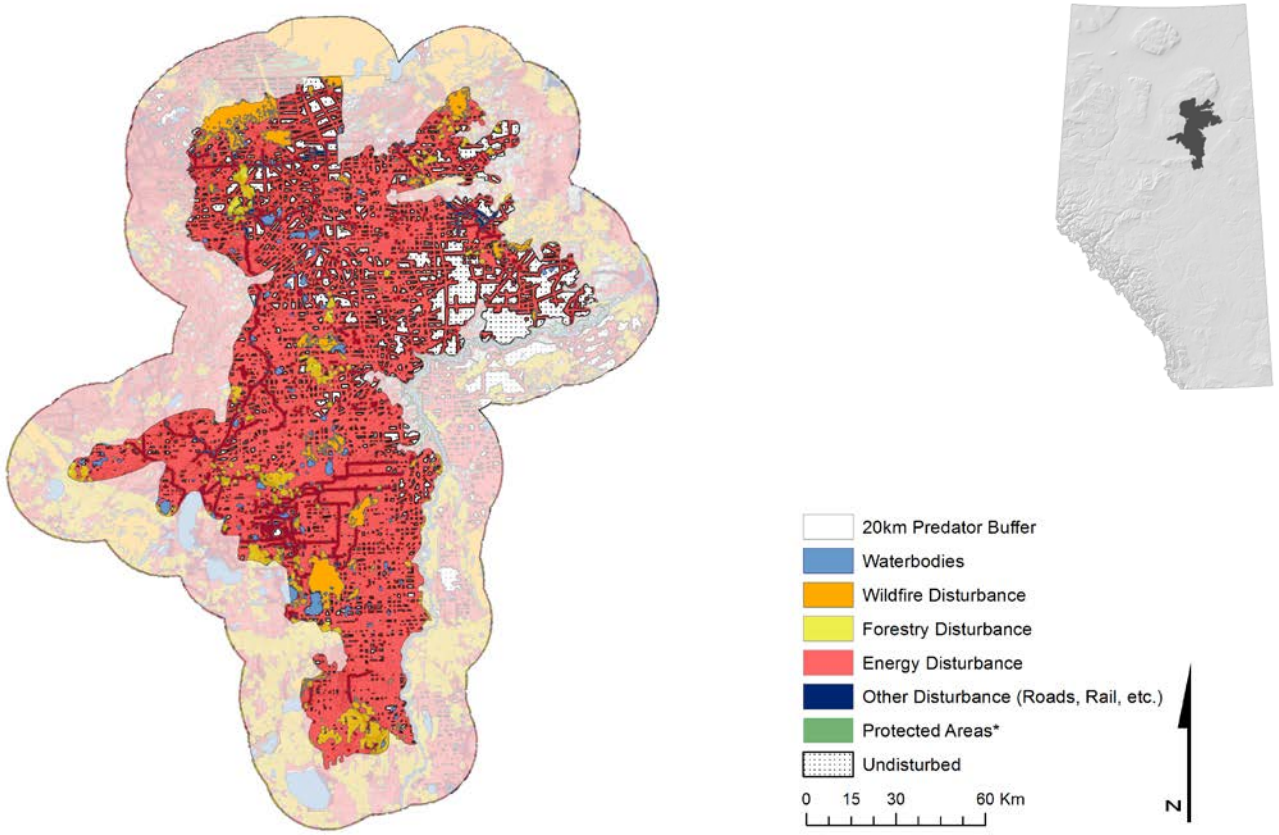



**Figure 21. Undisturbed habitat within the WSAR range. *Protected areas have been drawn under disturbance. A black outline is used to indicate the boundary of protected areas.**

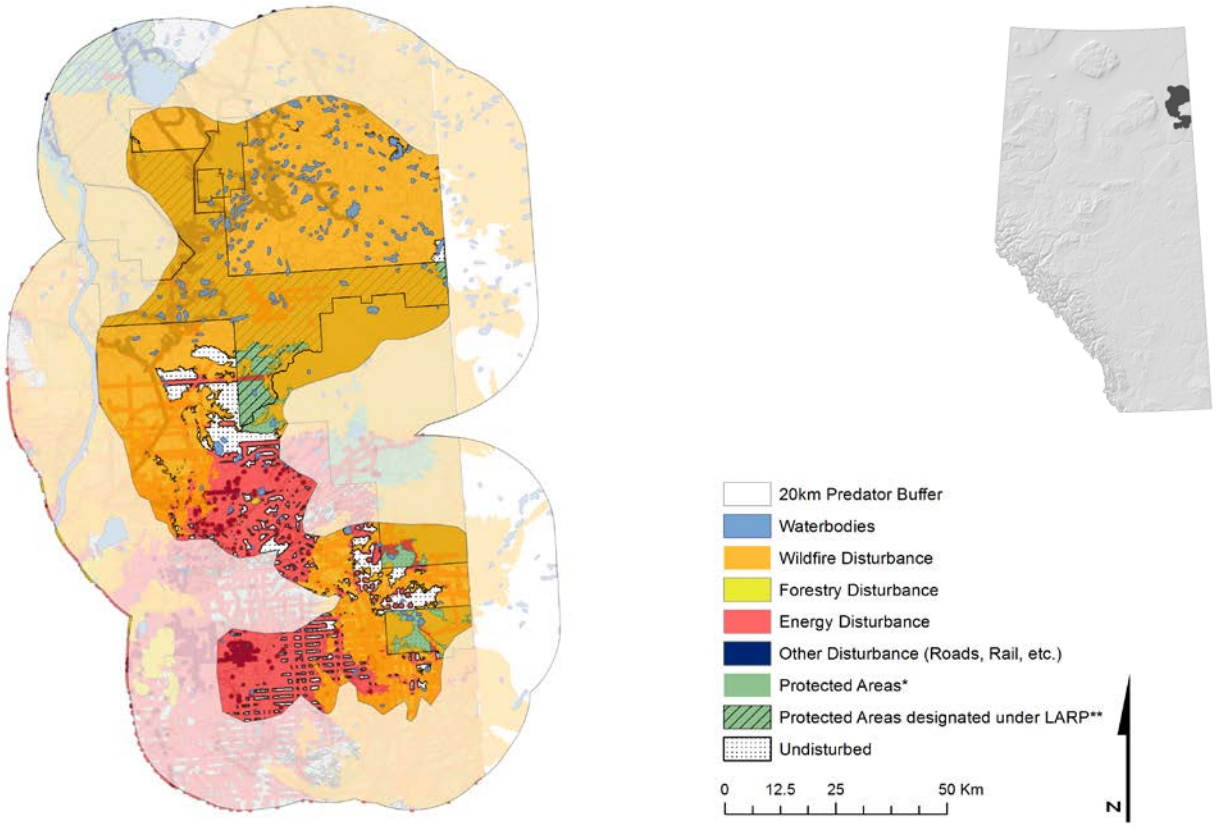



**Figure 22. Undisturbed habitat within the Richardson range. *Protected areas have been drawn under disturbance. A black outline is used to indicate the boundary of protected areas. **Protected areas that were designated under LARP have not yet been passed through order in council.**

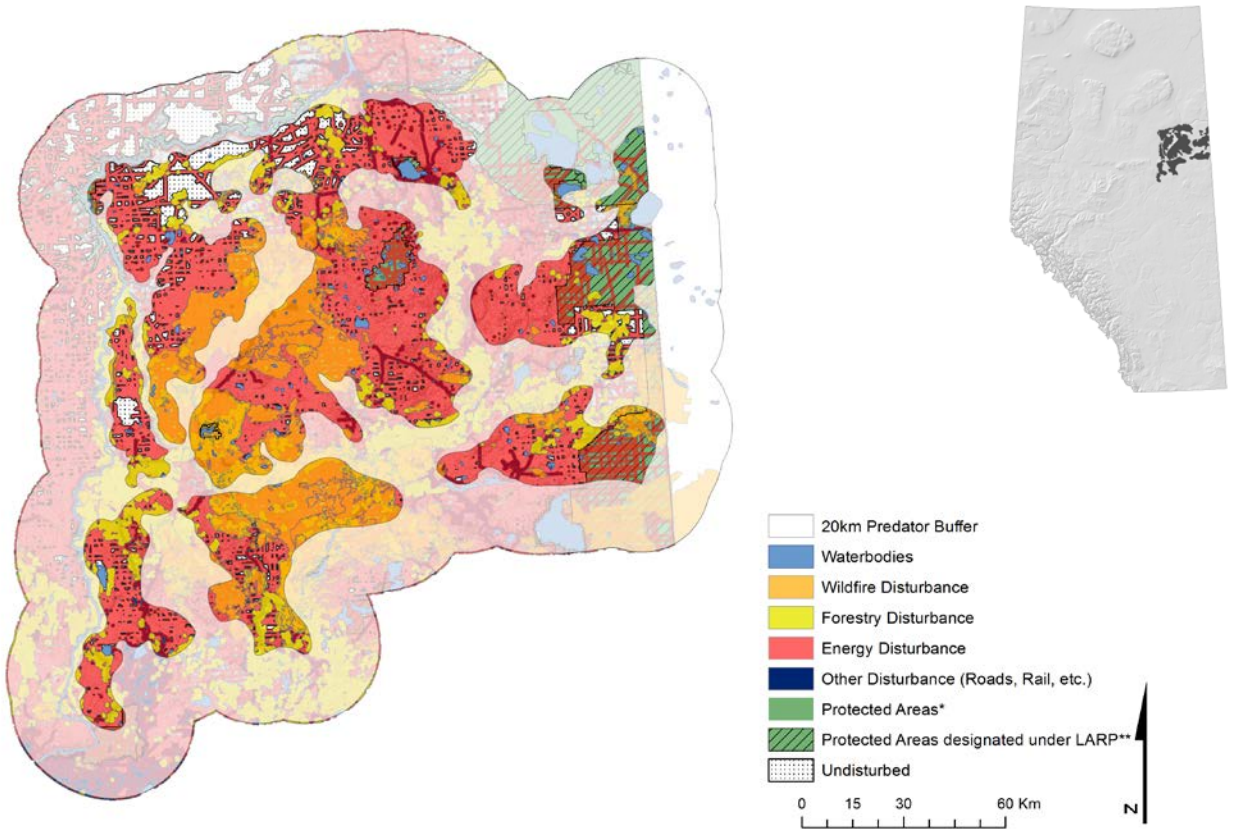



**Figure 23. Undisturbed habitat within the ESAR range. *Protected areas have been drawn under disturbance. A black outline is used to indicate the boundary of protected areas. **Protected areas that were designated under LARP have not yet been passed through order in council.**

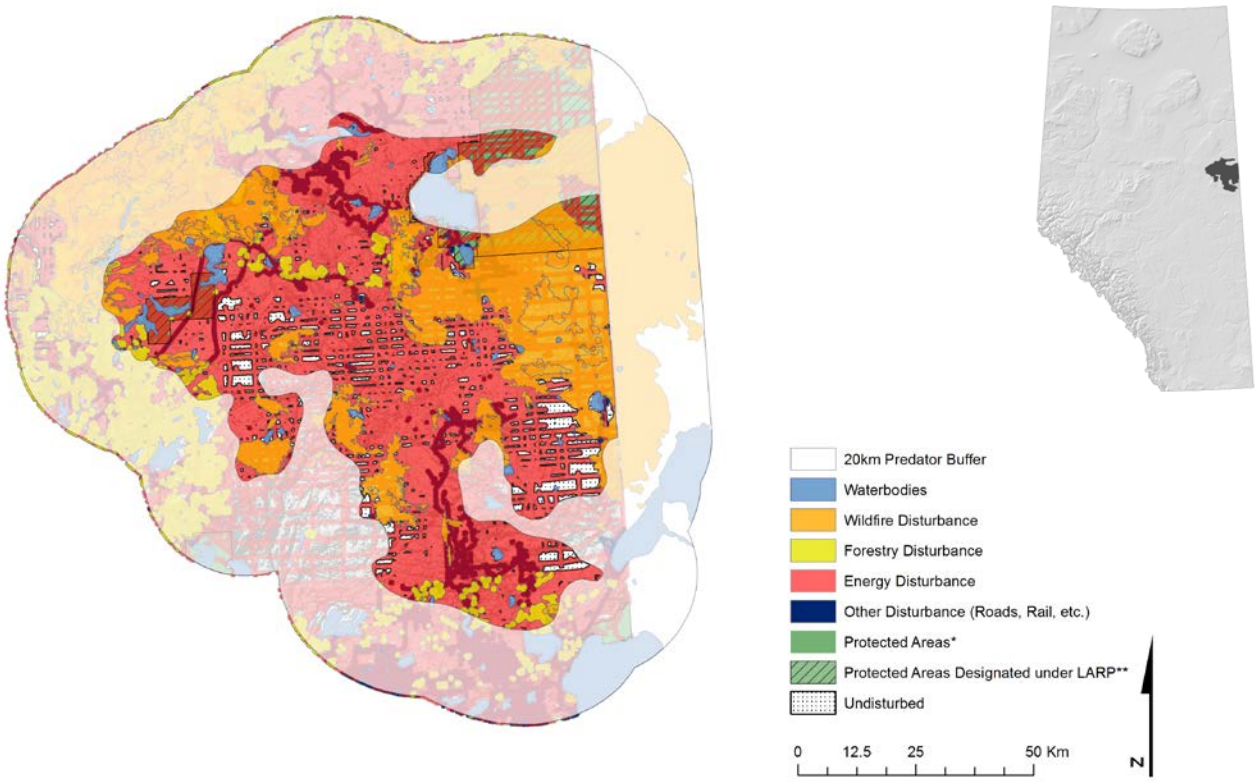



**Figure 24. Undisturbed habitat within the Cold Lake range. *Protected areas have been drawn under disturbance. A black outline is used to indicate the boundary of protected areas.**Protected areas that were designated under LARP have not yet been passed through order in council.**

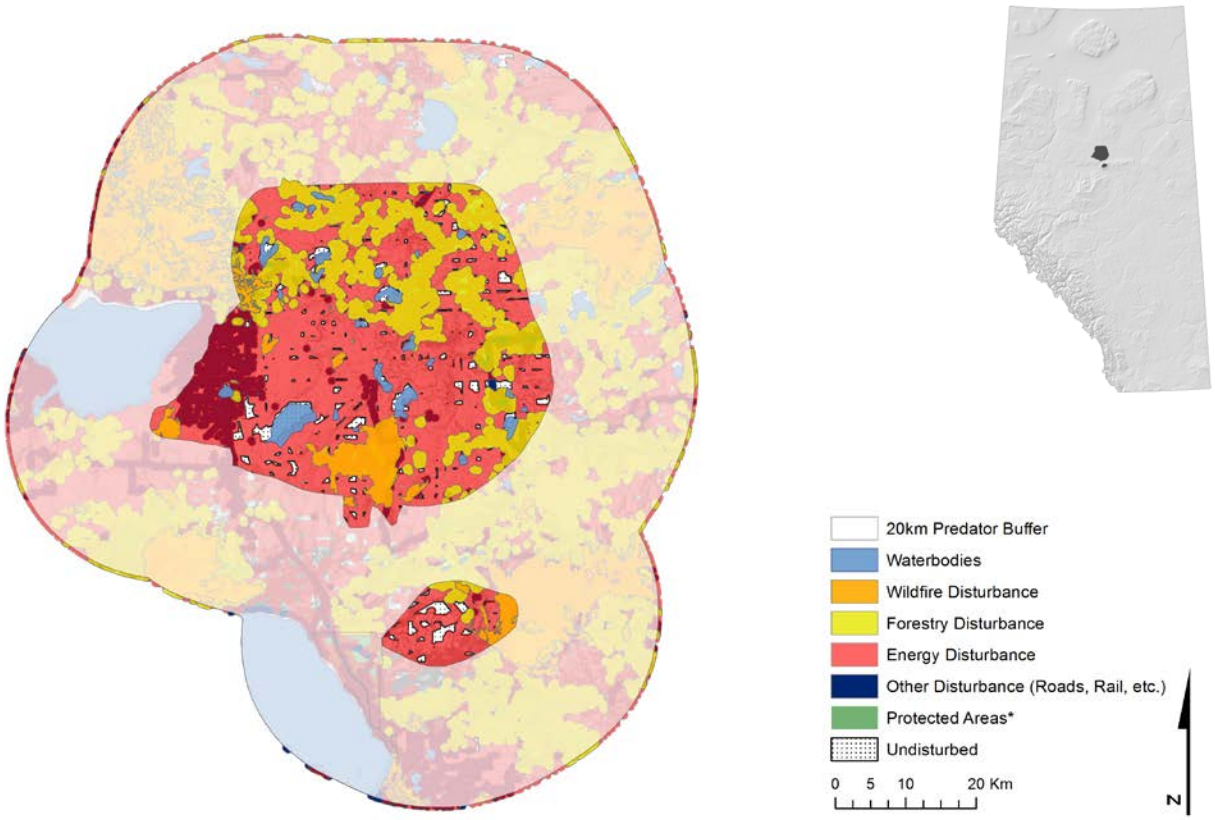



**Figure 25. Undisturbed habitat within the Nipisi range. *Protected areas have been drawn under disturbance. A black outline is used to indicate the boundary of protected areas.**

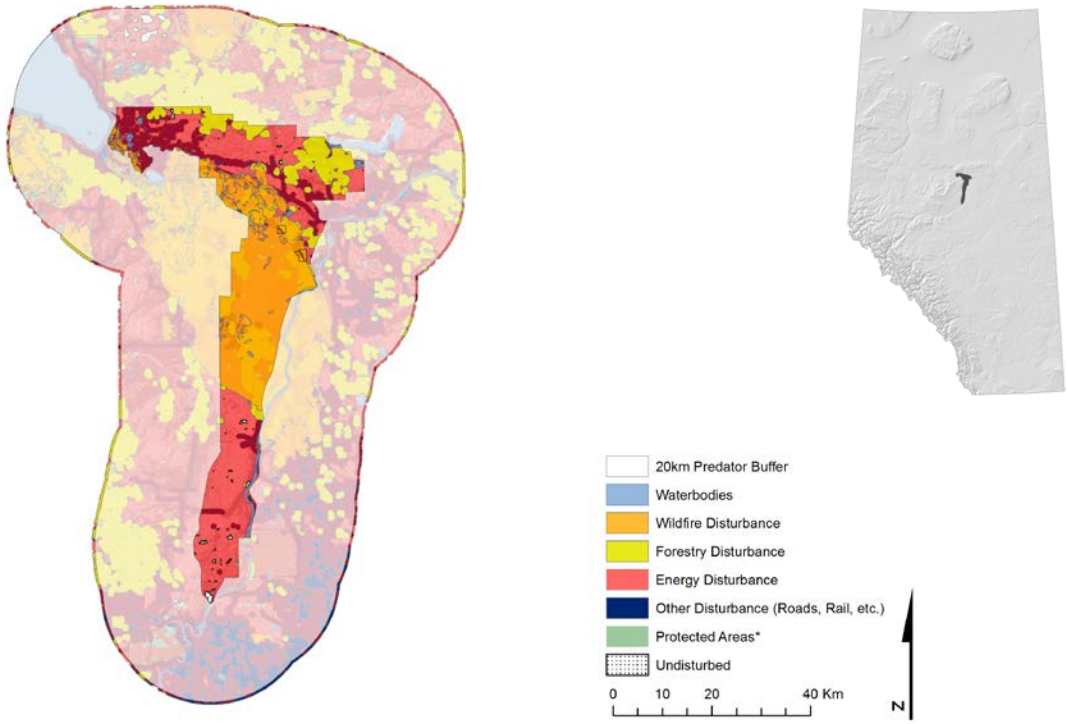



**Figure 26. Undisturbed habitat within the Slave Lake range. *Protected areas have been drawn under disturbance. A black outline is used to indicate the boundary of protected areas.**

## Conservation Value of Boreal Woodland Caribou Ranges in Alberta

CPAWS Northern Alberta's Conservation Blueprint was used as a tool to determine areas of highest conservation value on the landscape to determine the best areas to restore within boreal woodland caribou ranges. The Conservation Blueprint uses Marxan conservation planning software to identify candidate areas in each caribou range.[70] Marxan is publicly available conservation planning software that serves as a decision support by providing a range of "good" options that meet both conservation and socio-economic objectives, thereby facilitating the exploration of trade-offs.[71] Marxan uses a suite of conservation features, each with a defined target level, to try to find the most efficient areas to focus restoration and protection. The Conservation Blueprint included 85 coarse filter conservation features such as surficial geology, land cover, and wetland classes, with the idea that if all types of habitat are protected it would protect the range of species that live in those habitats. In addition, the Conservation Blueprint included 190 species at-risk and culturally important species as fine filter conservation features to ensure that these species do not fall through the coarse filter crack. For detailed methodology of the Conservation Blueprint including a list of the datasets and conservation features used, see Ronson and Pendlebury (2015).

