



Alberta's Caribou:

**A Guide to Range Planning
Vol. 3: Northwest Alberta**





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With thanks to Jaymie Campbell, Dave Hervieux, Dr. Elston Dzus and Dr. Liv Vors.

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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

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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 northwestern 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 northwest 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 three of this three-part series specifically addresses boreal woodland caribou ranges in northwestern Alberta – the Chinchaga, Bischo, Yates, and Caribou Mountains boreal woodland caribou ranges. Volumes one and two were previously released and focused on the caribou ranges in northeastern in Alberta and the Little Smoky range in west-central Alberta, respectively.

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 Mccloughlin 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

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- 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 Management*. (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

LOOKING FOR ACTION: *Caribou losing ground*

Second annual report
on governments' efforts
to conserve Canada's
boreal caribou
December 2014



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 achieve 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).

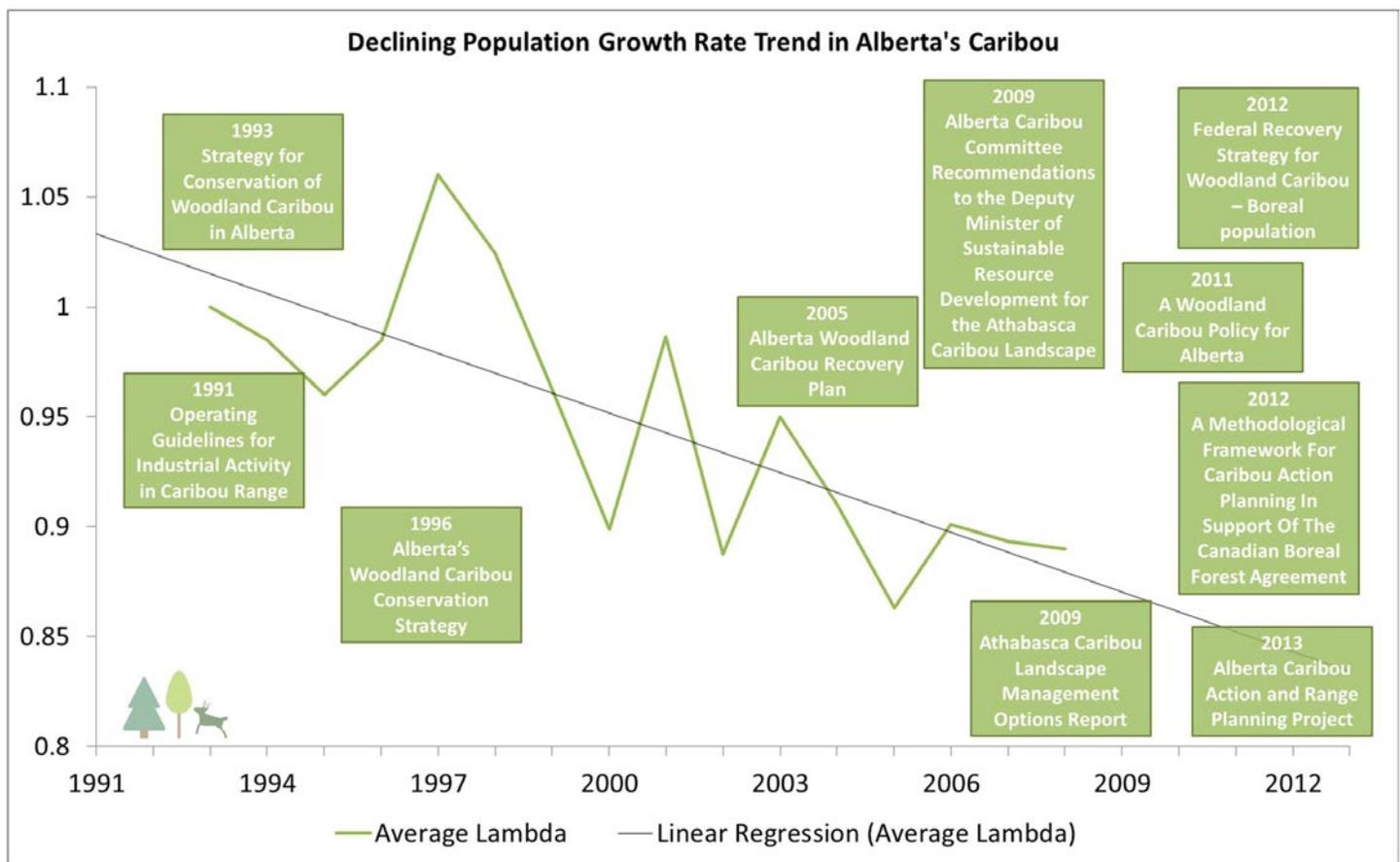


Figure 2: The average population growth rate (lambda; λ) for all Alberta’s boreal woodland Caribou herds from May 1993 to April 2009. A value of 1.0 is a stable population, values greater than 1.0 indicate population growth, and a value less than 1.0 indicates population decline. Caribou population lambda data taken from Status of the Woodland Caribou (Rangifer tarandus caribou) in Alberta: Update 2010⁵⁴

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 Alberta,” 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-sustaining⁵⁵ due to declining population trends and large amounts of disturbance caused by industry presence and wildfire (Figure 3, Table 1).