The Conservation Value maps developed for this guide to range planning highlight areas that are irreplaceable on the landscape due to their representation of conservation features, using the Conservation Blueprint tool. Current legislated protected areas were locked into the model to account for the conservation features already present in the protected areas network. Disturbance density was assigned as a proxy for cost of restoration in the model to capture caribou's preference for intact forest, as well as the socio-economic interest. In addition, due to the importance of large undisturbed habitat to caribou, any continuous undisturbed area larger than 200 square kilometers was locked into the model; only four of these areas occurred in any of Alberta's caribou herd ranges.

The resulting maps show areas of high irreplaceability value that are representative of all of biodiversity, while having relatively lower socio-economic costs of protection. On the maps, the color indicates the number of times the planning unit was selected over 100 repetitions, with darker brown indicating a higher number. Planning units that have rare or unique features, or a high diversity of conservation features, will be selected more often in the model and can therefore be considered irreplaceable and should be prioritized for protection. Irreplaceability value for all northeast caribou ranges can be seen in the maps in Figures 27 through 33.

70 Marxan software can be downloaded at: http://www.uq.edu.au/marxan/index.html?page=106808 (as of April 26, 2016)

71 I.R. Ball, H. P. Possingham, and M. Watts, "Marxan and Relatives: Software for Spatial Conservation Prioritisation.," *Spatial Cnoservation Prioritisation: Quantitative Methods and Computational Tools.*, 2009.

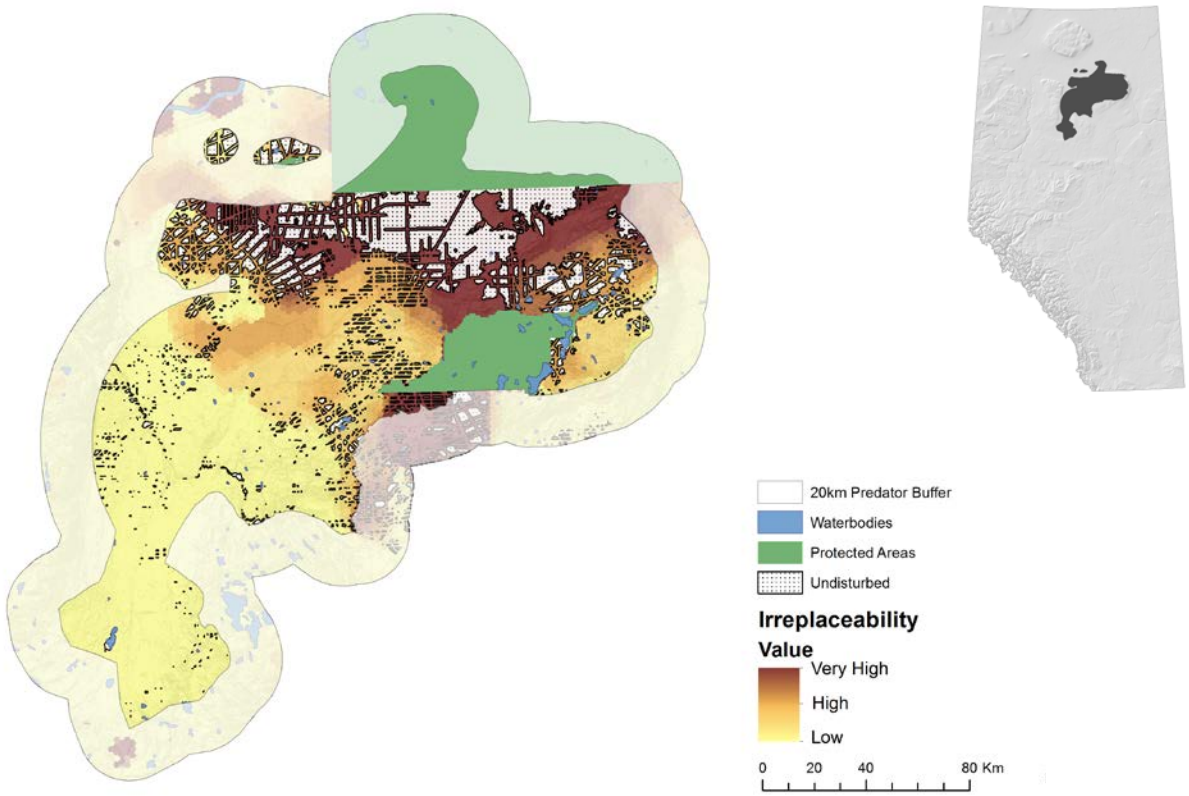



**Figure 27. Irreplaceability value in the Red Earth range.**

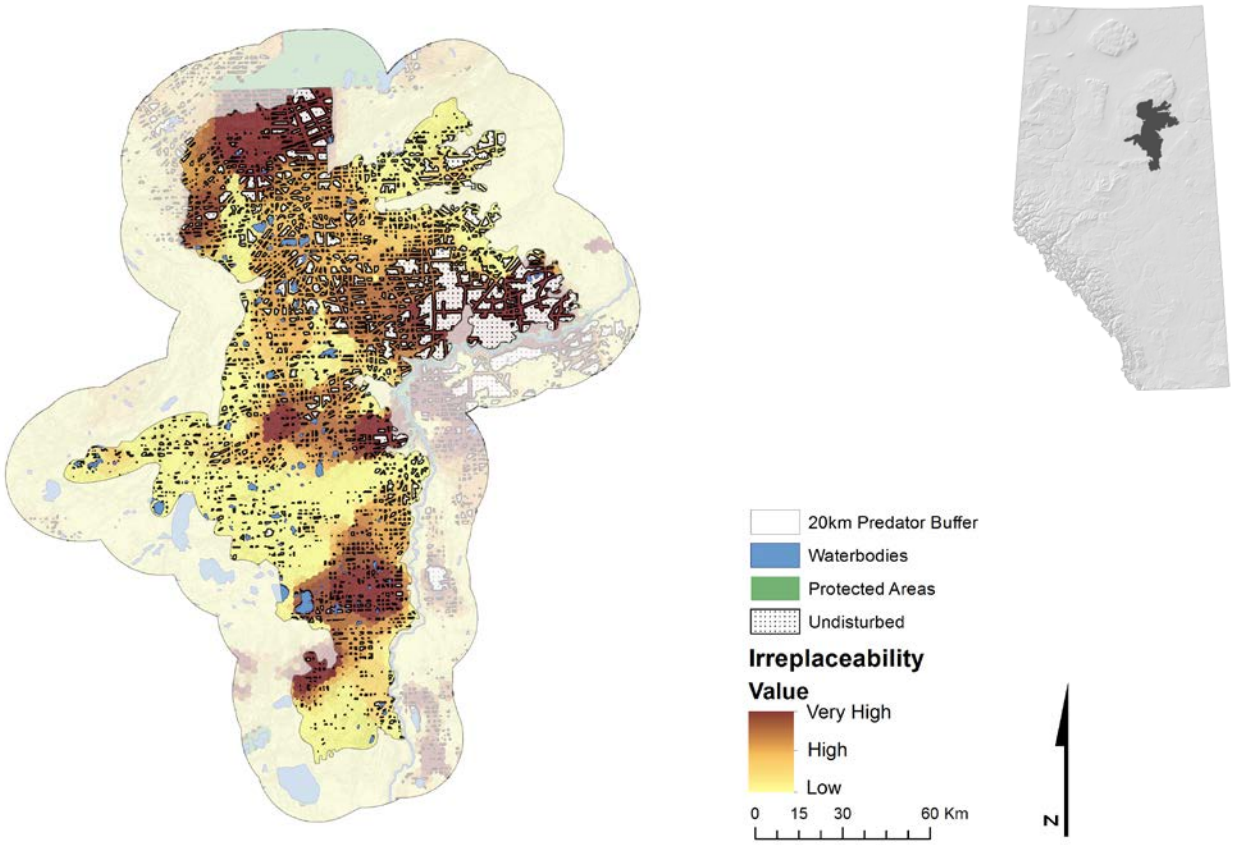



**Figure 28. Irreplaceability value in the WSAR range.**

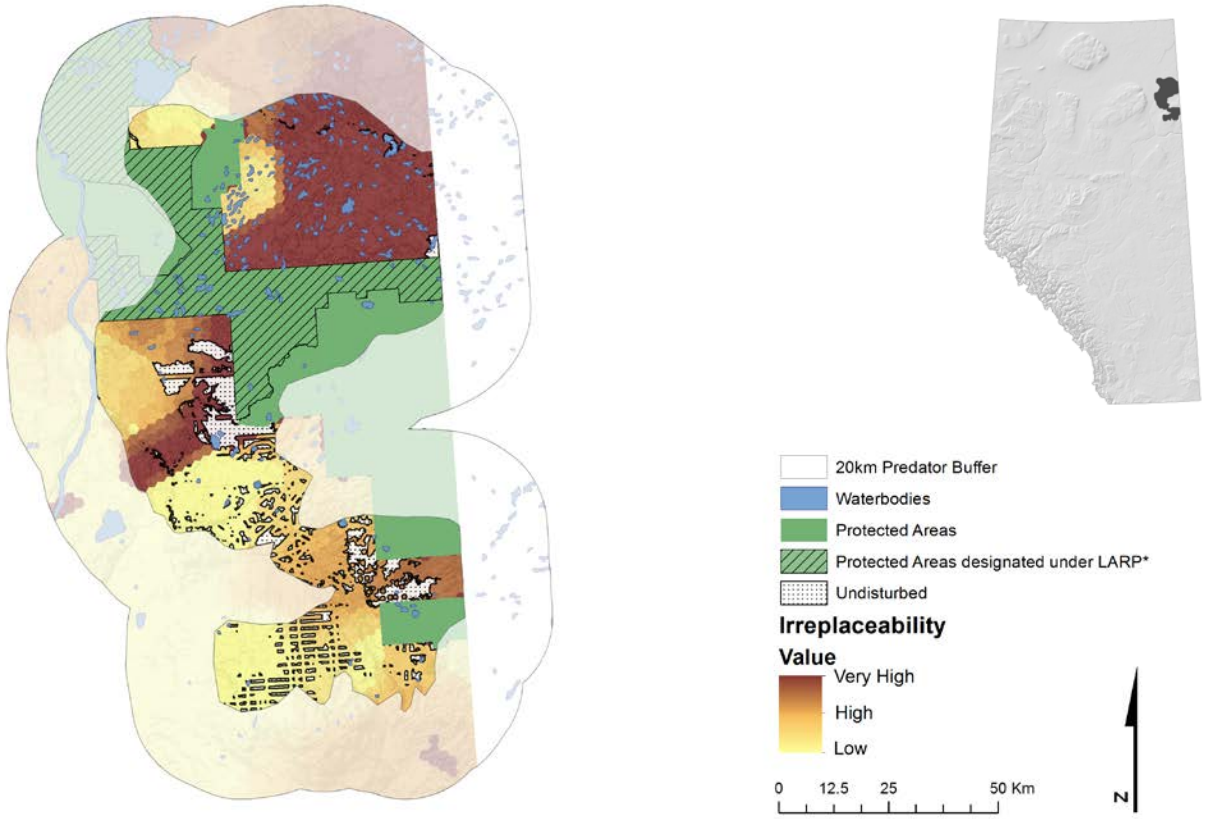



**Figure 29. Irreplaceability value in the Richardson range. *Protected areas that have been designated under LARP have not been passed though order in council.**

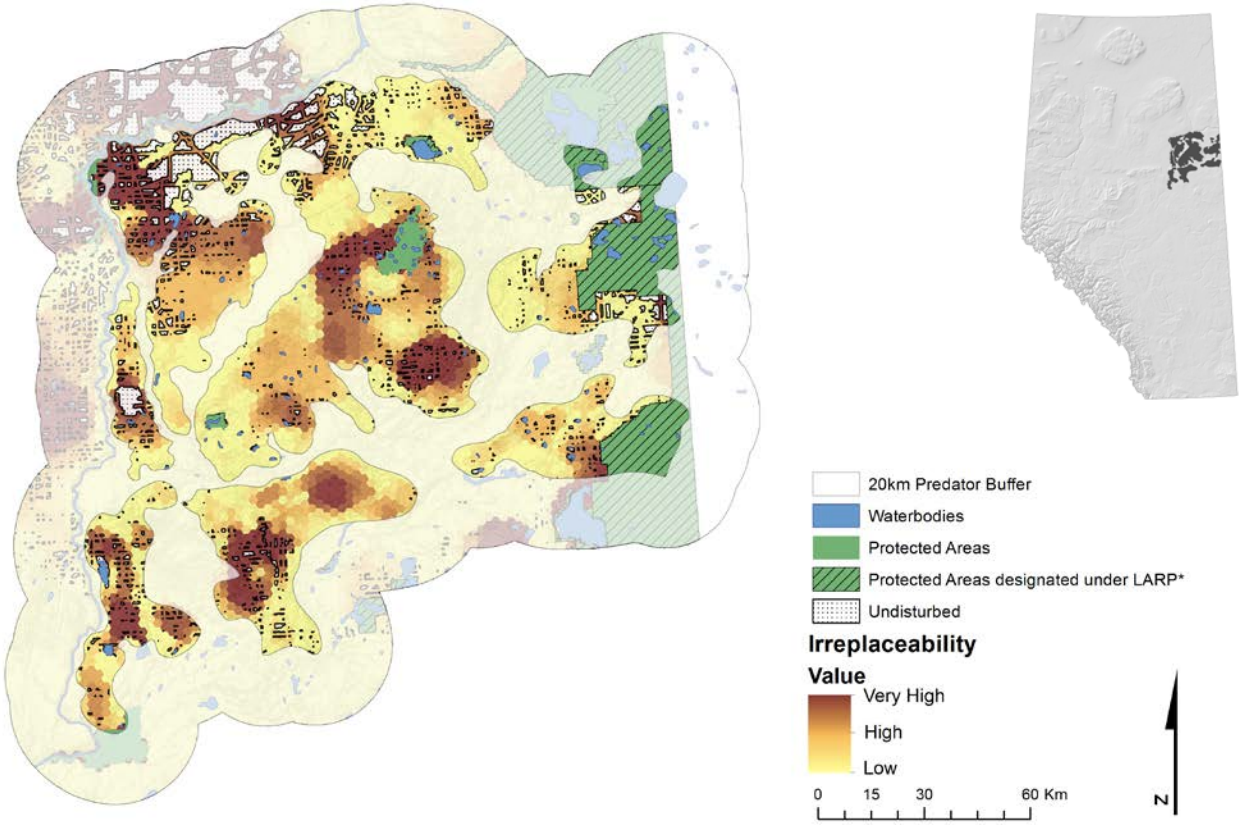



**Figure 30. Irreplaceability value in the ESAR range. *Protected areas that have been designated under LARP have not been passed though order in council.**

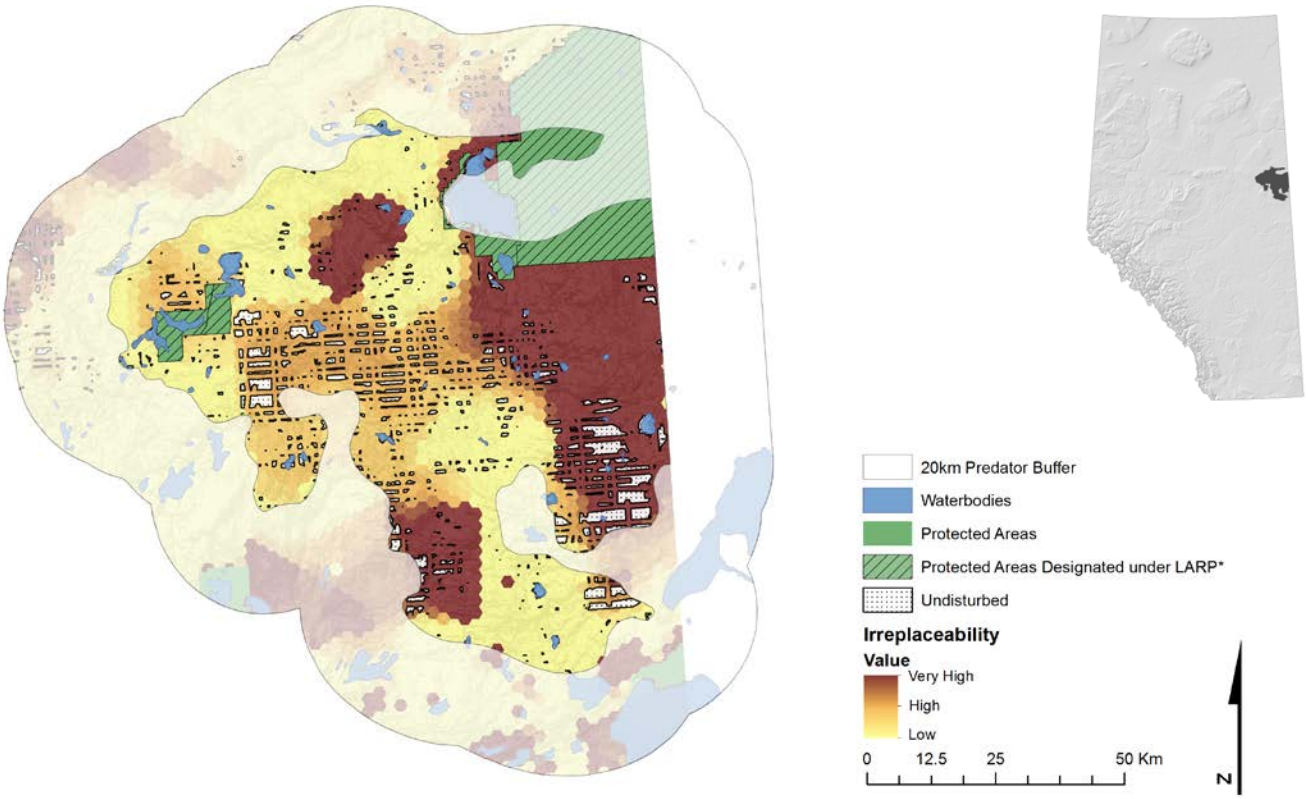



**Figure 31. Irreplaceability value in the Cold Lake range. *Protected areas that have been designated under LARP have not been passed though order in council.**

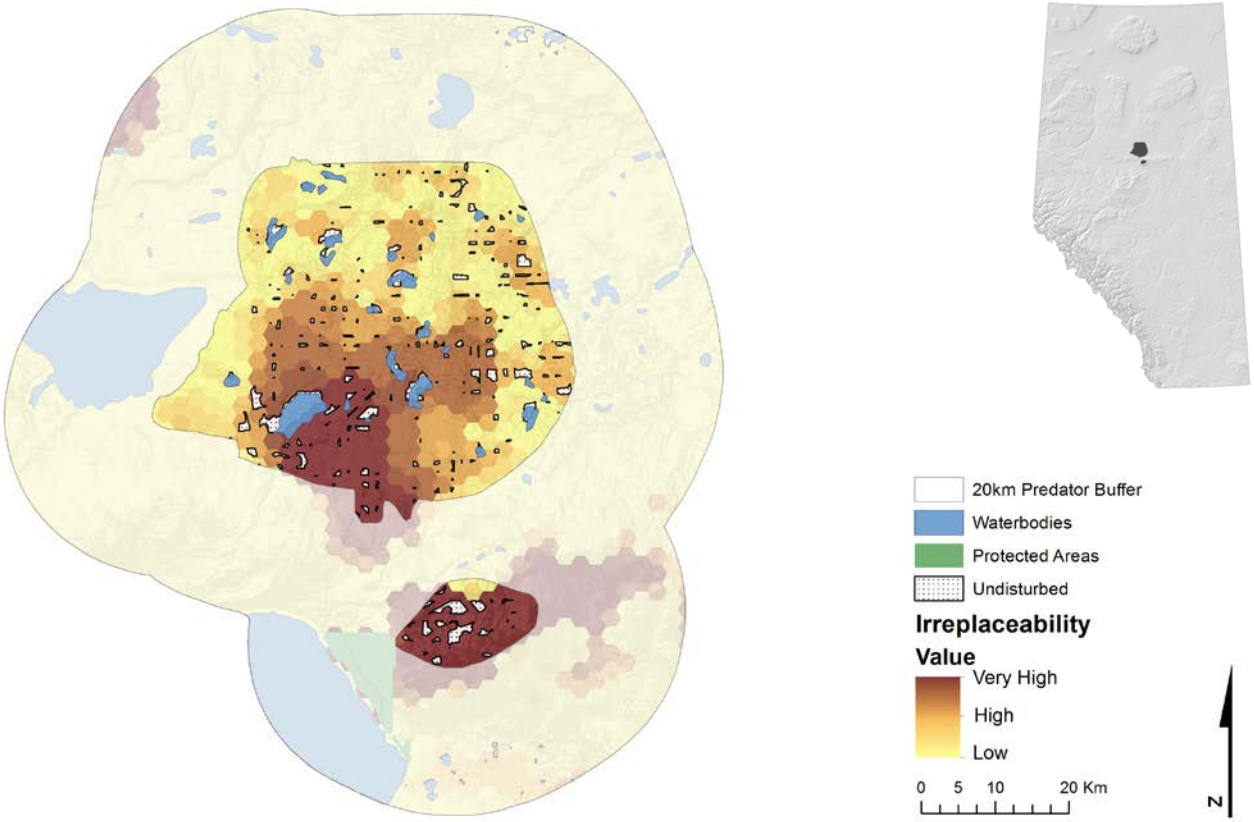



**Figure 32. Irreplaceability value in the Nipisi range.**

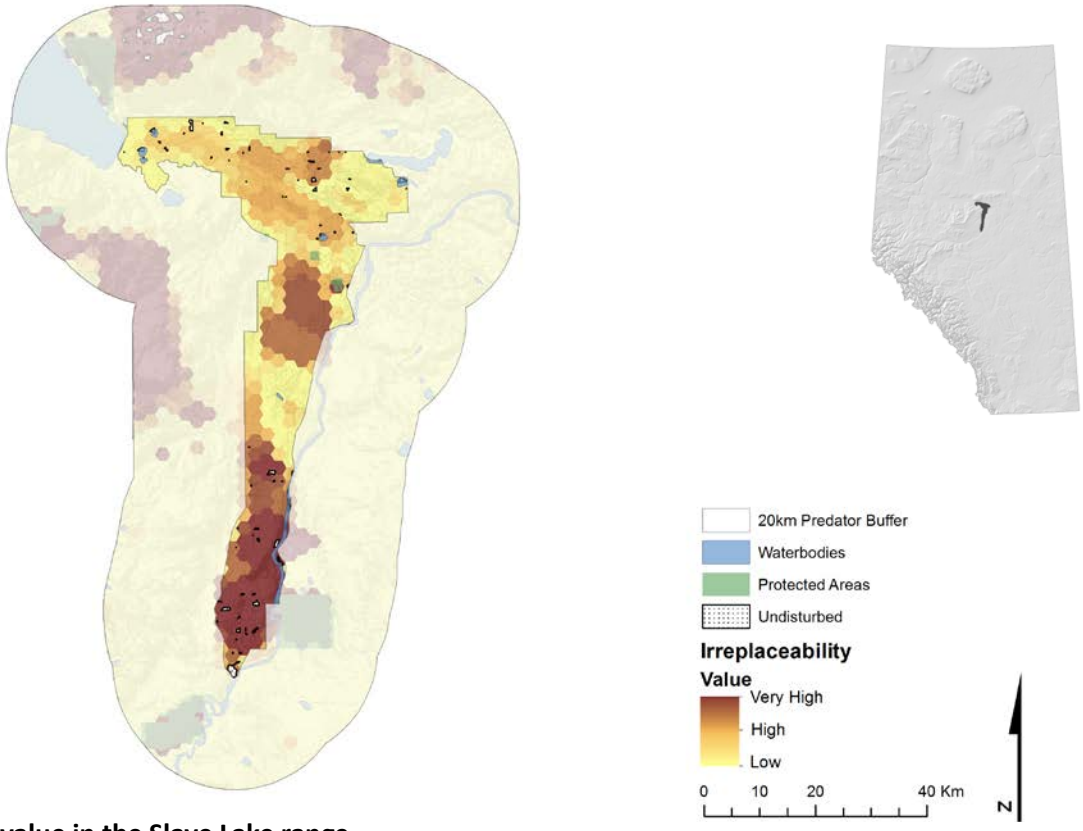



**Figure 33. Irreplaceability value in the Slave Lake range.**

## Home Range for Boreal Woodland Caribou Herds in Alberta

Boreal woodland caribou require large home ranges throughout the year to avoid predation through spatial separation. Using telemetry data points of collared female caribou, individual female home ranges can be observed using minimum convex polygons ("MCP").[72] These home ranges show the amount of habitat required by each collard caribou, with the percent of overlapping female home ranges indicating areas of high caribou usage within the range. It is important to note that both the telemetry data points and overlapping home ranges should not be interpreted as fully representative of caribou usage of the range. Only a small sample of female caribou have been collared in Alberta, and therefore the spatial distribution will contain gaps. A high percentage of overlap in female home ranges may indicate areas of high usage, but a low percentage of overlap does not necessarily indicate areas of low usage and should not be interpreted as areas of the range that are not important to caribou.

Due to the large area and spatial separation of each of the individual home ranges, proper management of the entire range is crucial for self-sustaining populations. However, the high degree of restoration that is necessary in each of the ranges requires some prioritization. MCP data was not used in CPAWS Northern Alberta's prioritization. Caribou home rangesm and areas of high caribou usage should still be a consideration when creating range plans.

## Restoration Priority Areas for Boreal Woodland Caribou Ranges in Alberta

Habitat restoration will be the best approach to address the ultimate cause of caribou decline due to the level of disturbance in each range.[73,74] Seismic lines overwhelm the northern Alberta landscape, and the forest within these lines often does not recover well on its own. Around 60 percent of seismic lines do not recover to adequate vegetation within 35 years after being cut, and average around 112 years to naturally recover.[75] Seismic lines, including low impact seismic lines, within boreal woodland caribou-preferred habitat such as bogs and fens are especially slow to recover naturally.[76,77,78] With

72 Alberta Environment and Parks, "Alberta Woodland Caribou GPS-VHF Locations, Minimum Convex Polygons, and Overlapping Minimum Convex Polygons," December 2015.

73 Christine B. Robichaud and Kyle H. Knopff, "Biodiversity Offsets and Caribou Conservation in Alberta: Opportunities and Challenges," *Rangifer* 35, no. 2 (2015): 99, doi:10.7557/2.35.2.3636.

74 Athabasca Landscape Team, "Athabasca Caribou Landscape Management Options Report."

75 Philip Lee and Stan Boutin, "Persistence and Developmental Transition of Wide Seismic Lines in the Western Boreal Plains of Canada," *Journal of Environmental Management* 78, no. 3 (2006): 240–50, doi:10.1016/j.jenvman.2005.03.016.

76 John L Kansas, Michael L Charlebois, and Hans G Skatter, "Vegetation Recovery on Low Impact Seismic Lines in Alberta ' S Oil Sands and Visual Obstruction of Wolves (Canis Lupus) and Woodland Caribou (Rangifer Tarandus Caribou)," *Canadian Wildlife Biology and Management* 4, no. 2 (2015).

77 Cassidy K. van Rensen et al., "Natural Regeneration of Forest Vegetation on Legacy Seismic Lines in Boreal Habitats in Alberta's Oil Sands Region," *Biological Conservation* 184 (2015): 127–35.

78 Lee and Boutin, "Persistence and Developmental Transition of Wide Seismic Lines in the Western Boreal Plains of Canada."

caribou extirpation from Alberta anticipated within the next 40 to 50 years, the long timeline for natural recovery must be sped up through active restoration of linear disturbances.[79,80]

Large areas of each range were shown to be of high irreplaceability value. Thus, in order to more efficiently use resources for restoration and protection within caribou range, a zonation approach was applied to further prioritize each range. Zones have been used as an approach to range planning in previous work completed by the Alberta Caribou Committee, The Government of Alberta, and the Canadian Boreal Forest Agreement and suggested as a management approach in the Recovery Strategy.[81,82,83,84] The zone prioritization within each range in this document was completed at a large scale so that caribou and all the biodiversity that exists within caribou range are considered; finer scale prioritization will need to occur within these zones and should occur with the input of First Nations communities, environmental organizations, and government and industry representatives.

Irreplaceability value, which considers intactness as a proxy for the value of natural resources to the forestry and oil and gas sectors, was used to determine the placement of each zone. Priority 1 zones represent approximately 20 percent of each range, priority zones 1 and 2 make up approximately 50 percent of each range, and priority zones 1 through 3 make up approximately 65 percent of each range.[85] Priority zones 1 through 3 in each range make up the 65 percent of each range that CPAWS Northern Alberta recommends should be the focus of restoration efforts to return the range to undisturbed habitat. Priority 1 zones can be considered the most efficient starting point, and protection through protected areas and restoration of disturbances should be implemented here first as Priority 1 zones are of high conservation value and least disturbed. Current legislated parks are Priority 1 zones and should be first priority for restoration. The disturbance maps highlight the amount of restoration needed within these protected areas. The remainder of the range is priority zone 4 and should be managed with caribou conservation as the landuse priority, with disturbance levels kept to a minimum. This 65 percent that has been identified by our mapping does not take into account future risk of wildfire. In addition to this 65 percent, range plans need to consider the risk of wildfire in each range when creating range plans.

Each of the maps include a 20 kilometre predator influence buffer;[86] however, best practices recommend creating a buffer based on telemetry data of predators in the area.[87] Where this data is unavailable more conservative predator buffers of around 100km are recommended.[88] Predator buffers are important to manage so disturbance levels in this buffer area do not encourage higher populations of primary prey and predators. Large populations of predators immediately surrounding caribou range have the potential to negate beneficial work completed within the range. Although the predator buffer was not included in our analysis, it is recommended that it be managed the same as priority zone 4.

The maps, in Figures 34 through 47, show caribou locations and areas of high overlap in female home ranges as well as priority zones for restoration and protection for each caribou range.

Woodland caribou - K Bluck

79 Carlson and Browne, "The Future of Wildlife Conservation and Resource Development in the Western Boreal Forest."
80 Lee and Boutin, "Persistence and Developmental Transition of Wide Seismic Lines in the Western Boreal Plains of Canada."
81 Alberta Caribou Committee Governance Board, "Alberta Caribou Committee Recommendations to the Deputy Minister of Sustainable Resource Development for the Athabasca Caribou Landscape."
82 Alberta Sustainable Resource Development, "A Woodland Caribou Policy for Albert."
83 Antoniuk et al., "A Methodological Framework For Caribou Action Planning In A Methodological Framework for Caribou Action Planning In Support of the Canadian Boreal Forest Agreement."
84 Environment Canada, *Recovery Strategy for the Woodland Caribou (rangifer Tarandus Caribou), Boreal Population, in Canada*.
85 The zone sizes, as a percent of the range, are approximate. Irreplaceability values for each herd were seperated into quantiles to determine zones, in some cases the spread of data led to a larger portion of the range being selected as zone 1 in order to capture the irreplaceability of the conservation features found in those areas.
86 Athabasca Landscape Team, "Athabasca Caribou Landscape Management Options Report."
87 Antoniuk et al., "A Methodological Framework for Caribou Action Planning In Support of the Canadian Boreal Forest Agreement."
88 Ibid.