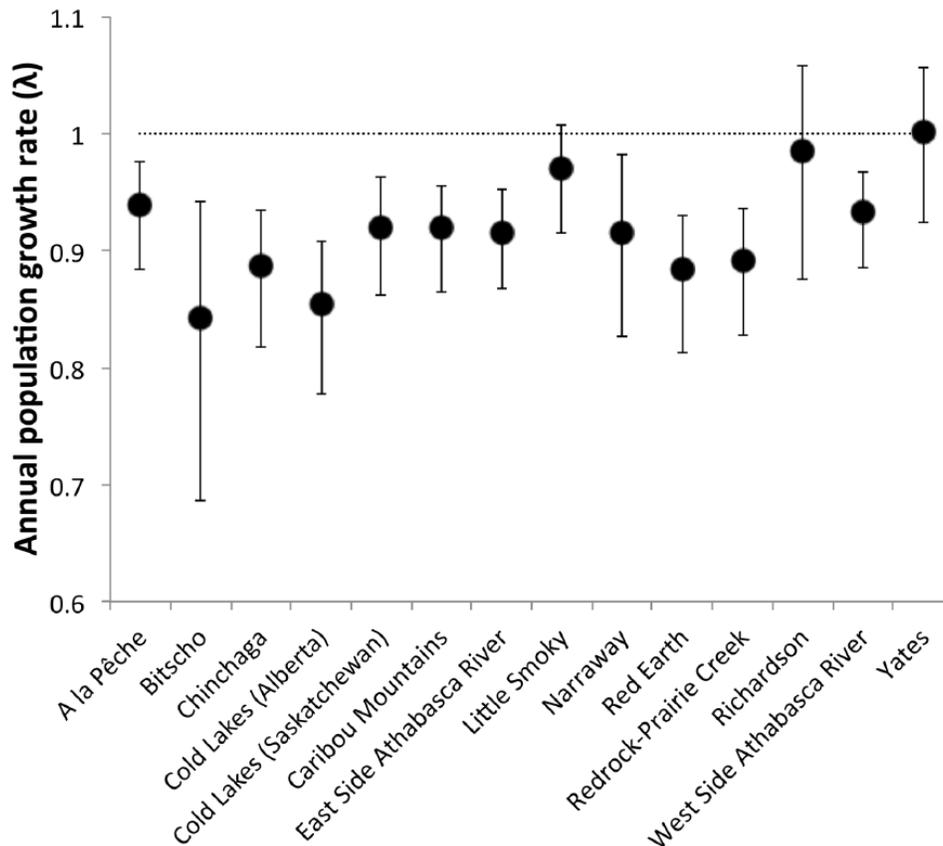


Figure 3. Geometric mean annual population growth rates (lambda) and 95% confidence interval averaged across all years for 14 boreal woodland caribou populations in Alberta from 1994 to 2012. Note that sampling variation is not removed from these estimates. Figure taken from Hervieux et al (2013).⁵⁶



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 Assessment
Chinchaga	250	Declining	74	8	76	Not Self-Sustaining
Bischo	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.

Percent of Range Disturbed

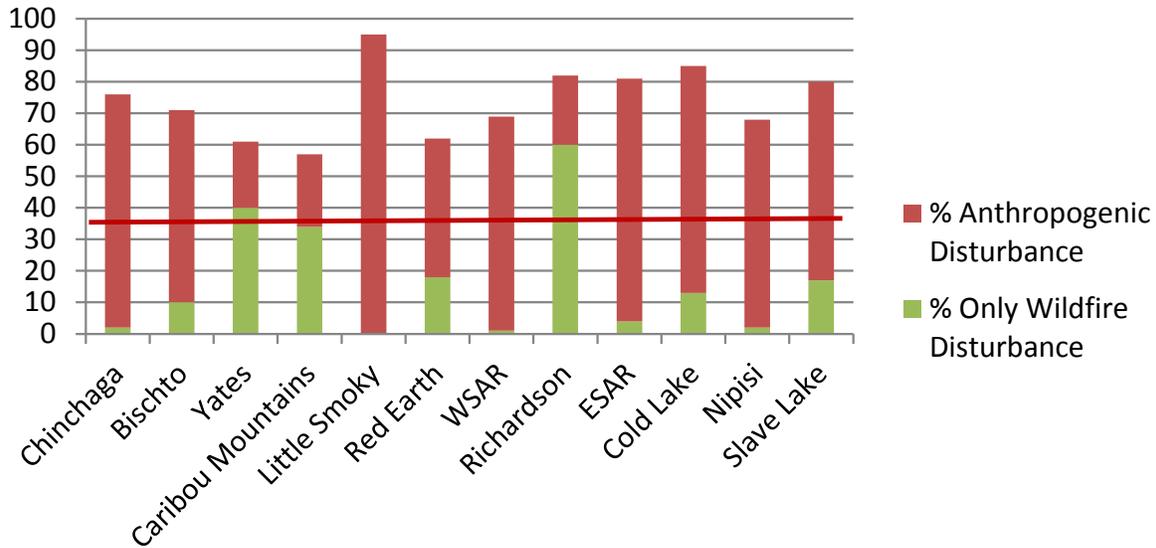


Figure 4. Percent of each caribou range disturbed.⁶⁰ The red line indicates the maximum disturbance level (35 percent) in critical habitat, or range, allowed by the Recovery Strategy.

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.

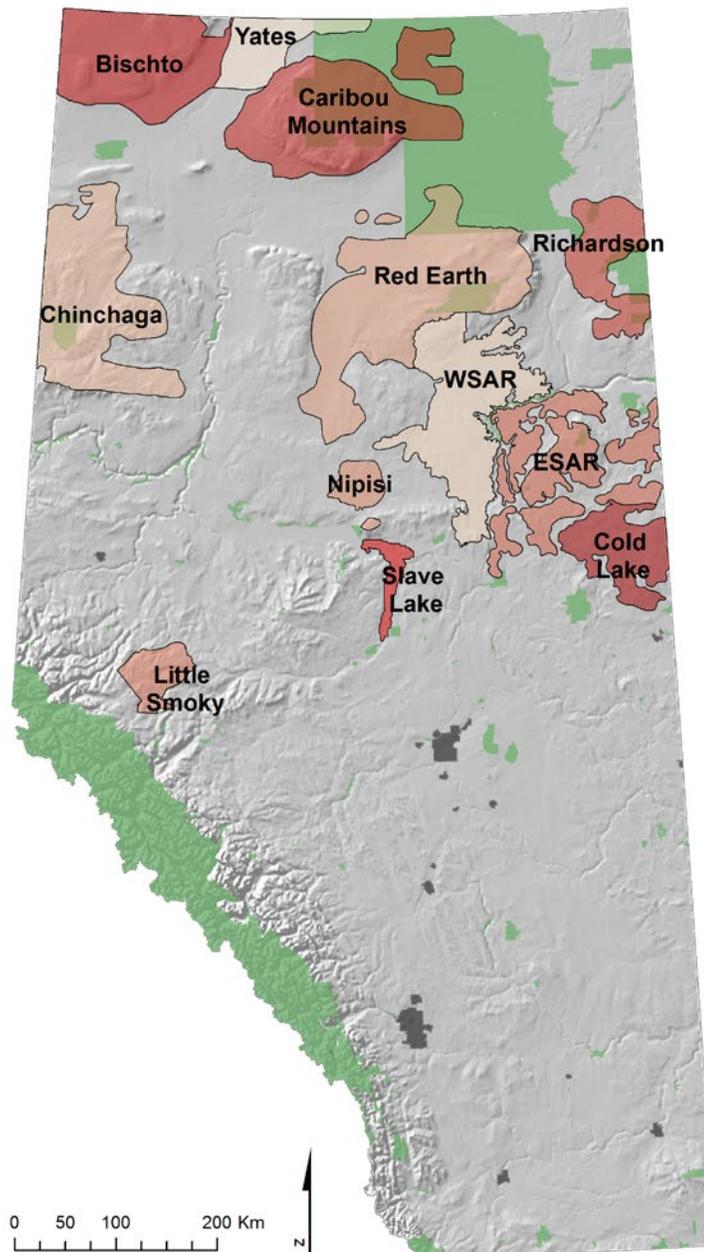


Figure 5. Alberta's boreal woodland caribou ranges. Different colours were used to indicate the boundaries of the separate ranges.