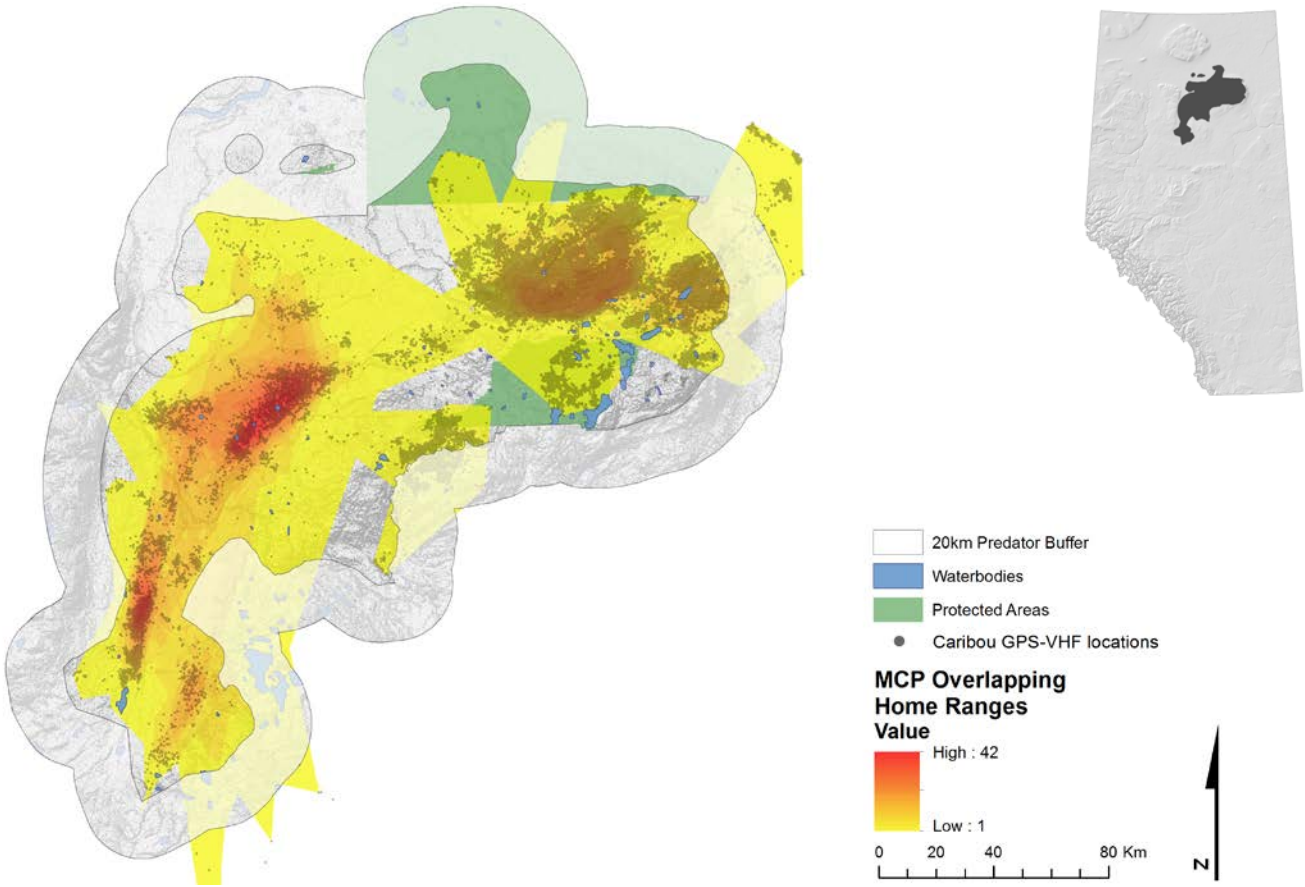



**Figure 34. Caribou telemetry locations and MCP overlapping home ranges in the Red Earth range.**

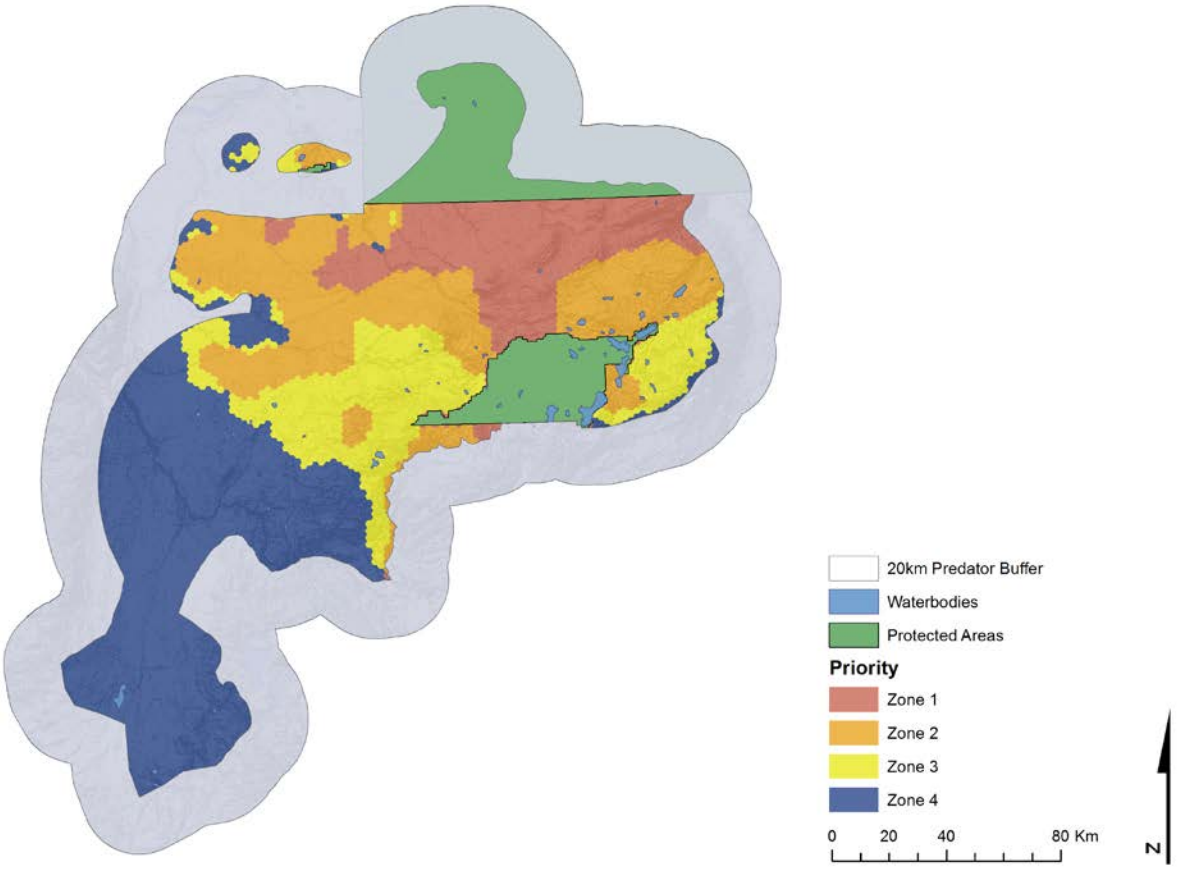



**Figure 35. Recommended priority zones in the Red Earth range.**

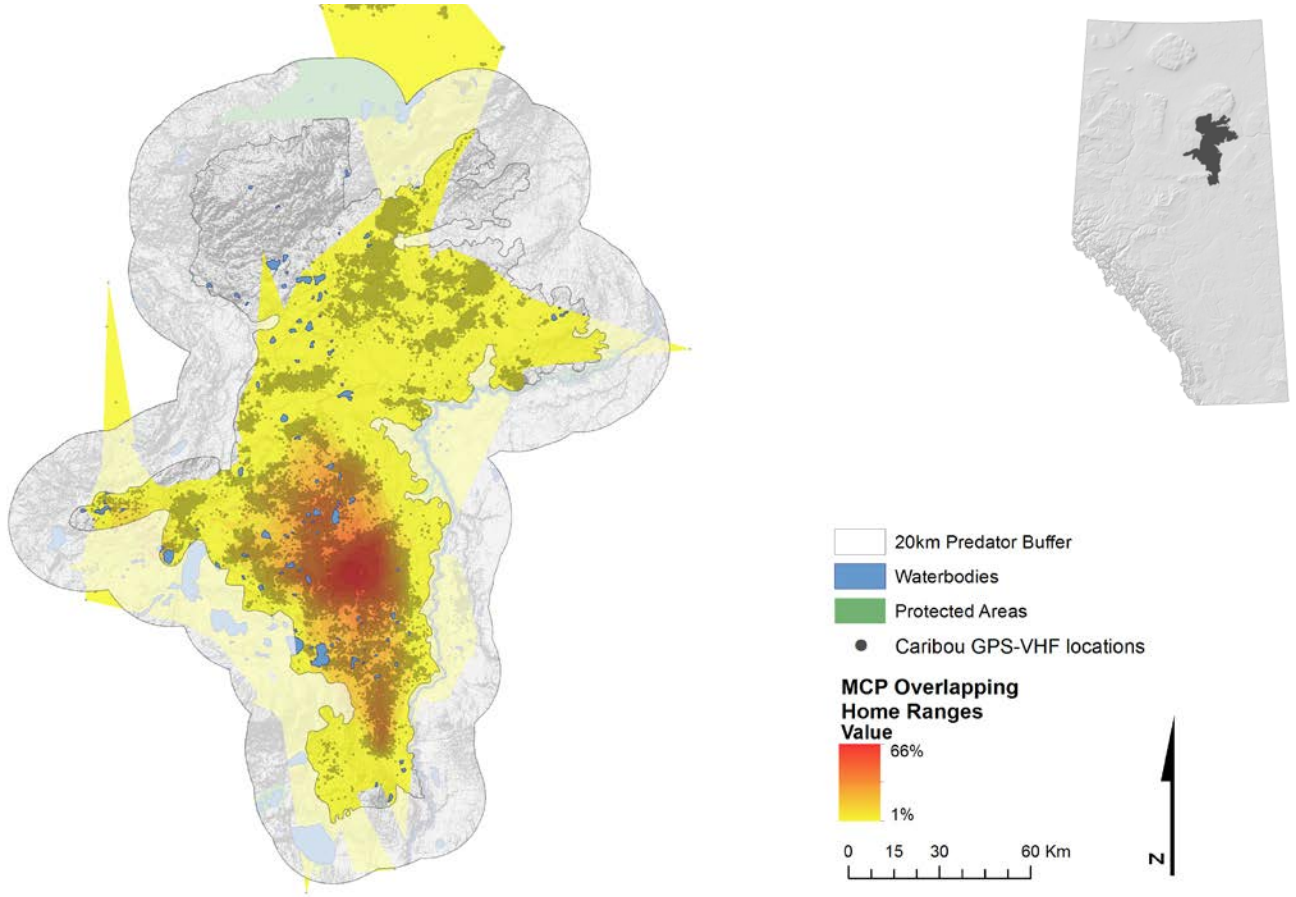



**Figure 36. Caribou telemetry locations and MCP overlapping home ranges in the WSAR range.**

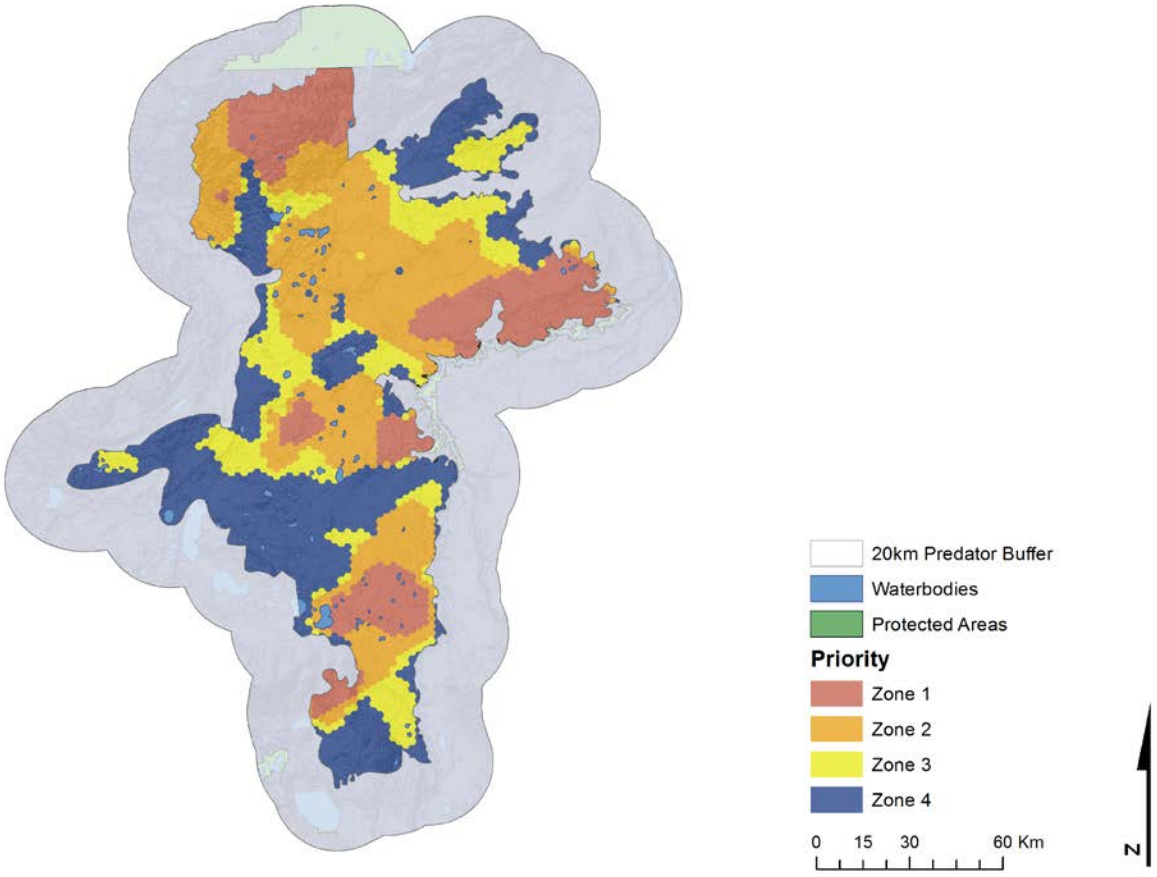



**Figure 37. Recommended priority zones in the WSAR range.**

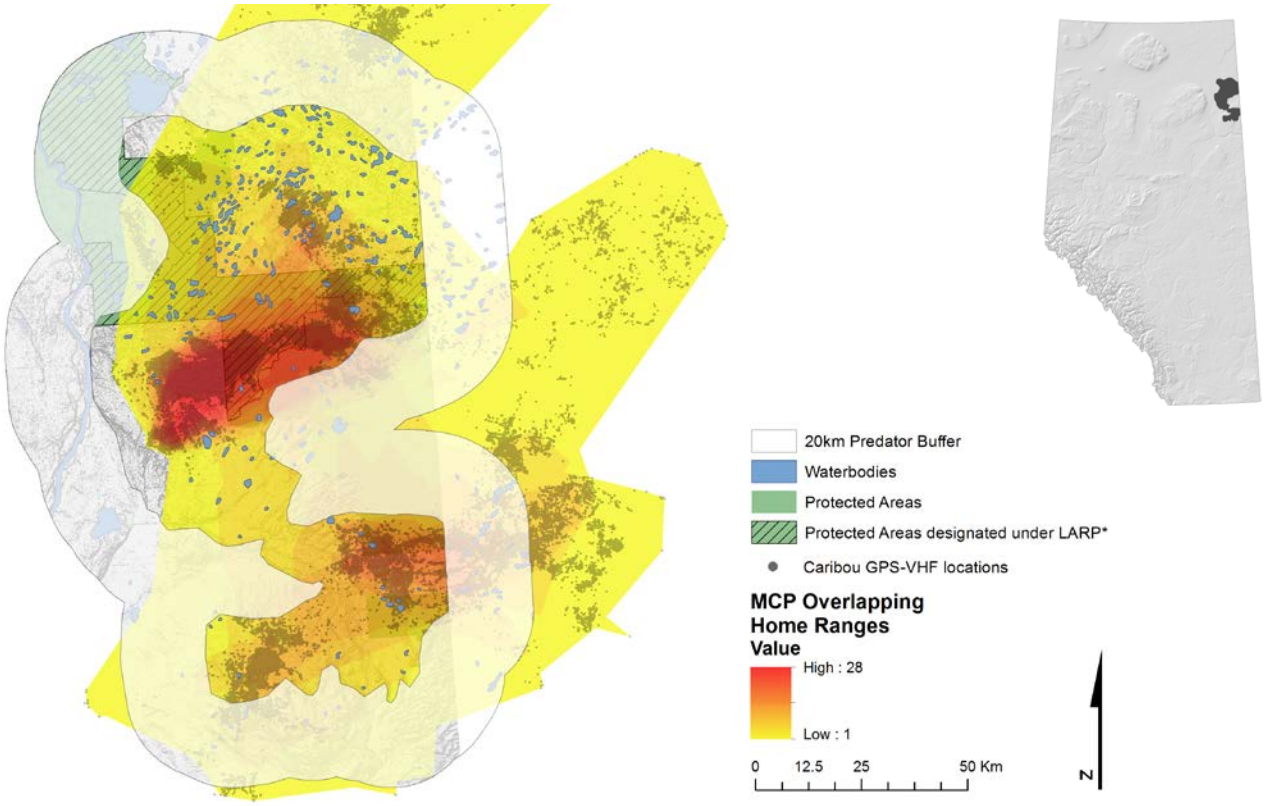



**Figure 38. Caribou telemetry locations and MCP overlapping home ranges in the Richardson range. *Protected areas that have been designated under LARP have not been passed though order in council.**

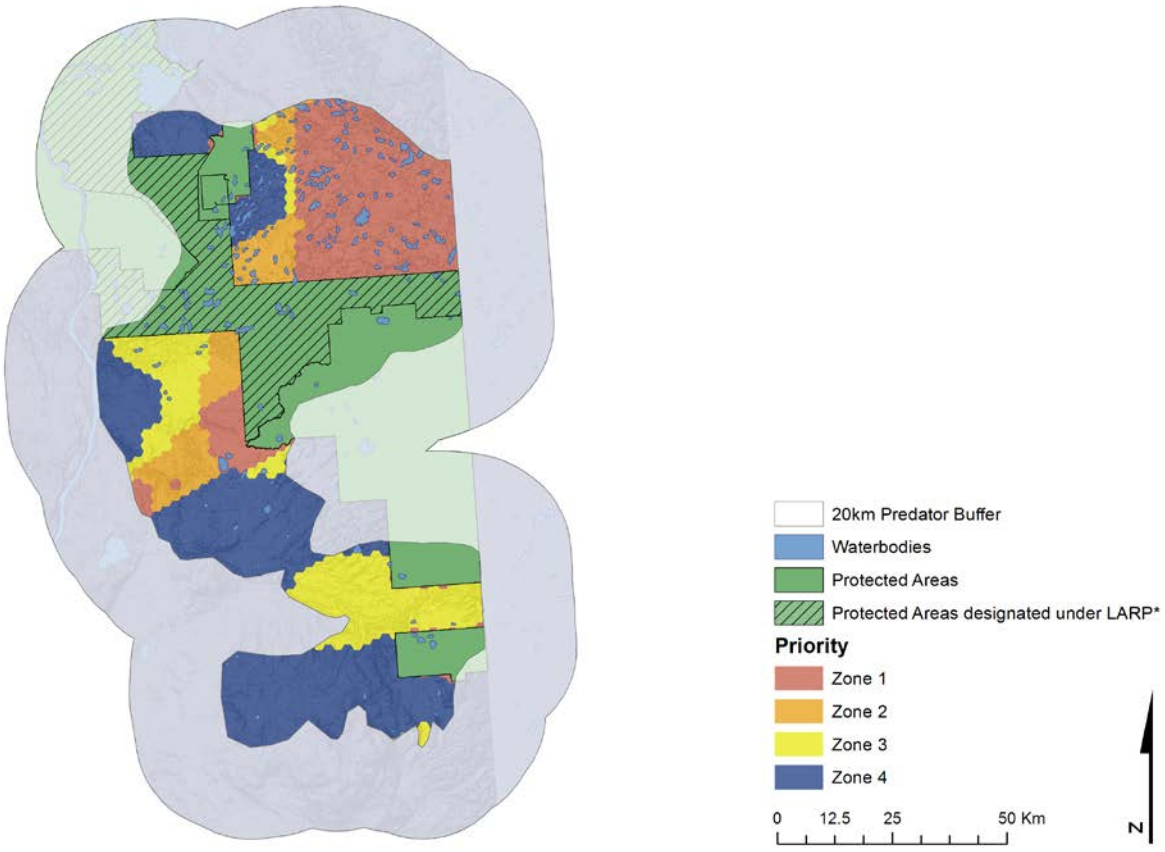



**Figure 39. Recommended priority zones in the Richardson range. *Protected areas that have been designated under LARP have not been passed though order in council.**

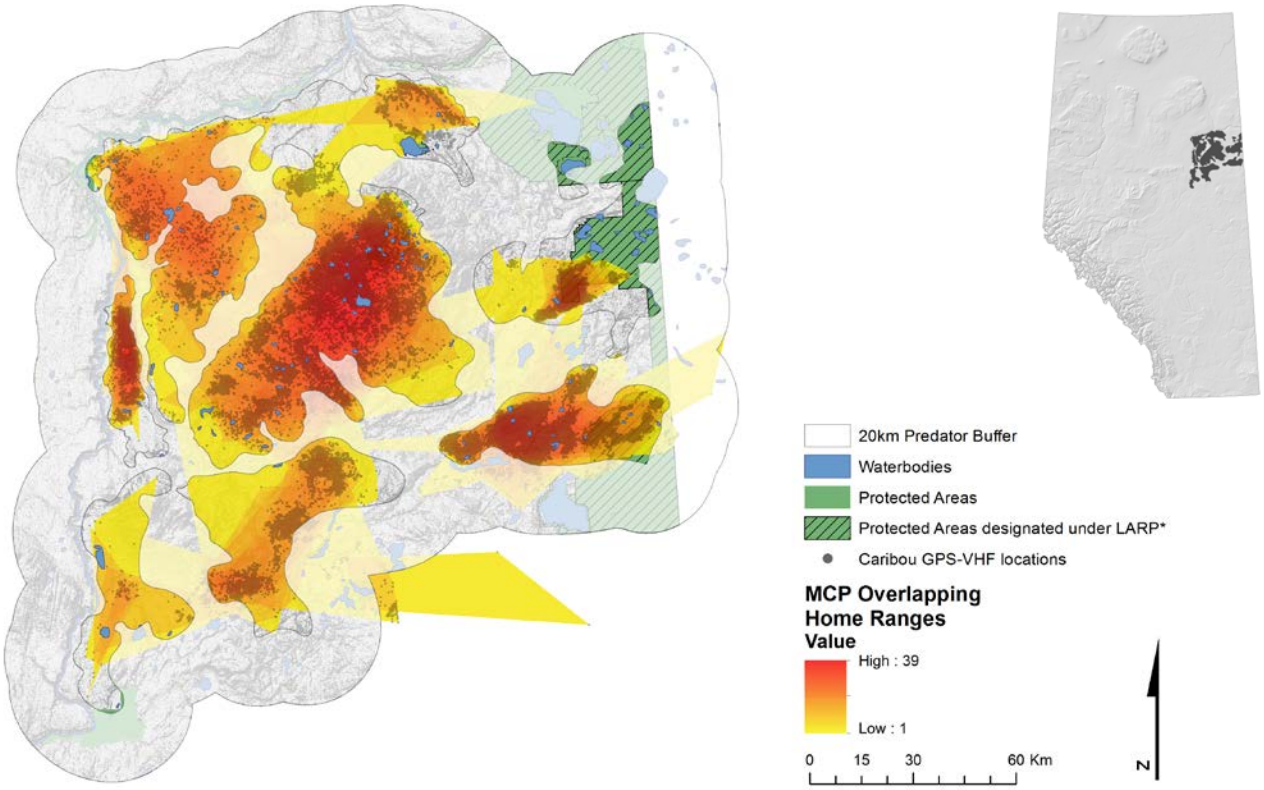



**Figure 40. Caribou telemetry locations and MCP overlapping home ranges in the ESAR range. *Protected areas that have been designated under LARP have not been passed though order in council.**

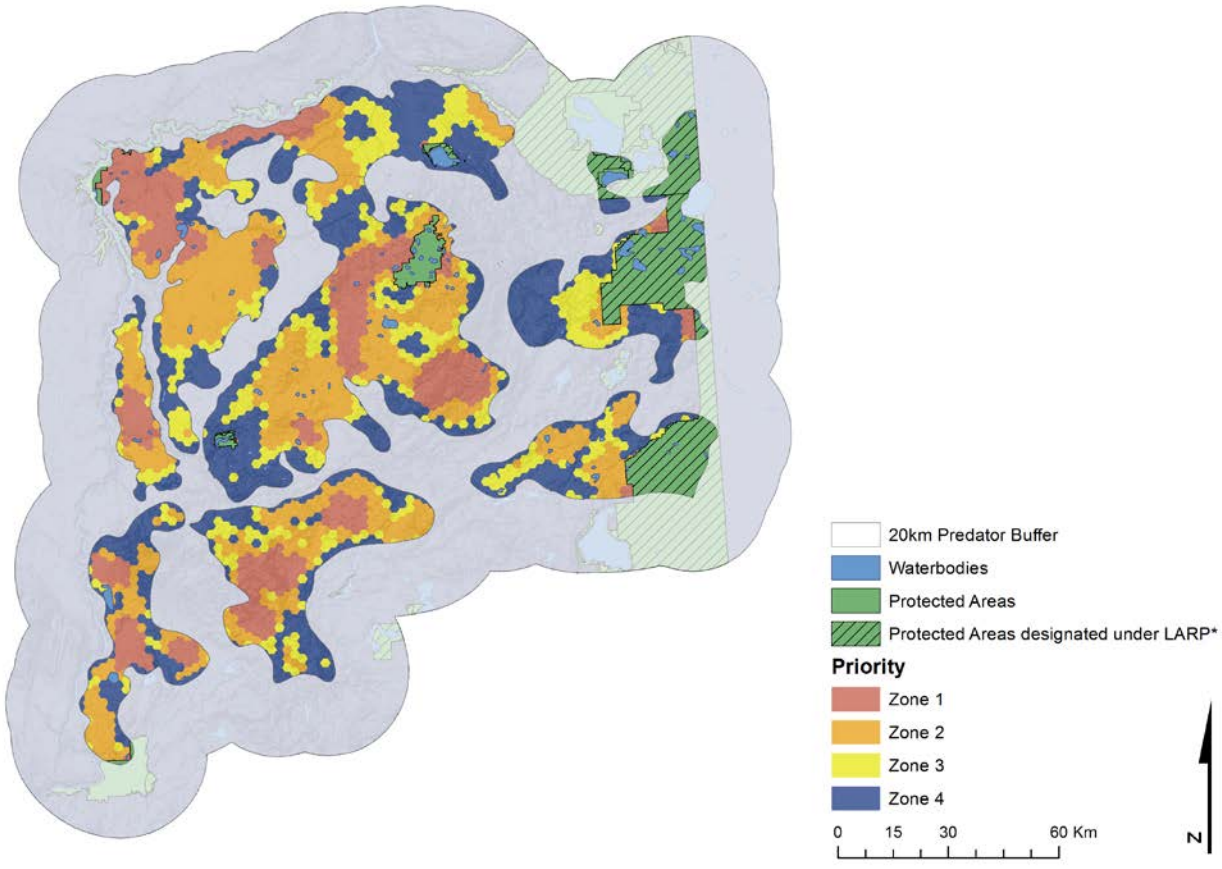



**Figure 41. Recommended priority zones in the ESAR range. *Protected areas that have been designated under LARP have not been passed though order in council.**

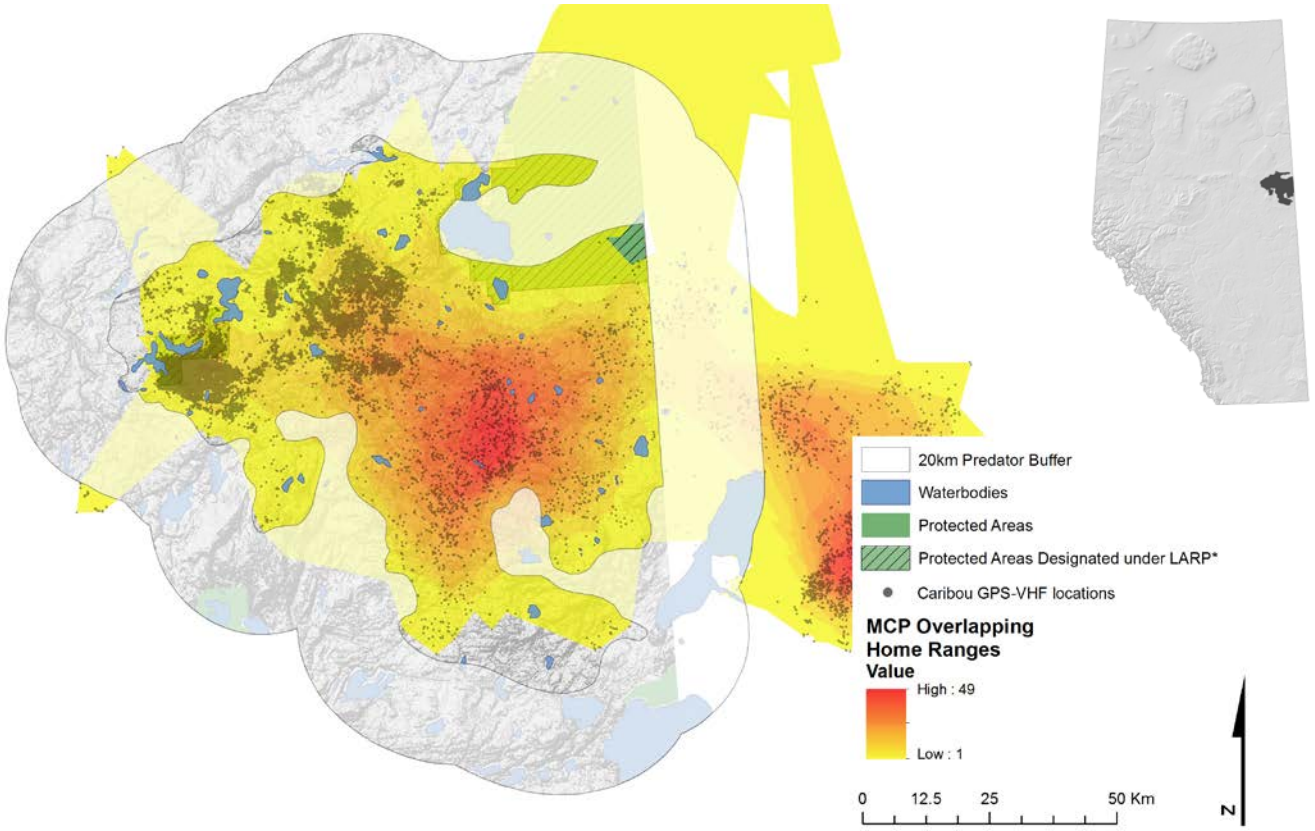



**Figure 42. Caribou telemetry locations and MCP overlapping home ranges in the Cold Lake range. *Protected areas that have been designated under LARP have not been passed though order in council.**