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 three of three) focuses solely on the four caribou herds in northwest 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 13; individual lease holders, number of leases held, and percent of range occupied by industrial tenures can be found in Appendix 1.



LOGS WAITING TO BE TRANSPORTED TO THE MILL - D PENDLEBURY

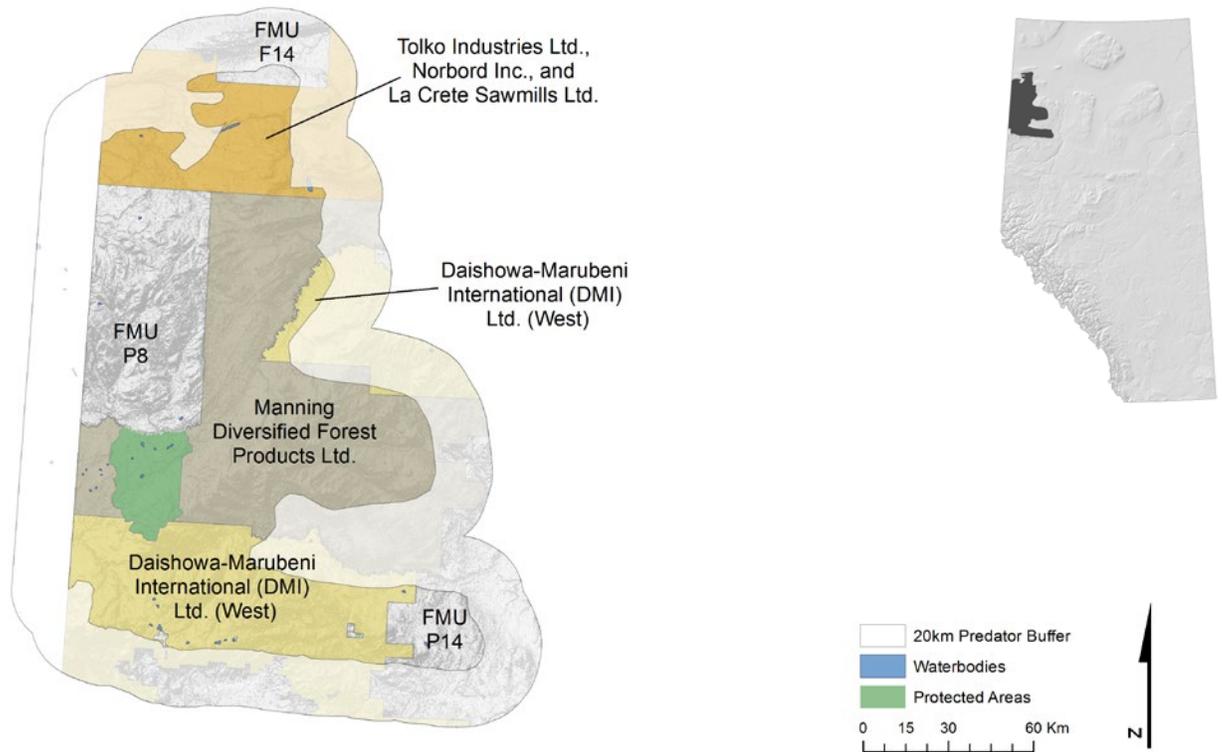


Figure 6. Forestry within the Chinchaga range. There are three FMA's covering 70.42% of the Chinchaga caribou range and three FMUs. Two companies operate on FMUs within the range.

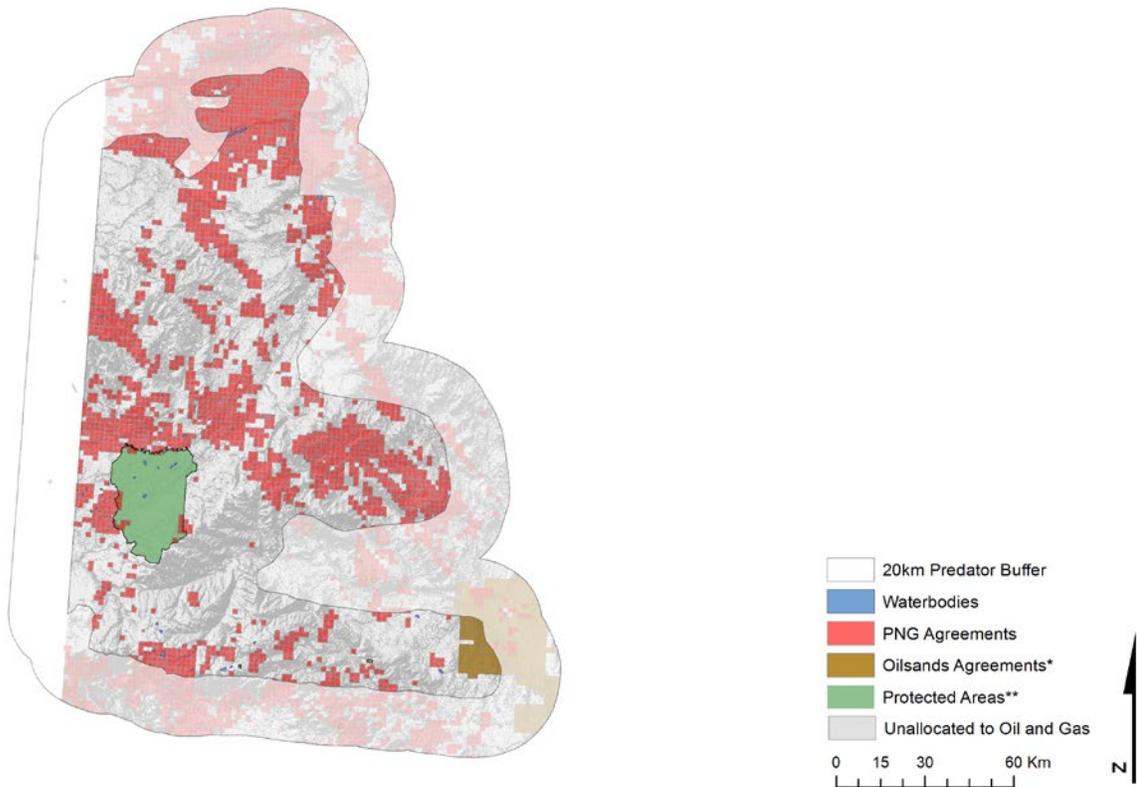


Figure 7. Oil and Gas within the Chinchaga range. There are 83 companies with PNG agreements covering 30.69% of the Chinchaga caribou range, and seven companies with oilsands agreements covering 1.11% of the range. *Oilsands agreements are drawn underneath PNG agreements; therefore, darker red indicates 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.

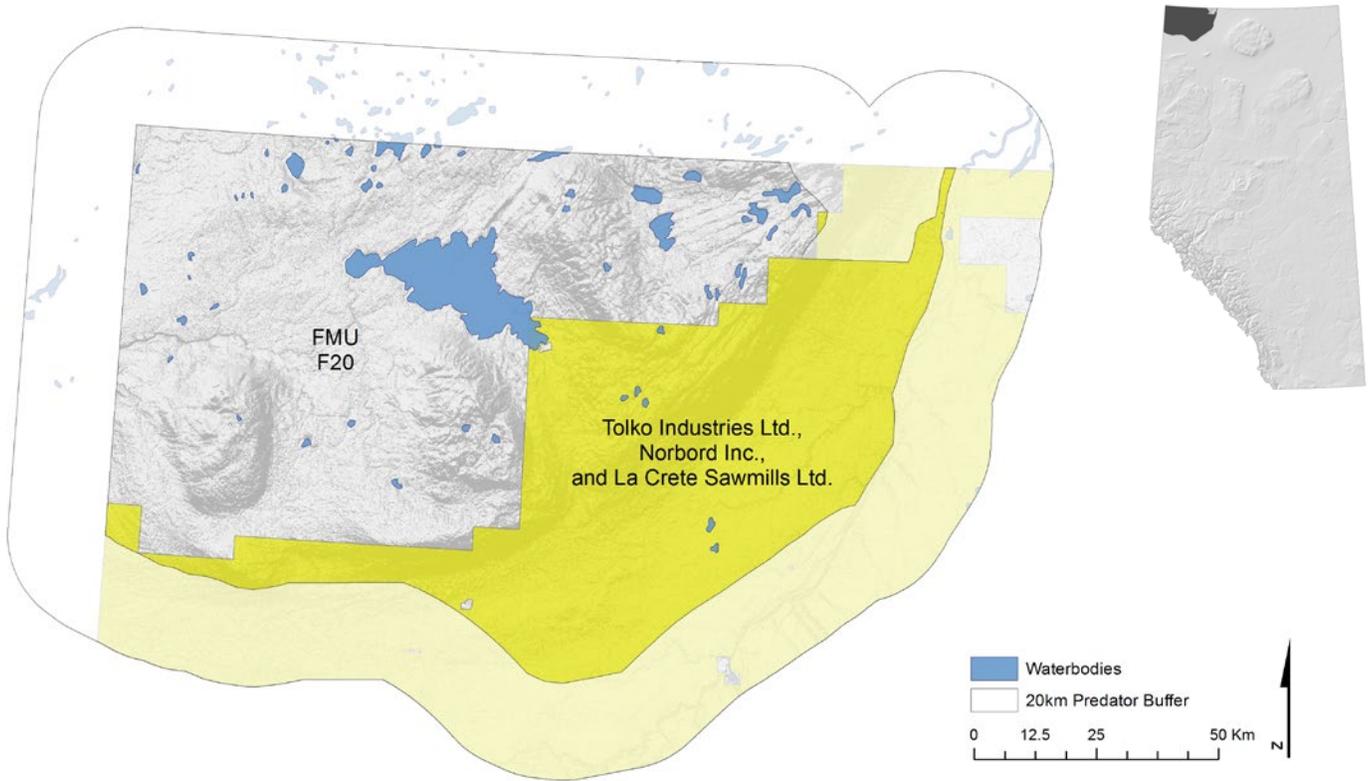


Figure 8. Forestry within the Bischo range. There is one FMA with three companies covering 39.34% of the Bischo caribou range.