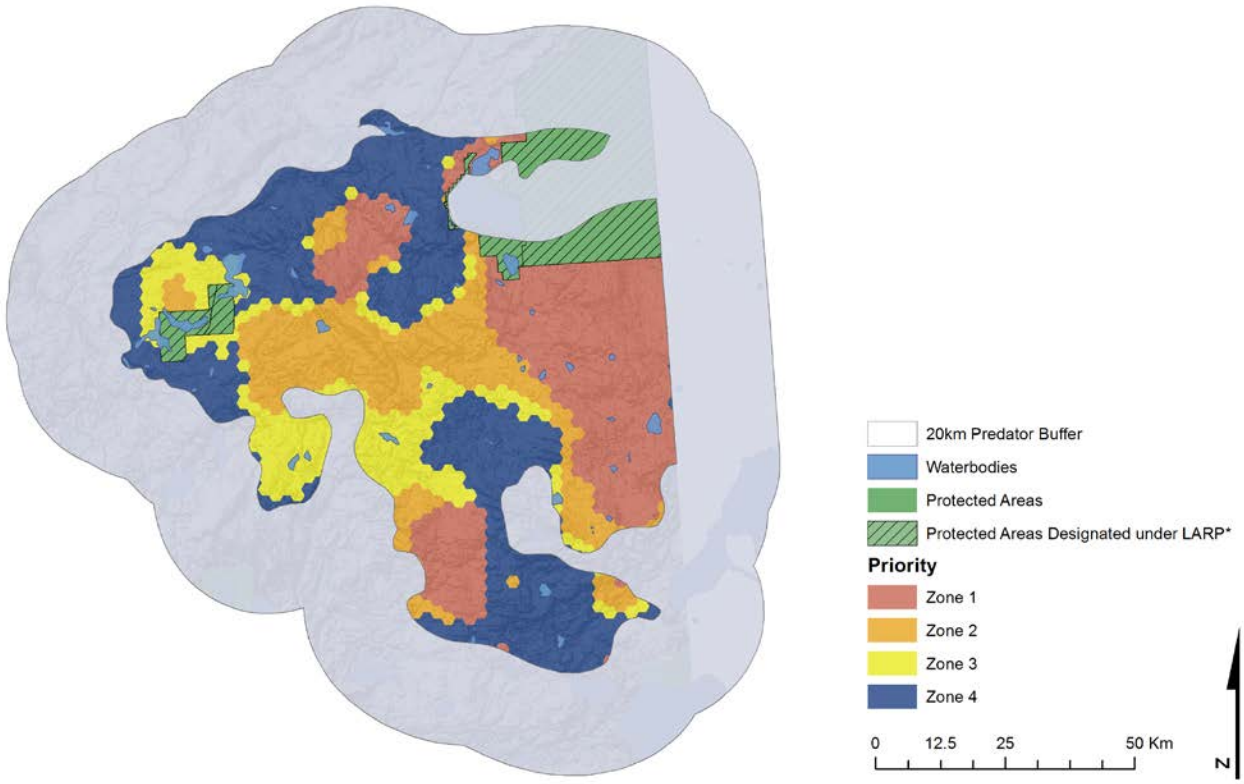



**Figure 43. Recommended priority zones in the Cold Lake range. *Protected areas that have been designated under LARP have not been passed though order in council.**

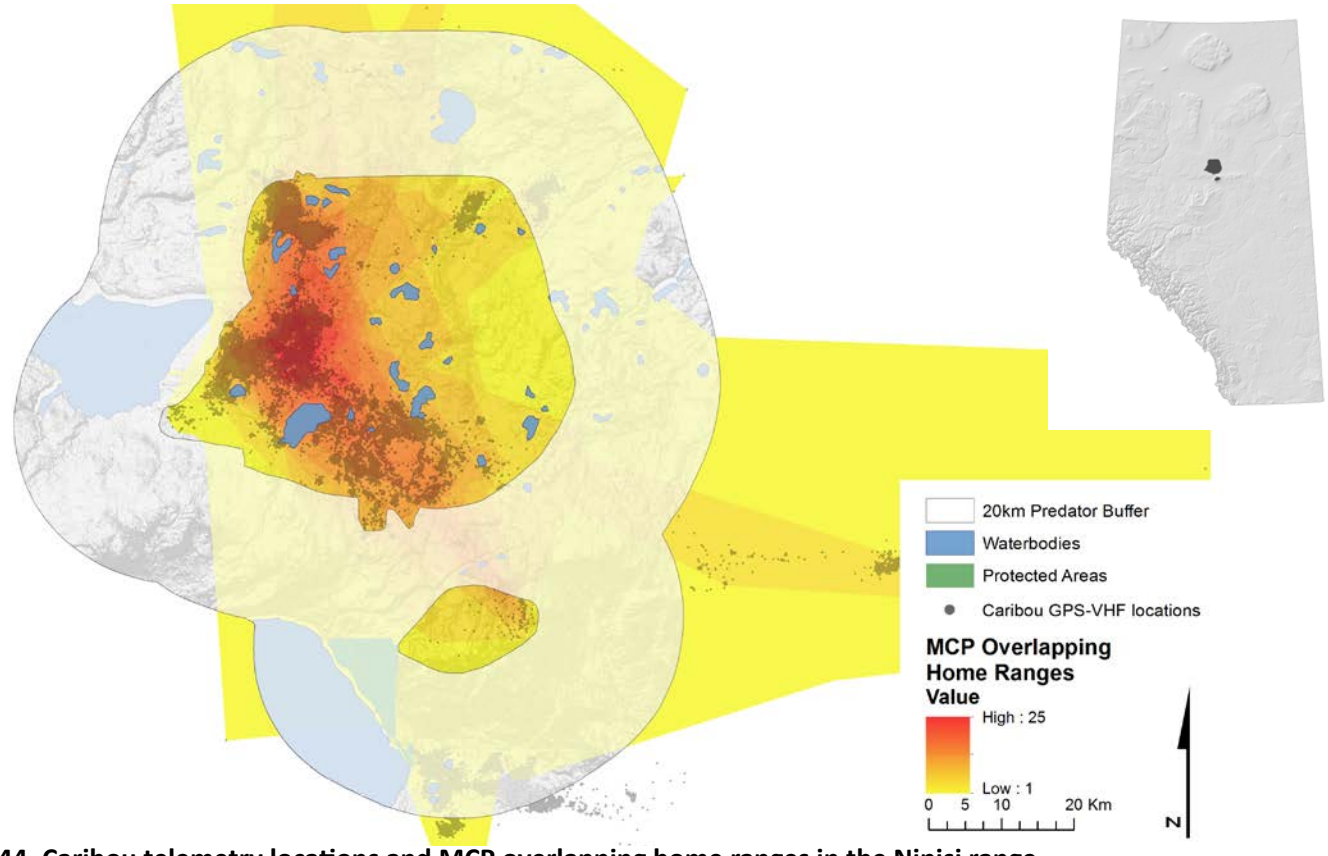



**Figure 44. Caribou telemetry locations and MCP overlapping home ranges in the Nipisi range.**

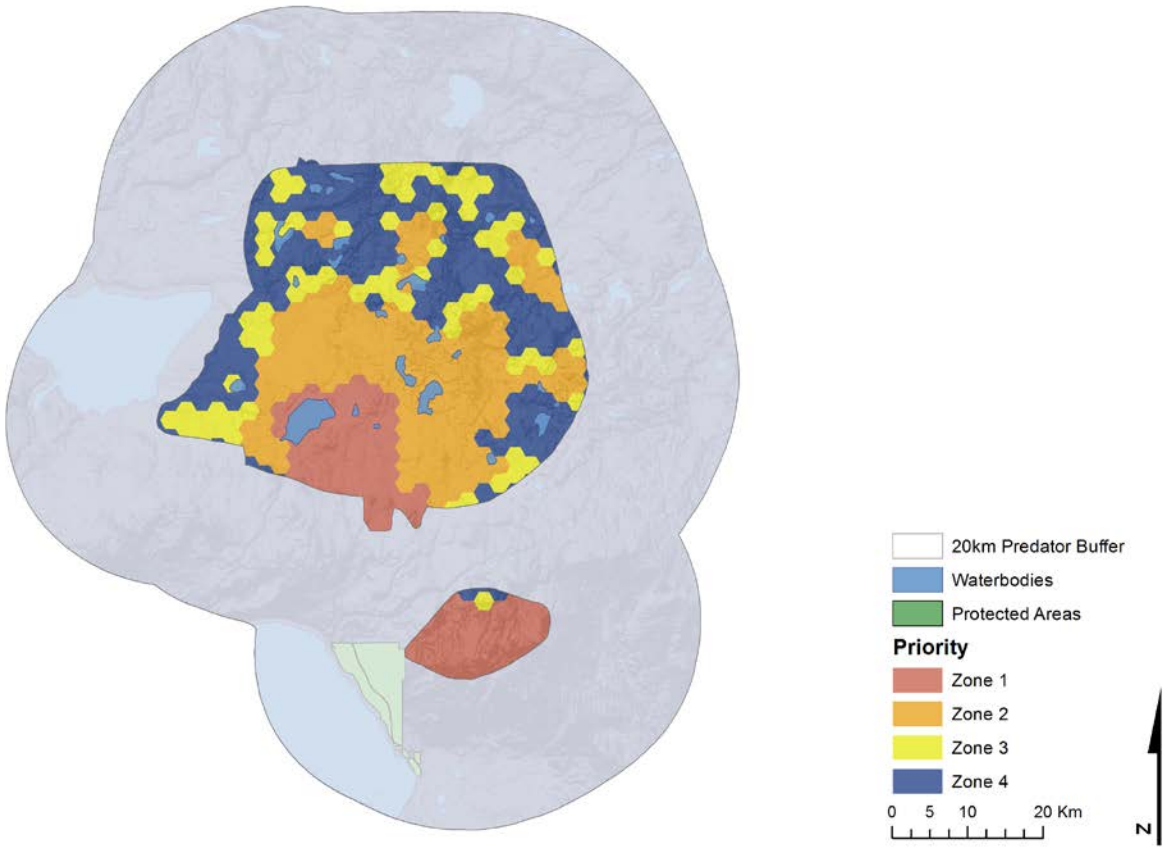



**Figure 45. Recommended priority zones in the Nipisi range.**

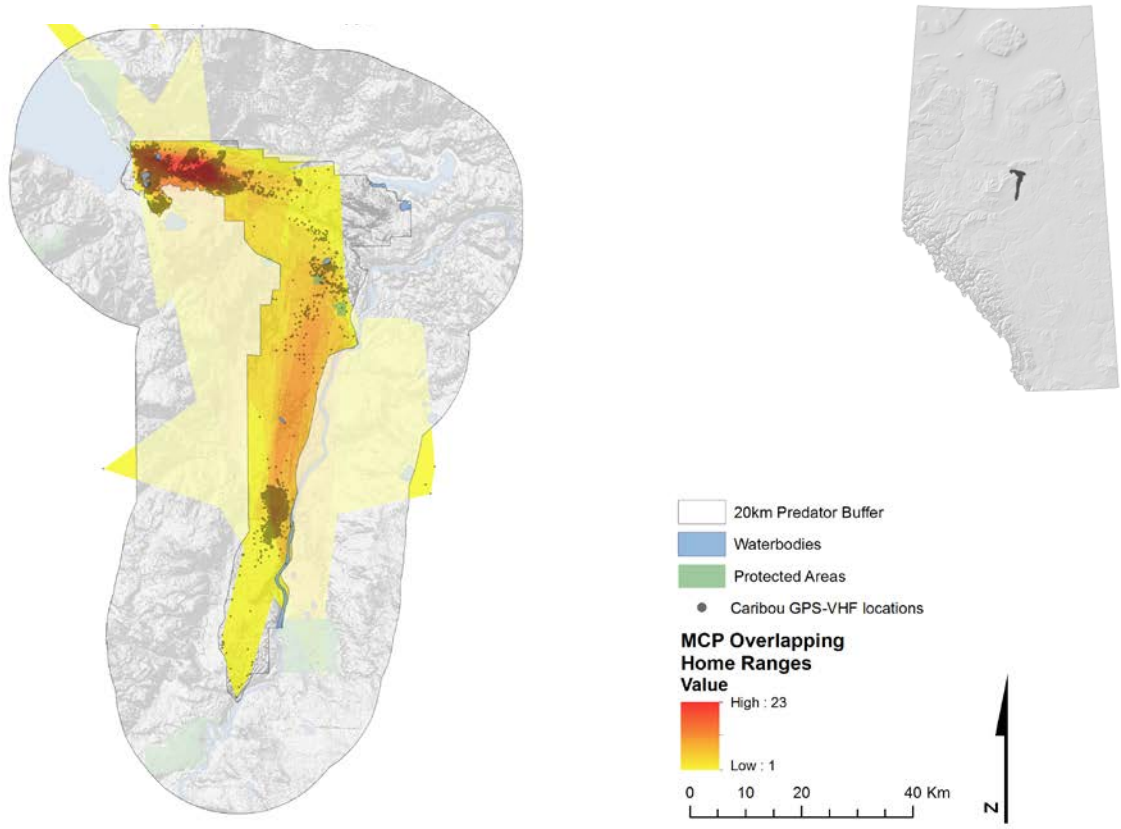



**Figure 46. Caribou telemetry locations and MCP overlapping home ranges in the Slave Lake range.**

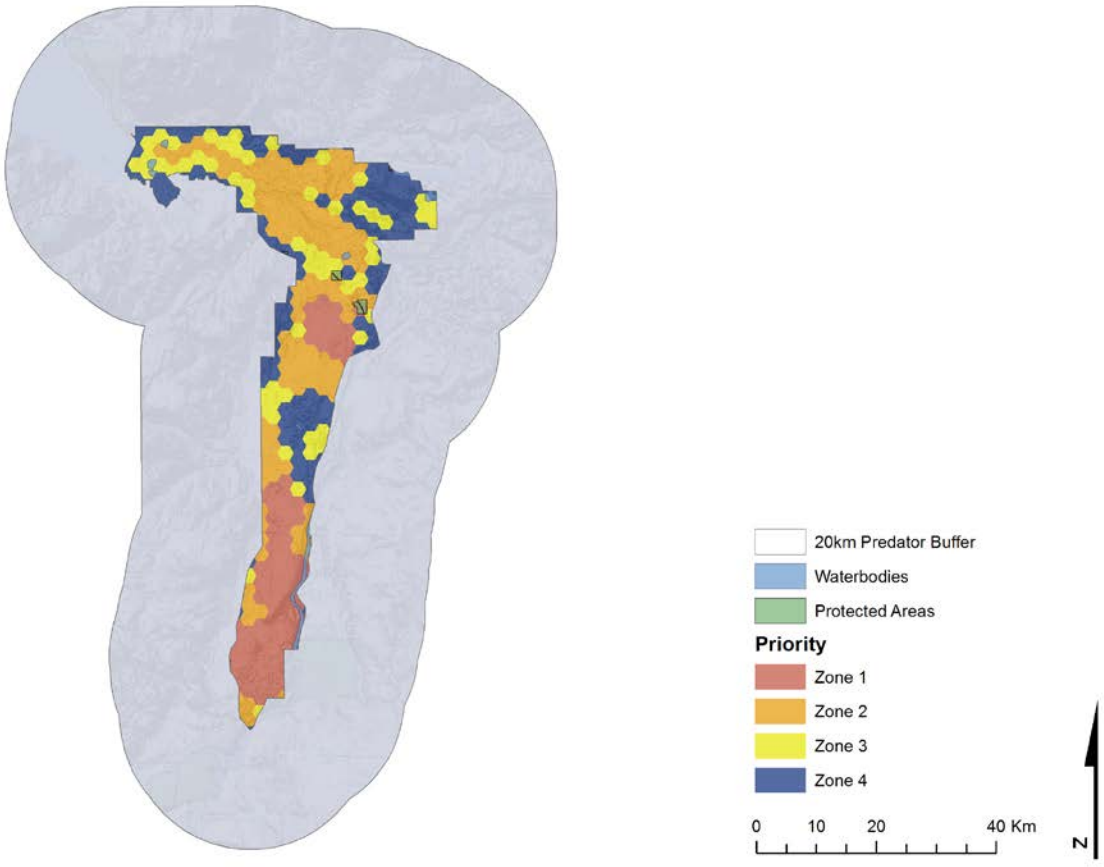



**Figure 47. Recommended priority zones in the Slave Lake range.**

## Summary: Recommendations Based on Range Modeling

CPAWS Northern Alberta recommends Priority 1 zones as the best areas for the potential creation of legislated protected areas as part of provincial range planning exercises because of the fragmented nature of boreal woodland caribou ranges in Alberta and the importance of currently undisturbed areas within each range. The creation or expansion of protected spaces in Priority 1 zones, with a focus on restoration, will prevent the destruction of critical habitat and create long-lasting protection for a portion of all caribou ranges. The focus for Priority zones 1 through 3 should be on the restoration of habitat to an undisturbed state. Priority 1 zones as well as existing protected areas in each range should be the starting point and restoration should occur in these zones and protected areas immediately. After restoration is completed in Priority 1 zones, Priority 2 zones should be restored.

Within all priority zones restoration of habitat should be the main focus; however, restricted land use should also be a key feature of the high priority zones. Caribou must be the focus of management within all ranges, and a system needs to be put in place to address cumulative impacts.

Enforcement mechanisms must be outlined in all range plans. For example, details on provincial laws and regulations, agreements with industry, and other legal tools that will be used to conserve and protect critical habitat should be explicit. The continued monitoring of caribou herds after range plan implementation is essential. The recommended 65 percent undisturbed area as a minimum amount of critical habitat is a management threshold that only allows for a 60 percent chance of a herd becoming self-sustaining. The risk of not achieving self-sustaining herds may be exasperated by regional variation and therefore requires careful monitoring for effectiveness and an adaptive management approach.

Ultimately, the province is responsible for creating range plans that outline where 65 percent undisturbed habitat should be within each caribou herd's range, and how it will be attained. There is a lag time for forest maturation to high quality undisturbed habitat of 40 to 100 years.[89,90,91] Due to the length of time for this recovery, habitat restoration needs to be set on a successful implementation trajectory as soon as possible.

## Protected Areas in Alberta

CPAWS Northern Alberta recommends that conservation of the land through legislated protected areas within caribou range is critical to their survival. Currently undisturbed areas should remain so through industrial activity deferrals, but high priority areas outlined in each of the maps should be restored and protected as soon as possible. Best practices were shown to have less of an effect on caribou survival than land conservation alone in a simulation conducted by the Canadian Wildlife Federation using A Landscape Cumulative Effects Simulator ("ALCES").[92] For the best chance of caribou survival both management best practices and land conservation need to be employed.

Under the province's current legislative scheme, there are eight different classifications of protected areas, including Willmore Wilderness Park, which is designated as a protected area under special legislation (Table 3).

Chinchaga River - CPAWS

89 Lee and Boutin, "Persistence and Developmental Transition of Wide Seismic Lines in the Western Boreal Plains of Canada."
90 Kansas, Charlebois, and Skatter, "Vegetation Recovery on Low Impact Seismic Lines in Alberta ' S Oil Sands and Visual Obstruction of Wolves (Canis Lupus) and Woodland Caribou (Rangifer Tarandus Caribou)."
91 Carlson and Browne, "The Future of Wildlife Conservation and Resource Development in the Western Boreal Forest."
92 Ibid.

**Table 3. Park Classifications and Objectives in Alberta.[93]**

| Park Class | Government Objective for Creation |
|---|---|
| Provincial Parks | To preserve natural heritage of provincial significance or higher, while supporting outdoor recreation, heritage tourism and natural heritage appreciation activities that depend upon and are compatible with environmental protection |
| Wildland Provincial Parks | To preserve and protect natural heritage and provide opportunities for compatible backcountry recreation |
| Provincial Recreation Areas | To support compatible outdoor recreation and tourism, often providing access to lakes, rivers, reservoirs and adjacent crown land |
| Wilderness Areas | To preserve and protect natural heritage, where visitors can experience solitude and non-consumptive, nature-based wilderness opportunities |
| Natural Areas | To preserve and protect sites of local significance and provide opportunities for low-impact nature-based recreation and nature appreciation activities |
| Ecological Reserves | To preserve and protect natural heritage in an undisturbed state for scientific research or education |
| Heritage Rangelands | To preserve and protect natural heritage that is representative of Alberta's grasslands. Grazing is used to maintain the grassland ecology |
| Willmore Wilderness Park | To preserve and protect natural heritage and provide opportunities for compatible backcountry recreation |

Many of these protected areas, despite being legislated for conservation or to protect natural heritage, are vulnerable to industrial activity and habitat fragmentation. Some of them are vulnerable to the impacts of irresponsible recreational activity as well, including random camping in the backcountry and reckless off-highway vehicle usage. In order for protected areas to provide the benefit needed for Alberta's boreal woodland caribou, CPAWS Northern Alberta recommends that new parks placed in caribou habitat be designated as Wildland Provincial Parks or Wilderness Areas. In both of these designations, both industrial and recreational activity are managed by Alberta Parks, with some recreational activities prohibited unless on designated, well-signed trails.