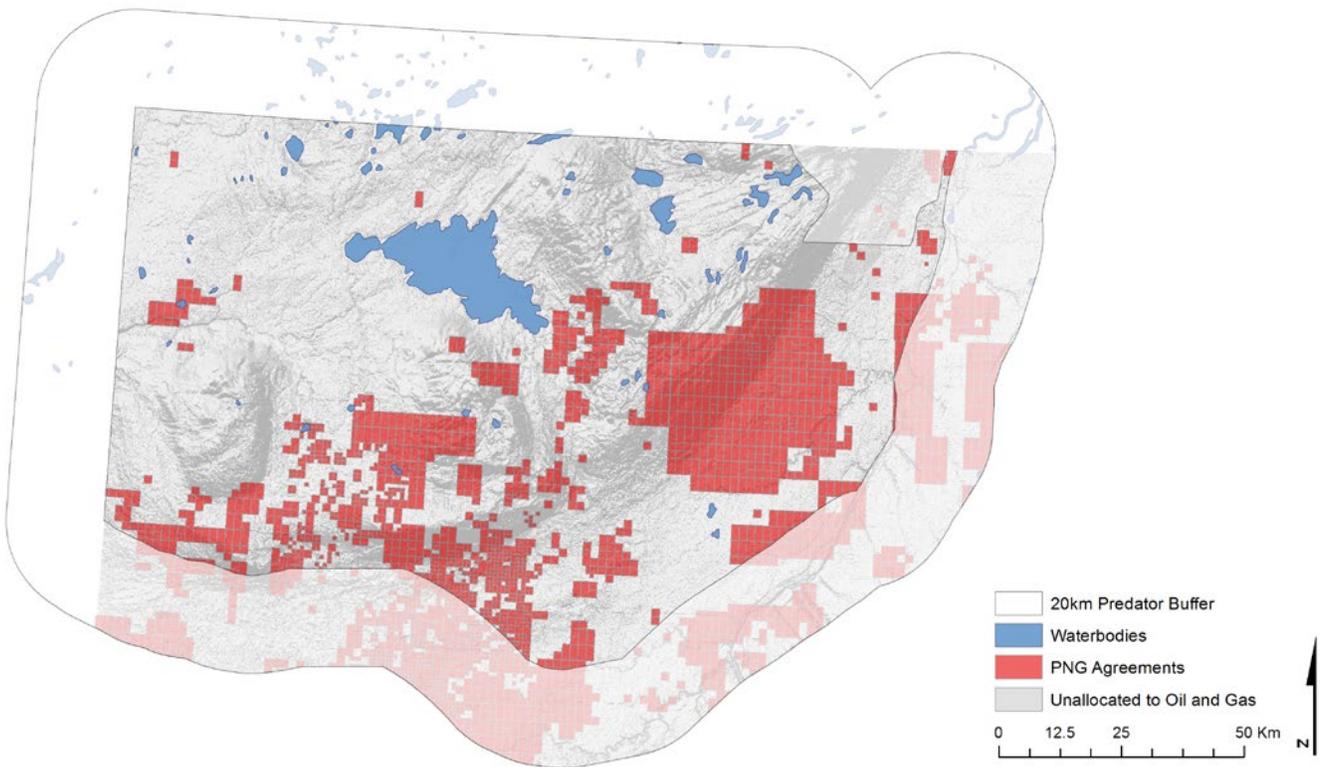


Figure 9. Oil and Gas within the Bischo range. There are 43 companies with PNG agreements covering 22.51% of the Bischo caribou range.

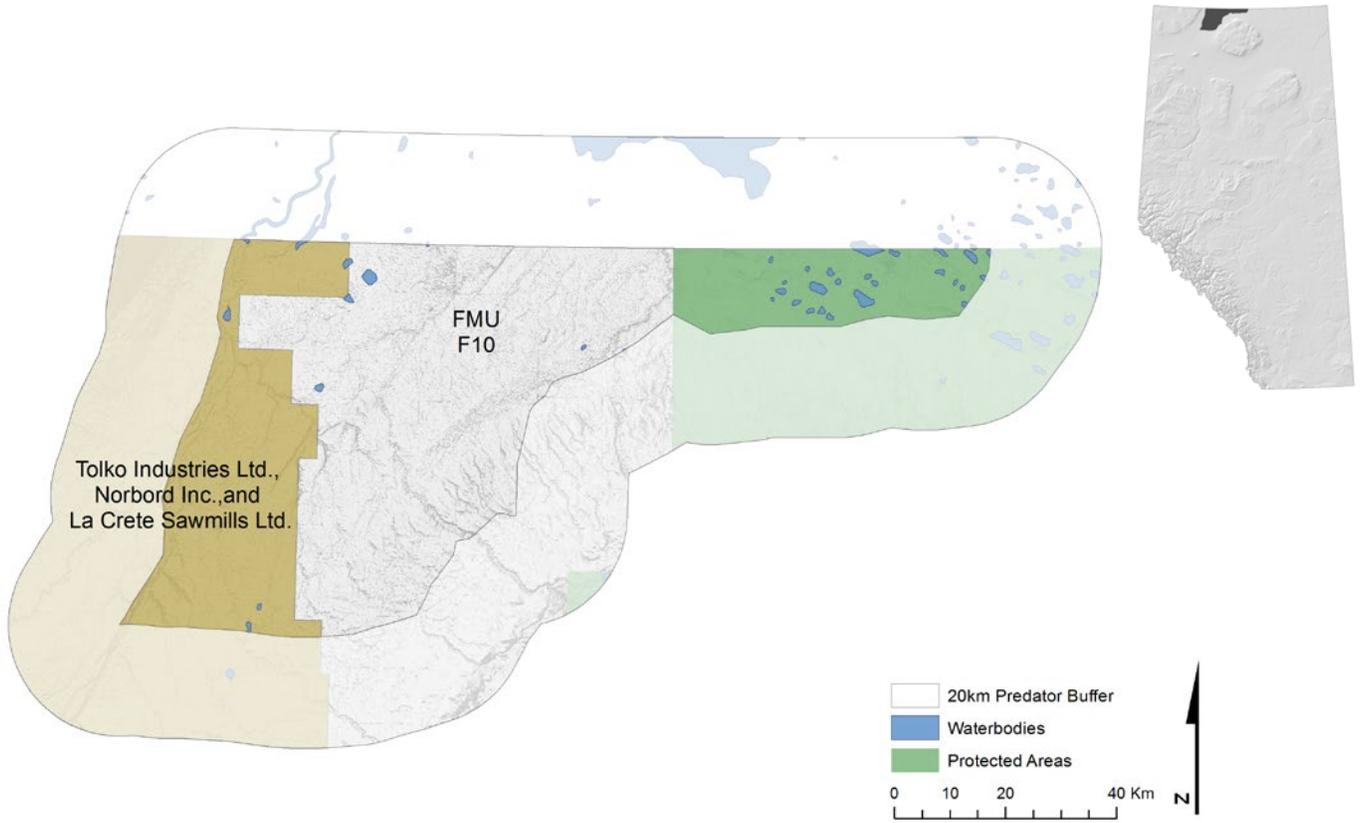


Figure 10. Forestry within the Yates range. There is one FMA covering 27.51% of the Yates caribou range.

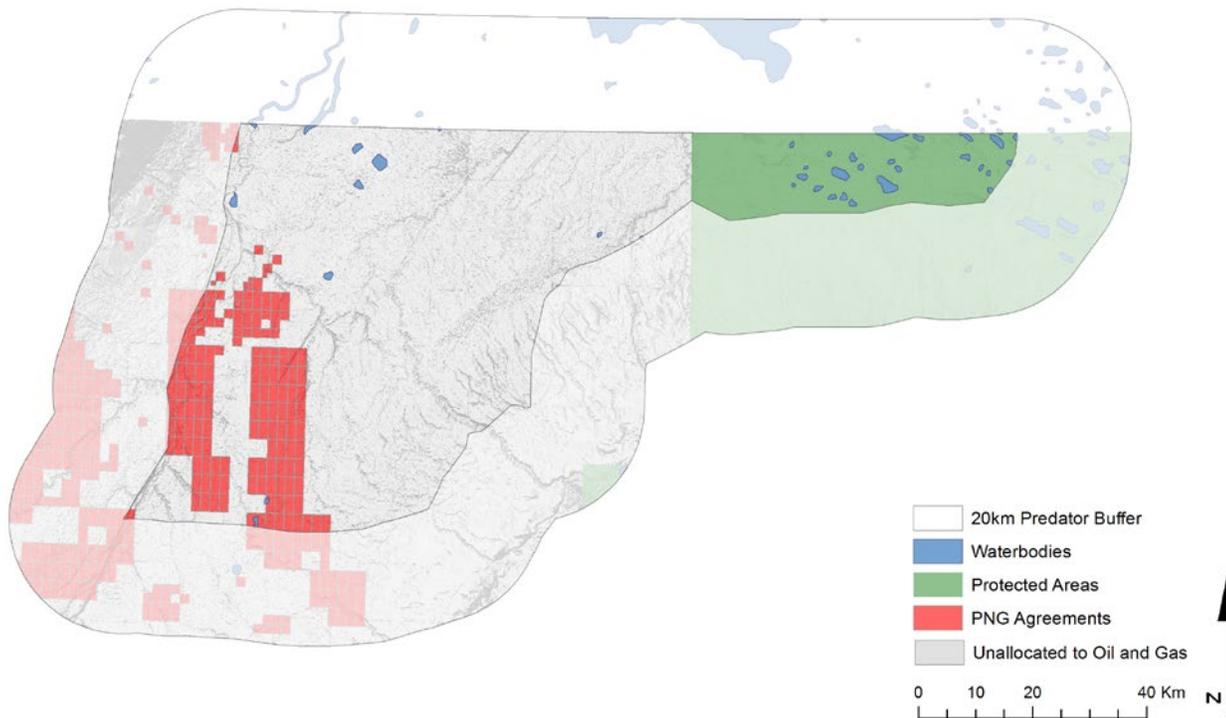


Figure 11. Oil and Gas within the Yates range. There are seven companies with PNG agreements covering 12.15% of the Yates caribou range.



Figure 12. Forestry within the Caribou Mountains range. There is one FMA covering 19.73% of the Caribou Mountains caribou range.

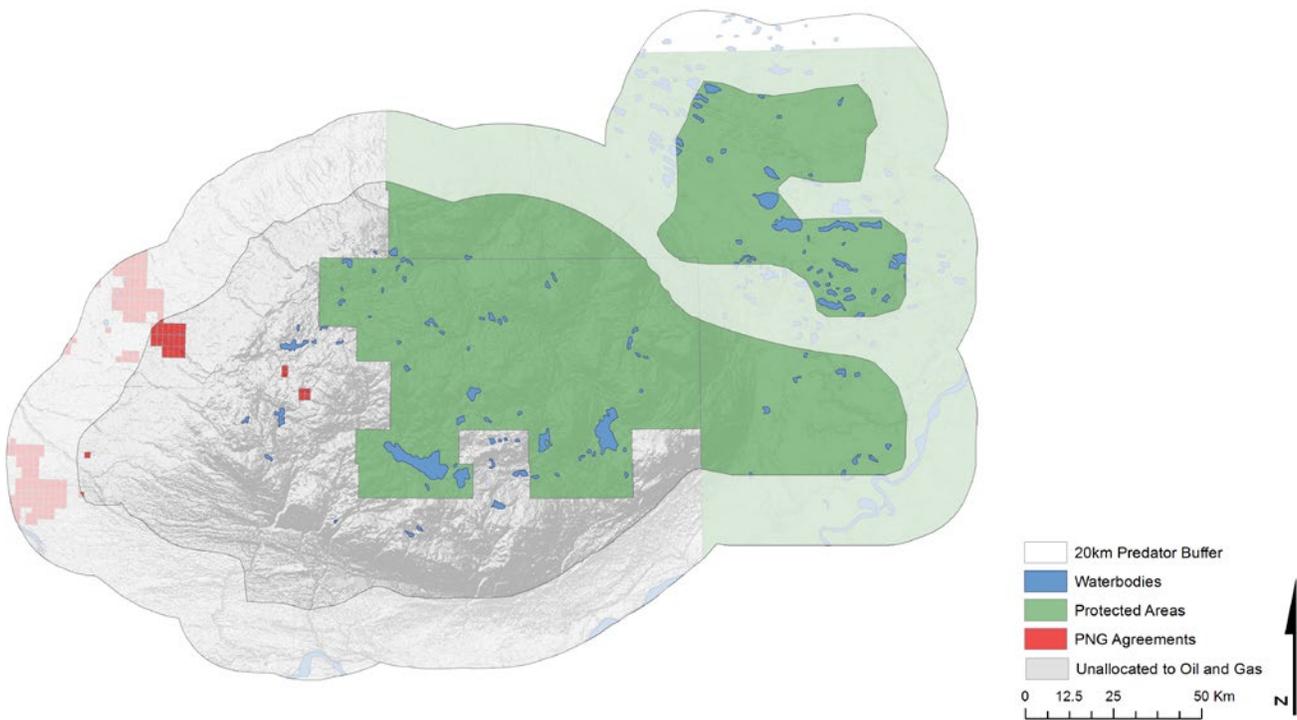


Figure 13. Oil and Gas within the Caribou Mountains range. There are four companies with PNG agreements covering 0.49% of the Caribou Mountains caribou range.

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 occurring 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 14 through 17.



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 ABMI, “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>.