## Restoration

Restoration of disturbance in the boreal forest needs to occur at a large scale to set disturbances on a trajectory for recovery if boreal woodland caribou in Alberta are to recover to self-sustaining. Although our maps have highlighted important areas for restoration, further prioritization is necessary on a disturbance-by-disturbance scale for efficient use of time and resources. CPAWS Northern Alberta's maps identified ares for restoration that meet caribou requirements and are beneficial to the whole forest ecosystem, but finer-scale prioritization is necessary so that resources allocated for restoration are not misplaced for disturbances that are likely to recover on their own.

We have highlighted two ongoing project that demonstrate this finer scale prioritization and which complement the conservation value mapping done by CPAWS Northern Alberta. There may be other ongoing projects working towards similar goals that have not been included here.

93 Alberta Environment and Parks, "Current Parks System," accessed April 6, 2016, http://www.albertaparks.ca/albertaparksca/management-land-use/current-parks-system/.

***FRI Research***[94]

Disturbed habitat is considered disturbed until it is no longer visible on aerial photographs according to the federal Recovery Strategy, but FRI Research aims to determine if this is true from a caribou perspective. FRI Research has been working on a strategy to restore legacy footprint in the Little Smoky and A La Peche (a southern mountain caribou range) herd ranges. Legacy footprint refers to historical seismic lines and non-owned disturbances. FRI Research is currently working on a project that will create an inventory of seismic lines within their study area that are classified according to their reforestation stage, level of human use, and impact on caribou. Once completed, this inventory will help establish where resources are best placed for restoration.

To do this, a comprehensive point–in-time, current state vegetation inventory was collected for the entire area through aerial photography and 3-dimensional analysis using the software "softcopy", and Light Detection and Ranging ("LiDar"). On the ground surveys were conducted and collected information on human use, animal use, and vegetation regrowth. The vegetation surveys will allow for analysis on the rate of regrowth that has occurred on historic lines. Comparing rates of regrowth will enable a strategic plan for restoration on a landscape scale. This information across the whole range will be used to compile a comprehensive restoration plan for the Little Smoky and A La Peche herds, once range plans are released.

This comprehensive plan is anticipated for release in June 2016, and will have applications for all boreal woodland caribou herds.

***Predicting Patterns of Regeneration on Seismic Lines to Inform Restoration Planning in Boreal Forest Habitat***[95]

Cassidy Van Rensen and Scott Neilson from the University of Alberta have developed a model to prioritize individual seismic lines for restoration. Using LiDar data for vegetation, forest stand inventory, and linear disturbance inventory in the Cumulative Environmental Management Association study area south of Fort McMurray, the probability of future regeneration of vegetation was modeled. The probability of regeneration to 3 metre vegetation height was mapped at 10, 30, and 50 year post disturbance time frames. These time frames were used to prioritize areas for restoration using Marxan.

To prioritize linear features for restoration, seismic lines within the study area were divided into planning units and modeled using data for previously identified priority areas for caribou recovery, probability of natural forest regeneration on seismic lines, linear feature density, and bitumen pay thickness. A target of 50 percent of all current conventional seismic lines was set within the study area and Marxan with a zonation approach was used to create multiple zones. Three zones were created: available forest (requiring no restoration); passive restoration (limited development and natural regrowth); and active zones (zones where active restoration should occur). By using Marxan to identify active zones within caribou range, restoration efforts can be focused in these areas to best utilize resources. This method, depending on available data, could be applied across all boreal woodland caribou ranges. The finer scale prioritization of seismic line restoration has the potential for huge cost savings. This project only considered areas beneficial to caribou, but can be used as a compliment to the areas that are representative of all biodiversity identified in this document.

## Best Management Practices

In order to successfully restore caribou habitat, as well as remain active on the landscape, a variety of best management practices will be required to implement each range plan. CPAWS Northern Alberta maintains that management practices should address the root cause of caribou decline with long term habitat solutions. Past caribou planning documents have recommended a large number of best management practices. These best practices should be considered in the creation of range plans as a complement to the protection and restoration of habitat as best management practices alone have been shown to have little effect on caribou populations.[96,97] The Forest Products Association of Canada ("FPAC") commissioned an audit of the effectiveness of management practices currently carried out by the forestry and oil and gas industry in 2007;[98,99] CPAWS Northern Alberta recommends that the effectiveness of best management practices be considered in the development of future guidelines and that they be scientifically evaluated on a case-by-case and an ongoing basis.

94 Wayne Thorp, "Personal Communication" (Edmonton, 2016).
95 Cassidy Kay Van Rensen, "Predicting Patterns of Regeneration on Seismic Lines to Inform Restoration Planning in Boreal Forest Habitats," 2014, 76.
96 Antoniuk et al., "A Methodological Framework for Caribou Action Planning In Support of the Canadian Boreal Forest Agreement."
97 Carlson and Browne, "The Future of Wildlife Conservation and Resource Development in the Western Boreal Forest."
98 Forest Products Association of Canada, "Woodland Caribou Recovery: Audit of Operating Practices and Mitigation Measures Employed within Woodland Caribou Ranges," 2007.
99 Antoniuk et al., "A Methodological Framework for Caribou Action Planning In Support of the Canadian Boreal Forest Agreement."

Best management practices focusing on reducing current footprint and reducing future footprint through coordinated access into the forest by industry actors can be achieved through Integrated Land Management ("ILM"). ILM is currently a mandatory part of the Lower Athabasca Regional Plan,[100] and can be applied at all phases of land use. Treatments for restoration of historic disturbances have been, and are currently being, tested by industry groups and academics. Many involve active restoration or the blocking of linear features to access.

For more details on recommended best practices in Alberta please see:

- Woodland Caribou Recovery: Audit of Operating Practices and Mitigation Measures Employed within Woodland Caribou Ranges, FPAC, 2007;[101]
- Athabasca Caribou Landscape Management Options Report, Athabasca Landscape Team, 2009;[102] and
- Appendix 5 of A Methodological Framework for Caribou Action Planning In Support Of the Canadian Boreal Forest Agreement.[103]

## Involvement in Range Planning

There are many interests at play on Alberta's landscape – from traditional territories and practices of Aboriginal communities, to industrial and commercial interests, to recreational users, to the interests of the environmental community. Range planning in Alberta is therefore a balancing act, with each herd's range facing different pressures and different competing priorities.

### Aboriginal Communities

The traditional territories of some Treaty 6 and many Treaty 8 First Nation communities overlap with Alberta's boreal woodland caribou herds. These communities are interested in caribou conservation as well as the protection of traditional rights balanced with the needs of their communities and other species. Some communities take a hands-on approach to caribou management, such as the Asenuwiche Winewak Nation located in Grande Cache, Alberta.

"Aseniwuche Winewak Nation's (AWN) Caribou Patrol Program, operating in West Central Alberta protecting the Little Smoky/A La Peche herds is entering into its fourth year. The patrols have been extremely effective in diverting caribou from roadways, raising awareness and providing education. This year, AWN hopes to expand the program further to include stewardship initiatives, such as restoration planning, in partnership with the Foothills Research Institute Caribou Program. Caribou continue to be a primary concern for the AWN community. We have maintained very focused efforts to work with industry stakeholders and the Government of Alberta. In January, AWN signed a Statement of Intent with Alberta Environment and Parks, committing to work together and provide real input and management opportunities to the community within the caribou ranges. AWN will continue to advocate for an improved process to work together, as we believe it is extremely important that Aboriginal Traditional Knowledge input is included in planning on our traditional lands." [104] -Jaymie Campbell

Caribou Patrol - K Moberly (top) and AWN (bottom)

100 AB ESRD (AB Environment and Sustainable Resource Development), *Lower Athabasca Regional Plan 2012 - 2022*, 2012.
101 Forest Products Association of Canada, "Woodland Caribou Recovery: Audit of Operating Practices and Mitigation Measures Employed within Woodland Caribou Ranges."
102 Athabasca Landscape Team, "Athabasca Caribou Landscape Management Options Report."
103 Antoniuk et al., "A Methodological Framework for Caribou Action Planning In Support of the Canadian Boreal Forest Agreement."
104 Jaymie Campbell, "Personal Communication," 2016.

## Environmental Non-Governmental Organizations

Environmental non-governmental organizations are heavily involved in caribou conservation efforts in Alberta. CPAWS Northern Alberta, for example, has been campaigning for caribou protection at least since the 1990s, most recently through the national "Caribou & You" campaign and through the production of this range planning guide. For the last 3 years, CPAWS has released annual reports on the state of boreal woodland caribou across the country. Other groups who have worked tirelessly to educate, create awareness, and influence government action to protect caribou include the Alberta Wilderness Association and Environmental Law Centre. Environmental organizations are important parts of the conservation dialogue for many reasons; however, the most important may be that these organizations, through their membership, donors and supporters, represent tens of thousands of Albertans who want to see Alberta's wilderness protected and wildlife safeguarded.

## Industry Initiatives

Although there are currently no overarching guides in Alberta to inform industry with regards to caribou conservation on industrial tenures, some corporations have taken initiative and started work on their own. From researching, monitoring and management strategies to undertaking hands-on restoration work in Alberta's boreal forest, many of these actions would be more efficient if part of a larger plan. However, any effort is important given the urgency of the situation for boreal woodland caribou in Alberta. Many of these initiatives have also provided important learnings from research on efficient steps for moving forward.

## Forestry

The Canadian Boreal Forest Agreement (the "CBFA") is the world's largest conservation initiative that aims to conserve large, significant areas of the boreal forest. The signatories to the CBFA include the 18 members of FPAC and six environmental non-governmental organizations. The CBFA contains six goals to address while operating under its twin pillars of achieving ecological integrity while maintaining social and economic prosperity. The six goals are:

1. Implementation of world-leading sustainable forest management practices;
2. Accelerating the completion of the protected spaces network for the boreal forest;
3. Fast-tracking plans to protect boreal forest species at risk, particularly woodland caribou;
4. Taking action on climate change as it relates to forest conservation;
5. Improving the prosperity of the Canadian forest sector and communities that rely on it; and
6. Promoting and publicizing the environmental performance of the participating FPAC companies.

Through this agreement, forestry signatories and environmental groups working in Alberta have created a caribou conservation plan for three boreal woodland caribou herds in the northeast: the Cold Lake, East Side Athabasca River, and West Side Athabasca River caribou herds.

The "Northeast Plan," which was the result of the hard work of the British Columbia/Alberta regional working group of the CBFA, involved three Alberta forest company CBFA signatories: Alberta Pacific Forest Industries Inc., Millar Western Forest Products Ltd.,[105] and West Fraser Mills Ltd. as well as environmental signatories. In a similar method to the ones that CPAWS used to determine high priority areas for caribou conservation, the Northeast Plan identified good habitat occupied by caribou, as well as current and future industrial footprint in the area. To minimize forestry impact on the landscape and within caribou range, harvest deferrals will be used as a tool in areas of high caribou value and low current and future industry footprint area. Using zones and forestry deferrals, the Northeast Plan mapped where timber harvest may occur within a large portion of caribou range that over the coming years will contribute to 65 percent of the habitat remaining undisturbed by forestry activity, with minimal impact to the timber supply.[106]

The Northeast Plan completed by the CBFA is an example of the collaborative work that can be achieved with the assistance of mapping projects such as this guide. The Northeast Plan should be used to inform the range planning in the three Northeast herds identified in the Northeast Plan (Figure 48).

105 Millar Western Forest Products Ltd. has sold their tenure to Northlands Forest Products Ltd. in this area.

106 The BC-Alberta Regional Working Group of the Canadian Boreal Forest Agreement, "Recommendations and Proposed Contributions towards Caribou Conservation in Northeastern Alberta: West Side of the Athabasca River, East Side of the Athabasca River, and Cold Lake Caribou Ranges," 2014.

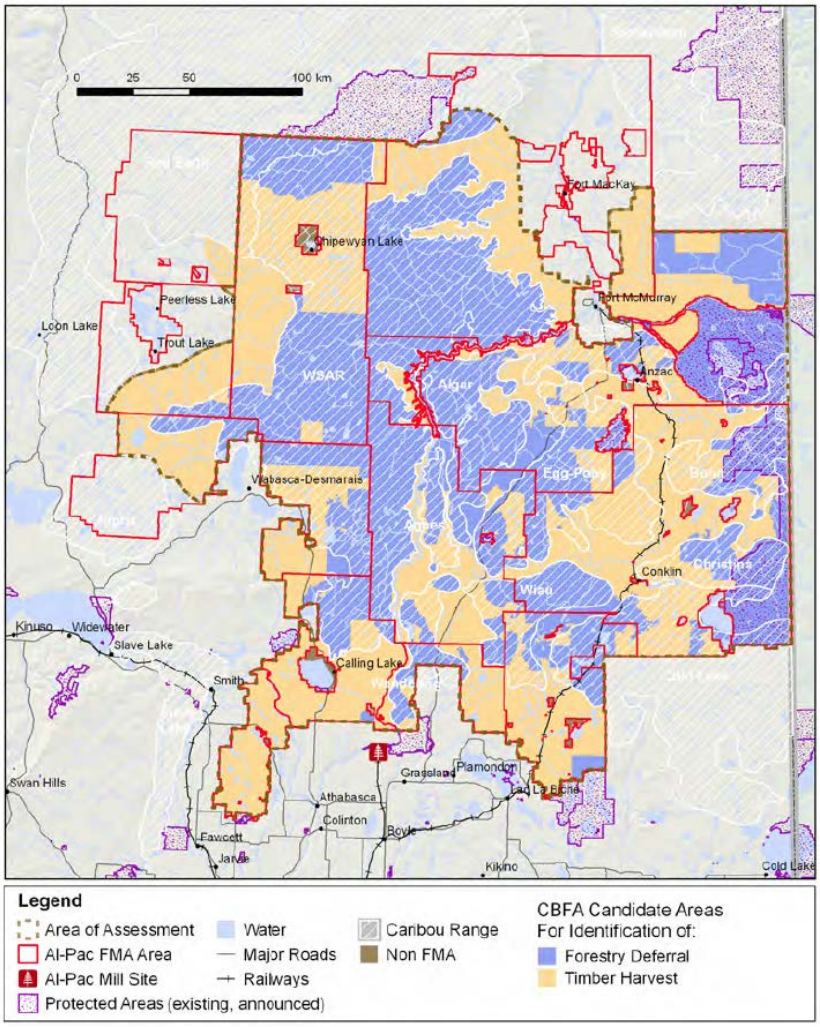



**Figure 48. A CBFA zonation scenario taking into account both caribou and forestry interests in identifying areas for caribou conservation and areas of timber harvest.** [107]

Further refinements to the Northeast Plan will occur as timber supply assessments are made during forest management planning processes and as a result of the government range planning for the northeast caribou herds.

## Oil and Gas

Projects that aim to restore historic footprint created by oil and gas exploration are currently ongoing:

1. The Algar project is a collaborative program that is working to restore 570 square kilometers of disturbed caribou habitat in northeast Alberta.[108] There are six participating companies: ConocoPhillips Canada, Nexen Inc., Shell Canada, Statoil Canada, Suncor Energy Inc. and Total E&P Canada; however, the land involved in the project is not part of any of the participating companies' license areas. The project is testing forest restoration techniques, as well as using modeling tools originally developed for the forestry industry to assess the future impacts of restoration; and

2. Cenovus has developed the Linear Deactivation Pilot Project ("LiDea") which restores old seismic lines to original characteristics of the forest through mounding and planting, woody debris placement, and bending tree stems to create a physical barrier across seismic lines. This project, which covers a treatment area of 370 square kilometres in northeast Alberta in the Cold Lake Air Weapons Range area, is being monitored for best outcomes and compared to two control areas nearby.[109,110]

107 Ibid.
108 Canadian Oil Sands Alliance, "Caribou Habitat Restoration," *Canada's Oil Sands Alliance*, accessed February 17, 2016, http://www.cosia.ca/caribou-habitat-restoration.
109 Ibid.
110 Michael Cody, "LiDea Forest Habitat Restoration Project," in *Living With Caribou: Technical Session* (Edmonton, 2015).

3. The Regional Industry Caribou Collaboration ("RICC") is a collaborative effort between both forestry companies and oilsands companies in the Cold Lake and ESAR ranges that aims to support the Government of Alberta's development of range plans for the boreal woodland caribou.[111]

The restoration efforts and research that has come out of these two projects is important and now needs to be implemented on a much larger scale under the direction of government-led range planning for boreal woodland caribou.

## Government Commitments

The government has committed to goals at provincial, federal, and international levels that align with the goal of self-sustaining, healthy herds of boreal woodland caribou. The provincial government is required to produce range plans by October 2017 as set out in the federal Recovery Strategy. As part of the UN's *Convention on Biological Diversity*, the federal government has committed to the Aichi Biodiversity Targets, which are required to be met by 2020.[112] By completing robust range plans that include protected areas and restoration, the provincial government will be working towards meeting Aichi Target 11, which aims to protect 17% of all terrestrial land by 2020, Aichi Target 12, the goal of which is to prevent the extinction of any threatened species and improve that species' status, and Aichi Target 15, which aims to restore 15% of all degraded ecosystems by 2020.[113]

It is important to note that 17% protection of terrestrial land and inland waters needs to be meaningful – in Alberta, this means that our protected areas network must be equally representative of all Natural Subregions in order to adequately protect all species.

## Conclusion

Boreal woodland caribou have been in decline in Alberta for many years. Human-caused disturbances such as industrial activity and the pressures of climate change in Alberta's boreal forest have disrupted the ecosystem to a point where caribou can no longer cope. This change and disruption has increased predation and caused caribou population declines. The science is clear; caribou need large areas of undisturbed boreal forest habitat if they are to persist on our landscape. Because of the large amount of disturbance within northern Alberta, restoration will play a key role in caribou recovery.

There is a very real chance that if nothing changes in the way that we manage our northern Albertan landscape, we will lose Alberta's caribou in our lifetime. Boreal woodland caribou need conservation measures, legislated protected areas, and restoration of disturbed forest habitat in their ranges now. This includes range plans that mandate action and clearly outline the road to caribou recovery. The range planning process should involve input from all stakeholders, but first and foremost should have caribou recovery as their number one priority.

Through our range-by-range mapping CPAWS Northern Alberta has provided detailed information on the status of each herd in northeast Alberta. In addition, to maximize the benefit of restoration efforts, CPAWS Northern Alberta has identified the most important areas to protect and restore within each herd's range. By delineating priority areas within each range, we hope that we are creating a manageable starting point for conservation, legislated protection, and forest restoration that will spur immediate action. This document along with its maps is meant to act as a tool in the range planning process.

Robust, scientifically-sound range plans should not only fulfill provincial commitments to the federal government, but also aid in fulfilling international commitments to the long term conservation of Alberta's biodiversity. Conservation efforts and legislated protection for caribou means better protection for a suite of other boreal species. Due to their large ranges and the necessity for pristine forests, legislated protection and restoration of boreal woodland caribou habitat benefits the whole forest ecosystem. CPAWS Northern Alberta calls on the province of Alberta to complete robust, scientifically-sound range plans as soon as possible so that positive on-the-ground action can truly begin.

111 Canada's Oil Sands Innovation Alliance, "Regional Industry Caribou Collaboration (RICC)", *COSIA*, accessed May 2, 2016, https://events.cosia.ca/initiative/551263dd8c56a60418c6e7d8

112 1992 Convention on Biological Diversity, 5 June 1992, 1760 UNTS 79, (entered into force 29 December 1993).

113 United Nations Environmental Programme, "Strategic Plan for Biodiversity 2011 – 2020 and the Aichi Targets," 2010, 4, http://www.cbd.int/doc/strategic-plan/2011-2020/Aichi-Targets-EN.pdf.