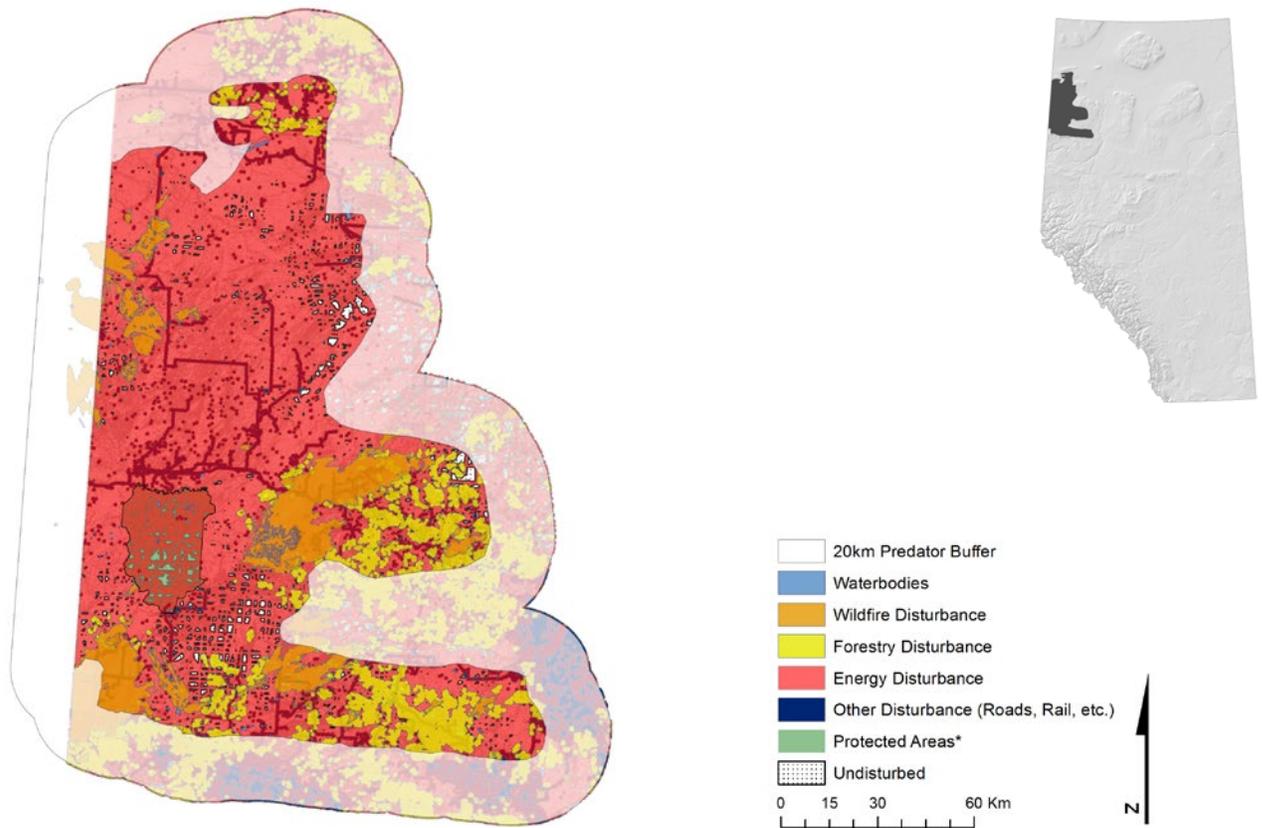


Figure 14. Undisturbed habitat within the Chinchaga range. *Protected areas have been drawn under disturbance. A black outline is used to indicate the boundary of protected areas.

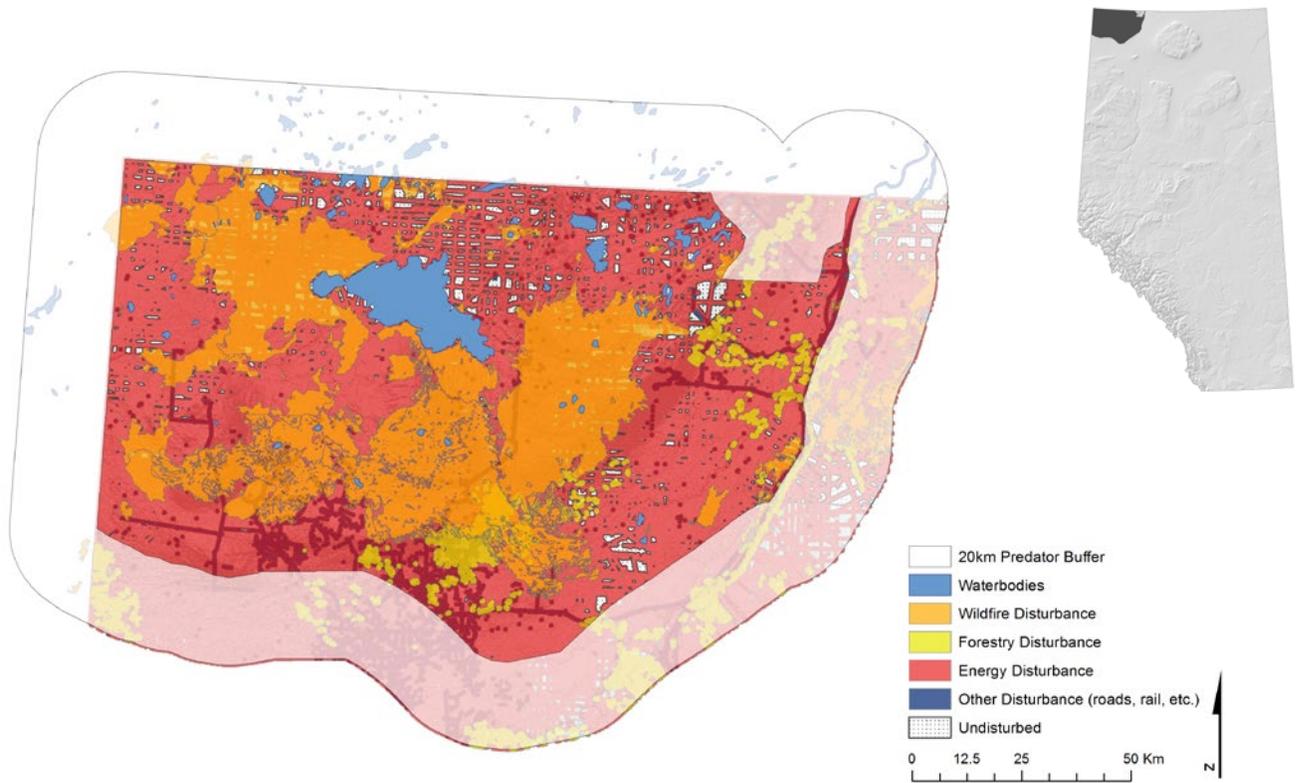


Figure 15. Undisturbed habitat within the Bischo range.