## Glossary of Terms

AWA……Alberta Wilderness Association

ABMI……..Alberta Biodiversity Monitoring Institute

ALCES……A Landscape Cumulative Effects Simulator

AWN……Aseniwuche Winewak Nation

CBFA……Canadian Boreal Forest Agreement

CPAWS…….Canadian Parks and Wilderness Society

ESAR……East Side Athabasca River

ESRD……Environment and Sustainable Resource Development Alberta

FMA…….Forest Management Area

FMU……Forest Management Unit

FPAC……Forest Products Association of Canada

GPS……..Global Positioning System

ILM……..Integrated Land Management

LARP……Lower Athabasca Regional Plan

LiDar……Light Detection and Ranging

LiDea……..Linear Deactivation Pilot Project

MCP…….Minimum Convex Polygons

PNG…….Petroleum and Natural Gas

WSAR……West Side Athabasca River

UN……United Nations

VHF……..Very-High Frequency

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# Appendix 1: Industry Present in Northeast Caribou Ranges

The data in Appendix 1 has been gathered by CPAWS Northern Alberta and represents what we were able to acquire from publicly available information from the Government of Alberta. It may not fully represent all of the corporations present or industrial activity currently occurring in northern Alberta. CPAWS Northern Alberta recognizes that some rights holders and quota holders that operate on the landscape may have been omitted, such as First Nations communities with forestry rights or agreements on FMUs. For example, we understand that Little Red River Cree Nation and Tallcree First Nation have forestry interests in the Red Earth caribou range; however, we were unable to find publicly available government information to reflect this. Information on industrial activities on public lands should be kept up to date, available and easily accessible to the public by the provincial government.

**List of Tables in Appendix 1**

**Table A1. Forestry companies within the Red Earth range**

| Forest Management Agreement Holder | Other companies operating within FMA | Area (KM2) |
|---|---|---|
| Alberta-Pacific Forest Products Incorporated | Alberta Forest Industries Ltd., Ed Bobocel Lumber (1993) Ltd., Northland Forest Products Ltd., S-11 Logging Company Ltd., Seehta Forest Products Ltd., Spruceland Millworks Inc., St. Jean Lumber (1984) Limited., Vanderwell Contractors (1971) Ltd., West Fraser Mills Ltd. | 4693.93 |
| Tolko Industries Ltd. (High Prairie) | Alberta Plywood Ltd., West Fraser Mills Ltd. | 10.93 |
| Tolko Industries Ltd., Norbord Inc., and A La Crete Sawmills Ltd. | Daishowa-Marubeni International Ltd., NDEH Limited Partnership, Netaskinan Development Corporation. | 1693.48 |
| Daishowa-Marubeni International Ltd. (East) | Boucher Bros. Lumber Ltd., Seehta Forest Products Ltd., Tolko Industries Ltd., West Fraser Mills Ltd. | 2346.23 |
| Company operating within FMU | | |
| A10 | Northland Forest Products Ltd. | |
| S10 | West Fraser Mills Ltd., Boucher Bros. Lumber Ltd. | |
| | | |
| Total area of FMA allocations | | 8744.57 |
| Area of Red Earth range | | 24702.03 |
| Percent of range allocated to FMAs | | 35.40 |

**Table A2. Petroleum and natural gas companies within the Red Earth range**

| Lease Holder | Number of leases held | Area (KM2) |
|---|---|---|
| CANADIAN NATURAL RESOURCES LIMITED | 202 | 890.56 |
| 1852797 ALBERTA ULC | 17 | 667.37 |
| CENOVUS ENERGY INC. | 46 | 588.19 |
| PREDATOR OIL LTD. | 99 | 386.13 |
| DRAGONWELL LTD. | 9 | 377.56 |
| SCOTT LAND & LEASE LTD. | 50 | 317.76 |
| PERPETUAL ENERGY OPERATING CORP. | 46 | 237.53 |
| BAYTEX ENERGY LTD. | 70 | 218.60 |
| PENN WEST PETROLEUM LTD. | 138 | 215.32 |
| LANDSOLUTIONS GP INC. | 6 | 109.40 |
| RALLY CANADA RESOURCES LTD. | 2 | 108.85 |
| CANADIAN COASTAL RESOURCES LTD. | 8 | 107.13 |
| HARVEST OPERATIONS CORP. | 93 | 105.69 |
| BRITT RESOURCES LTD. | 17 | 100.06 |
| VIRGINIA HILLS OIL CORP. | 70 | 95.98 |
| DEERGARDEN ENERGY LTD. | 4 | 94.67 |
| SONOMA RESOURCES LTD. | 16 | 94.00 |
| CONOCOPHILLIPS CANADA RESOURCES CORP. | 4 | 93.51 |
| GUNNARR RESOURCES INC. | 11 | 87.94 |
| STANDARD LAND COMPANY INC. | 24 | 68.59 |
| CREST JINN PETROLEUM CORPORATION | 3 | 67.19 |
| MSL LAND SERVICES LTD. | 4 | 51.16 |
| LONE PINE RESOURCES CANADA LTD. | 32 | 48.00 |
| THE LAND GROUP INC. | 1 | 47.54 |
| WINDFALL RESOURCES LTD. | 4 | 45.25 |
| BRIO ENERGY CORPORATION | 9 | 32.74 |
| VITAL ENERGY INC. | 2 | 28.26 |
| TWIN BUTTE ENERGY LTD. | 10 | 28.25 |
| ATHABASCA OIL CORPORATION | 2 | 23.93 |
| DEVON NEC CORPORATION | 3 | 22.69 |
| BARNWELL OF CANADA, LIMITED | 10 | 21.28 |
| BRISTOL LAND & LEASING LTD. | 8 | 21.18 |
| DEVON CANADA | 7 | 20.98 |
| O & G RESOURCE GROUP LTD. | 1 | 18.57 |
| SPARTAN ENERGY CORP. | 8 | 17.33 |
| HUSKY OIL OPERATIONS LIMITED | 1 | 15.41 |
| CANADIAN OIL & GAS INTERNATIONAL INC. | 1 | 13.28 |
| ZARGON OIL & GAS LTD. | 2 | 12.85 |
| MAVERICK LAND CONSULTANTS 2012 LTD. | 4 | 12.16 |
| MADISON LAND CO. LTD. | 4 | 11.54 |
| CRIMSON OIL & GAS LTD. | 10 | 11.52 |
| TAQA NORTH LTD. | 2 | 10.53 |
| PARAMOUNT RESOURCES LTD. | 2 | 10.20 |
| PLUNKETT RESOURCES LTD. | 5 | 9.96 |

| | | |
|---|---|---|
| SUMMERLAND ENERGY INC. | 8 | 9.74 |
| CARDINAL ENERGY LTD. | 5 | 9.01 |
| RANGER LAND SERVICES LTD. | 2 | 8.98 |
| SANDSTONE LAND & MINERAL COMPANY LTD. | 4 | 8.31 |
| TAYLOR HILL EXPLORATION LTD. | 2 | 7.03 |
| ANTELOPE LAND SERVICES LTD. | 1 | 6.41 |
| PENGROWTH ENERGY CORPORATION | 1 | 5.14 |
| COASTAL RESOURCES LIMITED | 5 | 5.13 |
| BANCROFT OIL AND GAS LTD. | 2 | 5.11 |
| GEOROX RESOURCES INC. | 5 | 4.18 |
| ROCKFORD LAND LTD. | 3 | 3.86 |
| HITIC ENERGY LTD. | 1 | 3.83 |
| WHITEHALL ENERGY LTD. | 7 | 3.68 |
| CHINOOK ENERGY INC. | 2 | 3.22 |
| IGNITE ENERGY CORP. | 2 | 3.22 |
| CANAMAX ENERGY LTD. | 2 | 2.58 |
| QUATTRO EXPLORATION AND PRODUCTION LTD. | 1 | 2.57 |
| PRAIRIESKY ROYALTY LTD. | 1 | 2.57 |
| CONTIGUOUS RESOURCES LTD. | 1 | 2.56 |
| CANADIAN COYOTE ENERGY LTD. | 1 | 2.56 |
| DOLOMITE ENERGY INC. | 1 | 1.94 |
| BOUNTY DEVELOPMENTS LTD | 2 | 1.89 |
| SCCC PETROLEUM CORPORATION | 1 | 1.29 |
| ENDURANCE ENERGY LTD. | 2 | 1.29 |
| BROTHERIN ENERGY LTD. | 2 | 1.29 |
| ALBERTA LAND & LEASE LTD. | 1 | 1.28 |
| HAWK EXPLORATION LTD. | 2 | 1.27 |
| ROCKY LAYMAN ENERGY INC. | 2 | 1.27 |
| NRG LANDSOLUTIONS INC. | 2 | 0.96 |
| SYDCO ENERGY INC. | 1 | 0.65 |
| LANDSOLUTIONS INC. | 1 | 0.65 |
| SIGNALTA RESOURCES LIMITED | 1 | 0.65 |
| L & C HOLDINGS LTD. | 1 | 0.65 |
| D. W. AXFORD & ASSOCIATES LTD. | 1 | 0.65 |
| 1688901 ALBERTA LTD. | 1 | 0.65 |
| GRYPHON PETROLEUM CORP. | 1 | 0.65 |
| FAR WEST ENERGY CORP. | 1 | 0.64 |
| CHARTER LAND SERVICES INC. | 1 | 0.64 |
| TERRA ENERGY CORP. | 1 | 0.64 |
| BORDER PETROLEUM LIMITED | 1 | 0.64 |
| BORDER ACQUISITION CORPORATION | 1 | 0.63 |
| HANNA OIL & GAS COMPANY - CANADA ULC | 1 | 0.62 |
| VERTEX PROFESSIONAL SERVICES LTD. | 1 | 0.06 |
| | | |
| Total area allocated to petroleum and natural gas | | 5349.63 |
| Total area of Red Earth range | | 24702.03 |
| Percent of range allocated to petroleum and natural gas | | 21.66 |

**Table A3. Oilsands companies within the Red Earth range**

| Lease Holder | Number of Leases Held | Area (KM2) |
|---|---|---|
| ATHABASCA OIL CORPORATION | 89 | 1687.34 |
| SUNSHINE OILSANDS LTD. | 34 | 980.21 |
| SCOTT LAND & LEASE LTD. | 30 | 630.20 |
| CENOVUS ENERGY INC. | 22 | 553.58 |
| STOMP ENERGY LTD. | 16 | 426.10 |
| PERPETUAL ENERGY OPERATING CORP. | 7 | 391.83 |
| ANTELOPE LAND SERVICES LTD. | 8 | 379.19 |
| MERIDIAN LAND SERVICES (90) LTD | 4 | 349.14 |
| SCCC PETROLEUM CORPORATION | 15 | 337.85 |
| CANADIAN NATURAL RESOURCES LIMITED | 19 | 323.63 |
| WINDFALL RESOURCES LTD. | 12 | 251.38 |
| PLUNKETT RESOURCES LTD. | 5 | 229.61 |
| SUNCOR ENERGY INC. | 13 | 210.14 |
| BOUNTY DEVELOPMENTS LTD | 6 | 210.10 |
| HUSKY OIL OPERATIONS LIMITED | 10 | 192.89 |
| GRIZZLY OIL SANDS ULC | 10 | 188.37 |
| BP CANADA ENERGY GROUP ULC | 6 | 188.11 |
| PENN WEST PETROLEUM LTD. | 9 | 184.76 |
| LARICINA ENERGY LTD. | 16 | 166.67 |
| RANGER LAND SERVICES LTD. | 4 | 126.53 |
| 9416471 CANADA INC. | 7 | 115.96 |
| MADISON LAND CO. LTD. | 6 | 99.28 |
| ALTERREN LAND SERVICES LTD | 2 | 94.72 |
| CAVALIER ENERGY INC. | 1 | 92.29 |
| PAN PACIFIC OILS LTD. | 2 | 70.62 |
| CANADA WEST LAND SERVICES LTD. | 2 | 68.59 |
| DEVON CANADA | 6 | 55.19 |
| BRION ENERGY CORPORATION | 18 | 38.59 |
| KOCH OIL SANDS OPERATING ULC | 3 | 31.22 |
| BRITT RESOURCES LTD. | 2 | 30.63 |
| MURPHY OIL COMPANY LTD. | 1 | 23.07 |
| DEVON NEC CORPORATION | 2 | 20.66 |
| HERITAGE FREEHOLD SPECIALISTS & CO. LTD. | 1 | 20.51 |
| PROSPER PETROLEUM LTD. | 4 | 16.03 |
| LANDSOLUTIONS INC. | 1 | 15.32 |
| MARATHON OIL CANADA CORPORATION | 3 | 15.03 |
| SOUTHERN PACIFIC RESOURCE CORP. | 1 | 14.45 |
| HARVEST OPERATIONS CORP. | 2 | 13.05 |
| CENTENNIAL LAND SERVICES LTD. | 1 | 12.84 |
| 366337 ALBERTA LTD. | 1 | 5.12 |
| BASM LAND & RESOURCES LTD. | 1 | 2.56 |
| CHEVRON CANADA LIMITED | 1 | 1.29 |
| SHELL CANADA LIMITED | 1 | 0.0000000032 |
| | | |
| Total area allocated to oilsands | | 8864.68 |
| Total Area of Red Earth range | | 24702.03 |
| Percent of range allocated to oilsands | | 35.89 |

**Table B1. Forestry companies within the WSAR range**

| Forest Management Agreement Holder | Other companies operating within FMA | Area (KM2) |
|---|---|---|
| Alberta-Pacific Forest Products Incorporated | Alberta Forest Industries Ltd., Ed Bobocel Lumber (1993) Ltd., Northland Forest Products Ltd., S-11 Logging Company Ltd., Seehta Forest Products Ltd., Spruceland Millworks Inc., St. Jean Lumber (1984) Limited., Vanderwell Contractors (1971) Ltd., West Fraser Mills Ltd. | 15461.29 |
| | | |
| Total area of FMA allocations | | 15461.29 |
| Total area of WSAR range | | 15707.12 |
| Percent of range allocated to FMAs | | 98.43 |

**Table B2. Petroleum and natural gas companies within the WSAR range**

| Lease Holder | Number of Leases Held | Area (KM2) |
|---|---|---|
| CANADIAN NATURAL RESOURCES LIMITED | 158 | 1582.62 |
| PERPETUAL ENERGY OPERATING CORP. | 172 | 1239.67 |
| HUSKY OIL OPERATIONS LIMITED | 203 | 1099.28 |
| ATHABASCA OIL CORPORATION | 99 | 755.27 |
| CENOVUS ENERGY INC. | 79 | 722.86 |
| ICONOCLAST GEORESOURCES INC. | 9 | 196.62 |
| SUNSHINE OILSANDS LTD. | 16 | 96.62 |
| PARAMOUNT RESOURCES LTD. | 7 | 89.39 |
| BONAVISTA ENERGY CORPORATION | 5 | 71.10 |
| KOCH OIL SANDS OPERATING ULC | 7 | 61.60 |
| WHITECAP RESOURCES INC. | 17 | 60.04 |
| WINDFALL RESOURCES LTD. | 3 | 56.37 |
| SCOTT LAND & LEASE LTD. | 4 | 43.60 |
| PROGRESS ENERGY CANADA LTD. | 3 | 25.68 |
| LANDSOLUTIONS GP INC. | 1 | 23.23 |
| LACADENA LAND COMPANY INC. | 2 | 12.92 |
| BADGER PASS MINERALS INC. | 1 | 12.85 |
| SIGNALTA RESOURCES LIMITED | 3 | 7.93 |
| BLACKPEARL RESOURCES INC. | 3 | 6.24 |
| TAQA NORTH LTD. | 1 | 5.14 |
| CHINOOK ENERGY INC. | 1 | 5.13 |
| MANCAL ENERGY INC. | 2 | 5.05 |
| SRIVASTAVA, NEHA | 2 | 4.99 |
| SUNCOR ENERGY INC. | 2 | 3.32 |
| MCNALLY LAND SERVICES LTD | 1 | 2.60 |
| INSIGNIA ENERGY LTD. | 1 | 2.57 |
| PROTERRA LANDWORKS INC. | 1 | 2.56 |
| CONOCOPHILLIPS CANADA RESOURCES CORP. | 1 | 0.82 |
| TOTAL PETROLEUM LAND SERVICES LTD. | 1 | 0.64 |
| | | |
| Total area allocated to petroleum and natural gas | | 5880.69 |
| Total area of WSAR range | | 15707.12 |
| Percent of range allocated to petroluem and natural gas | | 37.44 |

**Table B3. Oilsands companies with the WSAR range**

| Lease Holder | Number of Leases Held | Area (KM2) |
|---|---|---|
| CANADIAN NATURAL RESOURCES LIMITED | 119 | 2404.42 |
| SUNSHINE OILSANDS LTD. | 58 | 1319.31 |
| CENOVUS ENERGY INC. | 38 | 903.51 |
| BRION ENERGY CORPORATION | 127 | 896.35 |
| SHELL CANADA LIMITED | 20 | 879.57 |
| HUSKY OIL OPERATIONS LIMITED | 22 | 856.32 |
| GRIZZLY OIL SANDS ULC | 52 | 818.14 |
| KOCH OIL SANDS OPERATING ULC | 62 | 801.09 |
| ATHABASCA OIL CORPORATION | 79 | 792.78 |
| SUNCOR ENERGY INC. | 31 | 493.72 |
| OSUM OIL SANDS CORP. | 16 | 460.06 |
| PERPETUAL ENERGY OPERATING CORP. | 19 | 428.18 |
| LARICINA ENERGY LTD. | 78 | 400.84 |
| CONOCOPHILLIPS CANADA RESOURCES CORP. | 3 | 384.78 |
| CAVALIER ENERGY INC. | 23 | 351.93 |
| STANDARD LAND COMPANY INC. | 11 | 286.88 |
| CANADA WEST LAND SERVICES LTD. | 17 | 229.66 |
| CNPC INTERNATIONAL (CANADA) LTD. | 11 | 220.01 |
| CHEVRON CANADA LIMITED | 9 | 189.38 |
| PLUNKETT RESOURCES LTD. | 6 | 164.07 |
| CRESCENT POINT ENERGY CORP. | 13 | 128.46 |
| WINDFALL RESOURCES LTD. | 3 | 122.16 |
| SCOTT LAND & LEASE LTD. | 12 | 99.13 |
| TOTAL E&P CANADA LTD. | 11 | 92.04 |
| SOUTHERN PACIFIC RESOURCE CORP. | 11 | 91.17 |
| BRITT RESOURCES LTD. | 2 | 84.19 |
| LANDSOLUTIONS INC. | 3 | 76.97 |
| MINERAL CONSULTING SERVICES LTD. | 3 | 76.79 |
| PETROLAND SERVICES (1986) LTD. | 1 | 74.59 |
| PAN PACIFIC OILS LTD. | 7 | 56.41 |
| WHITECAP RESOURCES INC. | 4 | 56.28 |
| BLACKPEARL RESOURCES INC. | 5 | 55.30 |
| BP CANADA ENERGY GROUP ULC | 4 | 54.27 |
| MARATHON OIL CANADA CORPORATION | 6 | 54.07 |
| CHARTER LAND SERVICES INC. | 2 | 51.44 |
| MEG ENERGY CORP. | 6 | 51.13 |
| PETROLEO RESOURCES INC. | 1 | 46.61 |
| BOUNTY DEVELOPMENTS LTD | 4 | 46.10 |
| BAYTEX ENERGY LTD. | 5 | 41.91 |
| ANTELOPE LAND SERVICES LTD. | 1 | 38.48 |
| QUATTRO EXPLORATION AND PRODUCTION LTD. | 4 | 32.10 |
| TOWNSHIP LAND CO. LTD. | 1 | 30.92 |
| ALBERTA OILSANDS INC. | 11 | 29.45 |

| | | |
|---|---|---|
| BRISTOL LAND & LEASING LTD. | 2 | 17.35 |
| DEVON CANADA | 1 | 15.39 |
| HERITAGE FREEHOLD SPECIALISTS & CO. LTD. | 1 | 15.35 |
| ROLAND RESOURCES 2012 INC. | 2 | 12.42 |
| MAVERICK LAND CONSULTANTS 2012 LTD. | 1 | 10.29 |
| BANCROFT OIL AND GAS LTD. | 1 | 7.22 |
| OAK POINT ENERGY LTD. | 1 | 5.16 |
| LONE PINE RESOURCES CANADA LTD. | 1 | 5.14 |
| MADISON LAND CO. LTD. | 1 | 3.11 |
| STONE PETROLEUMS LTD. | 1 | 2.57 |
| O & G RESOURCE GROUP LTD. | 1 | 2.56 |
| 658903 ALBERTA LIMITED | 1 | 2.25 |
| CAITERRA INTERNATIONAL ENERGY CORPORATION | 1 | 2.06 |
| PROTERRA LANDWORKS INC. | 1 | 0.64 |
| STOMP ENERGY LTD. | 2 | 0.58 |
| | | |
| Total area of oilsands allocations | | 14270.15 |
| Total area of WSAR range | | 15707.12 |
| Percent of range allocated to oilsands | | 90.85 |

**Table C1. Forestry companies within the Richardson range**

| Forest Management Agreement Holders | Other companies operating within FMA | Area (KM2) |
|---|---|---|
| Alberta-Pacific Forest Products Incorporated | Alberta Forest Industries Ltd., Ed Bobocel Lumber (1993) Ltd., Millar Western Forest Products Ltd, Northland Forest Products Ltd., S-11 Logging Company Ltd., Seehta Forest Products Ltd., Spruceland Millworks Inc., St. Jean Lumber (1984) Limited., Vanderwell Contractors (1971) Ltd., West Fraser Mills Ltd. | 421.31 |
| Forest Management Units | Companies operating within FMU | |
| A10 | Northland Forest Products | |
| | | |
| Total area of FMA allocations | | 421.31 |
| Total area of Richardson range | | 7073.90 |
| Percent of range allocated to FMAs | | 5.96 |

**Table C2. Petroleum and natural gas companies within the Richardson range**

| Lease Holder | Number of Leases Held | Area (KM2) |
|---|---|---|
| ICONOCLAST GEORESOURCES INC. | 3 | 61.78 |
| HUSKY OIL OPERATIONS LIMITED | 1 | 17.60 |
| | | |
| Total area allocated to petroleum and natural gas | | 79.39 |
| Total area of Richardson range | | 7073.90 |
| Percent of range allocated to petroleum and natural gas | | 1.12 |

**Table C3. Oilsands companies within the Richardson range**

| Lease Holder | Number of Leases Held | Area (KM2) |
|---|---|---|
| SUNCOR ENERGY INC. | 14 | 728.90 |
| CENOVUS TL ULC | 23 | 449.23 |
| TECK RESOURCES LIMITED | 4 | 368.79 |
| IMPERIAL OIL RESOURCES LIMITED | 10 | 323.22 |
| TOTAL E&P CANADA LTD. | 4 | 195.50 |
| GRIZZLY OIL SANDS ULC | 2 | 175.49 |
| VALUE CREATION INC. | 3 | 108.04 |
| KOCH OIL SANDS OPERATING ULC | 2 | 92.16 |
| CENOVUS ENERGY INC. | 2 | 78.56 |
| PAN PACIFIC OILS LTD. | 2 | 60.42 |
| 9416471 CANADA INC. | 4 | 54.60 |
| IMPERIAL OIL RESOURCES VENTURES LIMITED | 1 | 41.38 |
| HUSKY OIL OPERATIONS LIMITED | 1 | 19.74 |
| SHELL CANADA LIMITED | 1 | 17.97 |
| | | |
| Total area allocated to oilsands | | 2713.99 |
| Total area of Richardson range | | 7073.90 |
| Percent of range allocated to oilsands | | 38.37 |

**Table D1. Forestry companies within the ESAR range**

| Forest Management Agreement Holder | Other companies operating within FMA | Area (KM2) |
|---|---|---|
| Alberta-Pacific Forest Products Incorporated | Alberta Forest Industries Ltd., Ed Bobocel Lumber (1993) Ltd., Millar Western Forest Products Ltd, Northland Forest Products Ltd., S-11 Logging Company Ltd., Seehta Forest Products Ltd., Spruceland Millworks Inc., St. Jean Lumber (1984) Limited., Vanderwell Contractors (1971) Ltd., West Fraser Mills Ltd. | 11457.14 |
| | | |
| Total area of FMA allocations | | 11457.14 |
| Total area of ESAR range | | 13119.02 |
| Percent of range allocated to FMAs | | 87.33 |

**Table D2. Petroleum and natural gas companies within the ESAR range**

| Lease Holder Name | Number of Leases Held | Area (KM2) |
|---|---|---|
| CANADIAN NATURAL RESOURCES LIMITED | 589 | 3327.34 |
| PERPETUAL ENERGY OPERATING CORP. | 112 | 858.44 |
| MEG ENERGY CORP. | 83 | 476.92 |
| ICONOCLAST GEORESOURCES INC. | 13 | 336.89 |
| HUSKY OIL OPERATIONS LIMITED | 73 | 336.20 |
| DEVON CANADA | 37 | 222.59 |
| CONNACHER OIL AND GAS LIMITED | 35 | 208.30 |
| STATOIL CANADA LTD. | 33 | 205.44 |
| CENOVUS ENERGY INC. | 22 | 195.80 |
| CHINOOK ENERGY INC. | 40 | 157.41 |
| BLACKPEARL RESOURCES INC. | 19 | 156.53 |
| CONOCOPHILLIPS CANADA RESOURCES CORP. | 16 | 94.10 |
| SUPERMAN RESOURCES INC. | 25 | 82.64 |
| WINDFALL RESOURCES LTD. | 3 | 59.97 |
| BRITT RESOURCES LTD. | 3 | 59.16 |
| CENOVUS FCCL LTD. | 9 | 31.08 |
| WHITE SWAN ENVIRONMENTAL LTD. | 7 | 30.13 |
| RIFE RESOURCES LTD. | 2 | 25.81 |
| STONEWATER RESOURCES INC. | 3 | 25.65 |
| NEXEN ENERGY ULC | 6 | 19.25 |
| BELLATRIX EXPLORATION LTD. | 2 | 16.32 |
| IMPERIAL OIL RESOURCES LIMITED | 1 | 15.85 |
| RANGER LAND SERVICES LTD. | 4 | 9.68 |
| CHAIR RESOURCES INC. | 5 | 8.97 |
| PARAMOUNT RESOURCES LTD. | 2 | 7.71 |
| LANDSOLUTIONS INC. | 1 | 6.83 |
| DEVON NEC CORPORATION | 4 | 5.84 |
| SINOPEC DAYLIGHT ENERGY LTD. | 3 | 5.44 |
| SCOTT LAND & LEASE LTD. | 2 | 4.03 |
| STANDARD LAND COMPANY INC. | 2 | 2.85 |
| TOTAL PETROLEUM LAND SERVICES LTD. | 4 | 2.64 |
| CANPAR HOLDINGS LTD. | 1 | 2.58 |
| WHITECAP RESOURCES INC. | 1 | 2.56 |
| SANDSTONE LAND & MINERAL COMPANY LTD. | 2 | 2.36 |
| CHARTER LAND SERVICES INC. | 1 | 1.17 |
| ISH ENERGY LTD. | 1 | 0.84 |
| PETROLAND SERVICES (1986) LTD. | 1 | 0.36 |
| THE LAND GROUP INC. | 1 | 0.24 |
| PTTEP CANADA LIMITED | 1 | 0.01 |
| | | |
| Total area allocated to petroleum and natural gas | | 6642.11 |
| Total area of ESAR range | | 13119.02 |
| Percent of range allocated to petroleum and natural gas | | 50.63 |

**Table D3. Oilsands companies within the ESAR range**

| Lease Holder Name | Number of Leases Held | Area (KM2) |
|---|---|---|
| MEG ENERGY CORP. | 182 | 1569.92 |
| CONOCOPHILLIPS CANADA RESOURCES CORP. | 23 | 1068.63 |
| IMPERIAL OIL RESOURCES LIMITED | 16 | 719.70 |
| SUNCOR ENERGY INC. | 22 | 644.99 |
| NEXEN ENERGY ULC | 55 | 538.04 |
| CENOVUS ENERGY INC. | 50 | 532.66 |
| PTTEP CANADA LIMITED | 44 | 487.89 |
| CANADIAN NATURAL RESOURCES LIMITED | 21 | 467.19 |
| GRIZZLY OIL SANDS ULC | 38 | 462.11 |
| KOCH OIL SANDS OPERATING ULC | 26 | 387.73 |
| ATHABASCA OIL CORPORATION | 38 | 379.13 |
| LANDSOLUTIONS GP INC. | 13 | 323.60 |
| STATOIL CANADA LTD. | 48 | 264.34 |
| JAPAN CANADA OIL SANDS LIMITED | 5 | 259.16 |
| CONNACHER OIL AND GAS LIMITED | 21 | 224.77 |
| CAVALIER ENERGY INC. | 9 | 209.18 |
| CENOVUS FCCL LTD. | 49 | 192.19 |
| LARICINA ENERGY LTD. | 25 | 187.59 |
| VALUE CREATION INC. | 7 | 155.48 |
| STANDARD LAND COMPANY INC. | 3 | 146.47 |
| SOUTHERN PACIFIC RESOURCE CORP. | 7 | 101.66 |
| TOTAL E&P CANADA LTD. | 3 | 97.42 |
| SUNSHINE OILSANDS LTD. | 4 | 91.60 |
| HUSKY OIL OPERATIONS LIMITED | 2 | 88.18 |
| ALBERTA OILSANDS INC. | 8 | 86.36 |
| ANTELOPE LAND SERVICES LTD. | 2 | 82.79 |
| OSUM OIL SANDS CORP. | 15 | 58.05 |
| SCOTT LAND & LEASE LTD. | 7 | 51.81 |
| SURMONT ENERGY LTD. | 4 | 48.62 |
| MAVERICK LAND CONSULTANTS 2012 LTD. | 1 | 30.73 |
| BLACKPEARL RESOURCES INC. | 5 | 19.91 |
| OAK POINT ENERGY LTD. | 6 | 15.34 |
| WINDFALL RESOURCES LTD. | 6 | 15.25 |
| SANDSTONE LAND & MINERAL COMPANY LTD. | 1 | 12.87 |
| ALPINE CAPITAL CORP. | 1 | 7.96 |
| IMPERIAL OIL RESOURCES VENTURES LIMITED | 1 | 5.13 |
| MERIDIAN LAND SERVICES (90) LTD | 1 | 5.12 |
| NORDIC AMERICA'S INC. | 2 | 4.35 |
| MADISON LAND CO. LTD. | 1 | 3.41 |
| STOMP ENERGY LTD. | 2 | 3.23 |
| CHARTER LAND SERVICES INC. | 1 | 1.98 |
| PAN PACIFIC OILS LTD. | 2 | 1.93 |
| 366337 ALBERTA LTD. | 1 | 1.19 |
| BRION ENERGY CORPORATION | 1 | 0.29 |
| PETROLAND SERVICES (1986) LTD. | 1 | 0.12 |
| | | |
| Total area allocated to oilsands | | 10050.01 |
| Total area of ESAR range | | 13119.02 |
| Percent of ESAR range allocated to oilsands | | 76.61 |

**Table E1. Forestry companies within the Cold Lake range**

| Forest Management Agreement Holder | Other companies operating within FMA | Area (KM2) |
|---|---|---|
| Alberta-Pacific Forest Products Incorporated | Alberta Forest Industries Ltd., Ed Bobocel Lumber (1993) Ltd., Millar Western Forest Products Ltd, Northland Forest Products Ltd., S-11 Logging Company Ltd., Seehta Forest Products Ltd., Spruceland Millworks Inc., St. Jean Lumber (1984) Limited., Vanderwell Contractors (1971) Ltd., West Fraser Mills Ltd. | 1904.98 |
| | | |
| Total area of FMA allocations | | 1904.98 |
| Total area of Cold Lake range | | 6725.86 |
| Percent of range allocated to FMAs | | 28.32 |

**Table E2. Petroleum and natural gas companies within the Cold Lake range**

| Lease Holder | Number of Leases Held | Area (KM2) |
|---|---|---|
| CENOVUS ENERGY INC. | 157 | 1785.45 |
| CANADIAN NATURAL RESOURCES LIMITED | 123 | 772.32 |
| DEVON CANADA | 83 | 658.14 |
| ISH ENERGY LTD. | 12 | 134.10 |
| PERPETUAL ENERGY OPERATING CORP. | 10 | 112.24 |
| IMPERIAL OIL RESOURCES LIMITED | 5 | 98.65 |
| DEVON NEC CORPORATION | 26 | 87.47 |
| CENOVUS FCCL LTD. | 9 | 60.00 |
| HUSKY OIL OPERATIONS LIMITED | 12 | 44.20 |
| MEG ENERGY CORP. | 14 | 35.22 |
| CANADIAN OIL & GAS INTERNATIONAL INC. | 8 | 31.65 |
| PARAMOUNT RESOURCES LTD. | 2 | 10.28 |
| STANDARD LAND COMPANY INC. | 2 | 8.32 |
| LENDE INVESTMENTS LTD. | 1 | 8.22 |
| HARVEST OPERATIONS CORP. | 2 | 5.15 |
| LANDSOLUTIONS GP INC. | 1 | 5.11 |
| CHINOOK ENERGY INC. | 1 | 2.59 |
| SANDSTONE LAND & MINERAL COMPANY LTD. | 1 | 0.49 |
| O & G RESOURCE GROUP LTD. | 1 | 0.40 |
| | | |
| Total area allocated to petroleum and natural gas | | 3796.42 |
| Total area of Cold Lake range | | 6725.86 |
| Percent of range allocated to petroleum and natural gas | | 56.45 |

**Table E3. Oilsands companies within the Cold Lake range**

| Lease Holder | Number of Leases Held | Area (KM2) |
|---|---|---|
| CENOVUS FCCL LTD. | 79 | 1815.48 |
| CANADIAN NATURAL RESOURCES LIMITED | 33 | 1014.46 |
| DEVON NEC CORPORATION | 27 | 588.38 |
| IMPERIAL OIL RESOURCES LIMITED | 7 | 481.07 |
| HUSKY OIL OPERATIONS LIMITED | 2 | 142.90 |
| MEG ENERGY CORP. | 17 | 90.52 |
| DEVON CANADA | 5 | 30.88 |
| CENOVUS ENERGY INC. | 1 | 17.67 |
| GRIZZLY OIL SANDS ULC | 1 | 16.98 |
| STANDARD LAND COMPANY INC. | 1 | 12.53 |
| HARVEST OPERATIONS CORP. | 1 | 9.61 |
| CAVALIER ENERGY INC. | 2 | 5.12 |
| OSUM PRODUCTION CORP. | 1 | 0.94 |
| | | |
| Total area allocated to oilsands | | 4211.25 |
| Total area of Cold Lake range | | 6725.86 |
| Percent of range allocated to oilsands | | 62.61 |

**Table F1. Forestry companies within the Nipisi range**

| Forest Management Agreement Holder | Other companies operating within FMA | Area (KM2) |
|---|---|---|
| Alberta-Pacific Forest Products Incorporated | Alberta Forest Industries Ltd., Ed Bobocel Lumber (1993) Ltd., Millar Western Forest Products Ltd, Northland Forest Products Ltd., S-11 Logging Company Ltd., Seehta Forest Products Ltd., Spruceland Millworks Inc., St. Jean Lumber (1984) Limited., Vanderwell Contractors (1971) Ltd., West Fraser Mills Ltd. | 1263.93 |
| Tolko Industries Ltd. (High Prairie) | Alberta Plywood Ltd., West Fraser Mills Ltd. | 219.36 |
| Tolko Industries Ltd, Vanderwell Contractors (1971) Ltd., and West Fraser Mills Ltd. (Slave Lake) | | 621.06 |
| Forest Management Units | Companies operating within FMU | |
| S19 | Alberta Ltd., Joint Venture., Alberta Plywood Ltd., Lakeshore Timber Company., Smoky River | |
| | | |
| Total area of FMA allocations | | 2104.36 |
| Total area of Nipisi range | | 2104.36 |
| Percent of range allocated to FMAs | | 100 |

**Table F2. Petroleum and natural gas companies within the Nipisi range**

| Lease Holder | Number of Leases Held | Area (KM2) |
|---|---|---|
| HUSKY OIL OPERATIONS LIMITED | 41 | 169.40 |
| CANADIAN NATURAL RESOURCES LIMITED | 52 | 117.20 |
| CANADIAN OIL & GAS INTERNATIONAL INC. | 29 | 90.74 |
| EXALL ENERGY CORPORATION | 14 | 69.76 |
| PAN PACIFIC OILS LTD. | 11 | 60.89 |
| BROADVIEW ENERGY LTD. | 2 | 53.44 |
| RALLY CANADA RESOURCES LTD. | 7 | 39.75 |
| SCOTT LAND & LEASE LTD. | 5 | 31.04 |
| NORTHPINE ENERGY LTD. | 6 | 17.88 |
| BASM LAND & RESOURCES LTD. | 2 | 12.83 |
| ANTERRA ENERGY INC. | 11 | 10.91 |
| STANDARD LAND COMPANY INC. | 3 | 10.26 |
| SUPERMAN RESOURCES INC. | 8 | 10.16 |
| SUMMERLAND ENERGY INC. | 4 | 6.39 |
| SURGE ENERGY INC. | 10 | 5.81 |
| SRIVASTAVA, NEHA | 2 | 5.11 |
| HANNA OIL & GAS COMPANY - CANADA ULC | 1 | 4.23 |
| CHAIR RESOURCES INC. | 2 | 3.18 |
| KINMERC OIL & GAS INC. | 3 | 3.07 |
| DEVON NEC CORPORATION | 1 | 2.56 |
| BRITT RESOURCES LTD. | 1 | 2.56 |
| COASTAL RESOURCES LIMITED | 3 | 1.92 |
| IGNITE ENERGY CORP. | 2 | 1.28 |
| PREDATOR OIL LTD. | 1 | 0.78 |
| ENERCAPITA ENERGY LTD. | 1 | 0.65 |
| ARC RESOURCES LTD. | 1 | 0.65 |
| BOUNTY DEVELOPMENTS LTD | 1 | 0.64 |
| BAYTEX ENERGY LTD. | 1 | 0.64 |
| | | |
| Total area allocated to petroleum and natural gas | | 705.71 |
| Total area of Nipisi range | | 2104.36 |
| Percent of range allocated to petroleum and natural gas | | 33.54 |

**Table F3. Oilsands companies within the Nipisi range**

| Lease Holder | Number of Leases Held | Area (KM2) |
|---|---|---|
| DEERGARDEN RESOURCES LTD. | 7 | 160.24 |
| PLUNKETT RESOURCES LTD. | 3 | 90.60 |
| MAVERICK LAND CONSULTANTS 2012 LTD. | 3 | 82.39 |
| CANADIAN NATURAL RESOURCES LIMITED | 2 | 44.74 |
| DEVON NEC CORPORATION | 1 | 15.56 |
| EXALL ENERGY CORPORATION | 1 | 7.82 |
| ROLAND RESOURCES 2012 INC. | 1 | 6.36 |
| | | |
| Total area allocated to oilsands | | 407.72 |
| Total area of Nipisi range | | 2104.36 |
| Percent of range allocated to oilsands | | 19.37 |

**Table G1. Forestry companies within the Slave Lake range**

| Forest Management Agreement Holder | Other companies operating within FMA | Area (KM2) |
|---|---|---|
| Tolko Industries Ltd, Vanderwell Contractors (1971) Ltd., and West Fraser Mills Ltd. (Slave Lake) | | 455.32 |
| Vanderwall Contractors (1971) Ltd. | | 490.00 |
| West Fraser Mills Ltd. (Slave Lake) | Millar Western Forest Products Ltd., Vanderwall Contractors (1971) Ltd., West Fraser Mills Ltd. | 244.68 |
| Millar Western Forest Products Ltd. | Fort Assiniboine Lumber Ltd., Spruceland Millworks Inc., Weyerhaeuser Company Limited | 260.65 |
| | | |
| Total area of FMA allocations | | 1450.64 |
| Total area of Slave Lake range | | 1516.23 |
| Percent of range allocated to FMAs | | 95.67 |

**Table G2. Petroleum and natural gas companies within the Slave Lake range**

| Lease Holder | Number of Leases Held | Area (KM2) |
|---|---|---|
| CANADIAN NATURAL RESOURCES LIMITED | 119 | 365.97 |
| CARDINAL ENERGY LTD. | 95 | 189.85 |
| APACHE CANADA LTD. | 23 | 50.76 |
| MERIDIAN LAND SERVICES (90) LTD | 5 | 34.52 |
| HUSKY OIL OPERATIONS LIMITED | 12 | 33.01 |
| MSL LAND SERVICES LTD. | 4 | 29.90 |
| PERPETUAL ENERGY OPERATING CORP. | 8 | 29.04 |
| QUESTFIRE ENERGY CORP. | 5 | 20.45 |
| TAMARACK ACQUISITION CORP. | 1 | 13.60 |
| SCOTT LAND & LEASE LTD. | 3 | 12.27 |
| CHINOOK ENERGY INC. | 11 | 11.06 |
| LONG RUN EXPLORATION LTD. | 2 | 10.09 |
| EXALL ENERGY CORPORATION | 3 | 3.87 |
| KAISER EXPLORATION LTD. | 3 | 3.79 |
| BERING EXPLORATION COMPANY, ULC | 2 | 3.23 |
| ENERCAPITA ENERGY LTD. | 3 | 1.24 |
| ARC RESOURCES LTD. | 3 | 0.78 |
| CANADIAN COYOTE ENERGY LTD. | 1 | 0.65 |
| CALEDONIAN ROYALTY CORPORATION | 1 | 0.65 |
| BOUNTY DEVELOPMENTS LTD | 1 | 0.65 |
| SHORELINE ENERGY CORP. | 1 | 0.65 |
| SIGNALTA RESOURCES LIMITED | 1 | 0.64 |
| KOR ENERGY INC. | 1 | 0.30 |
| MISTAHIYA RESOURCES LTD. | 1 | 0.02 |
| | | |
| Total area allocated to petroleum and natural gas | | 753.47 |
| Total area of Slave Lake range | | 1516.23 |
| Percent of range allocated to petroleum and natural gas | | 49.69 |


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