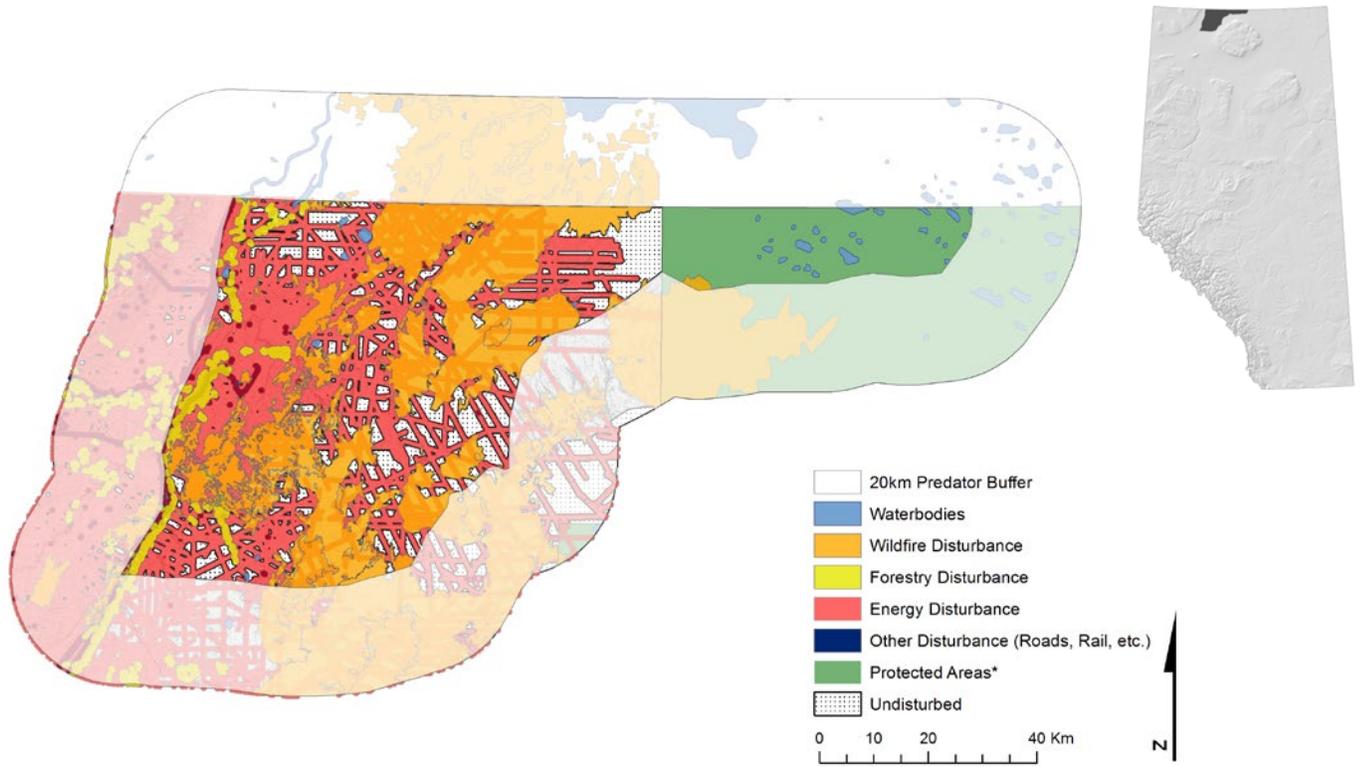


Figure 16. Undisturbed habitat within the Yates range. *Protected areas have been drawn under disturbance. A black outline is used to indicate the boundary of protected areas.

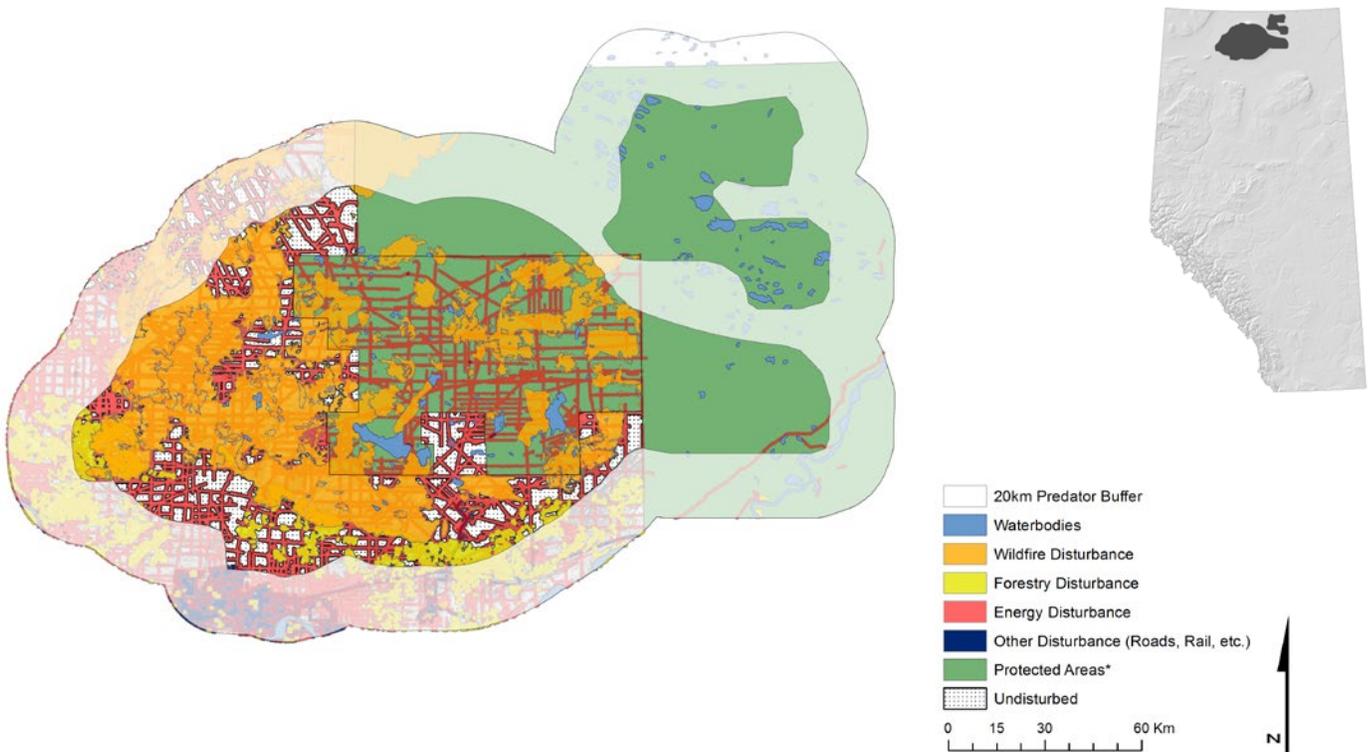


Figure 17. Undisturbed habitat within the Caribou Mountains range. *Protected areas have been drawn under disturbance. A black outline is used to indicate the boundary of protected areas.

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 northwest caribou ranges can be seen in the maps in Figures 18 through 21.



CARIBOU CALVES - B HILL

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 Conservation Prioritisation: Quantitative Methods and Computational Tools*, 2009.

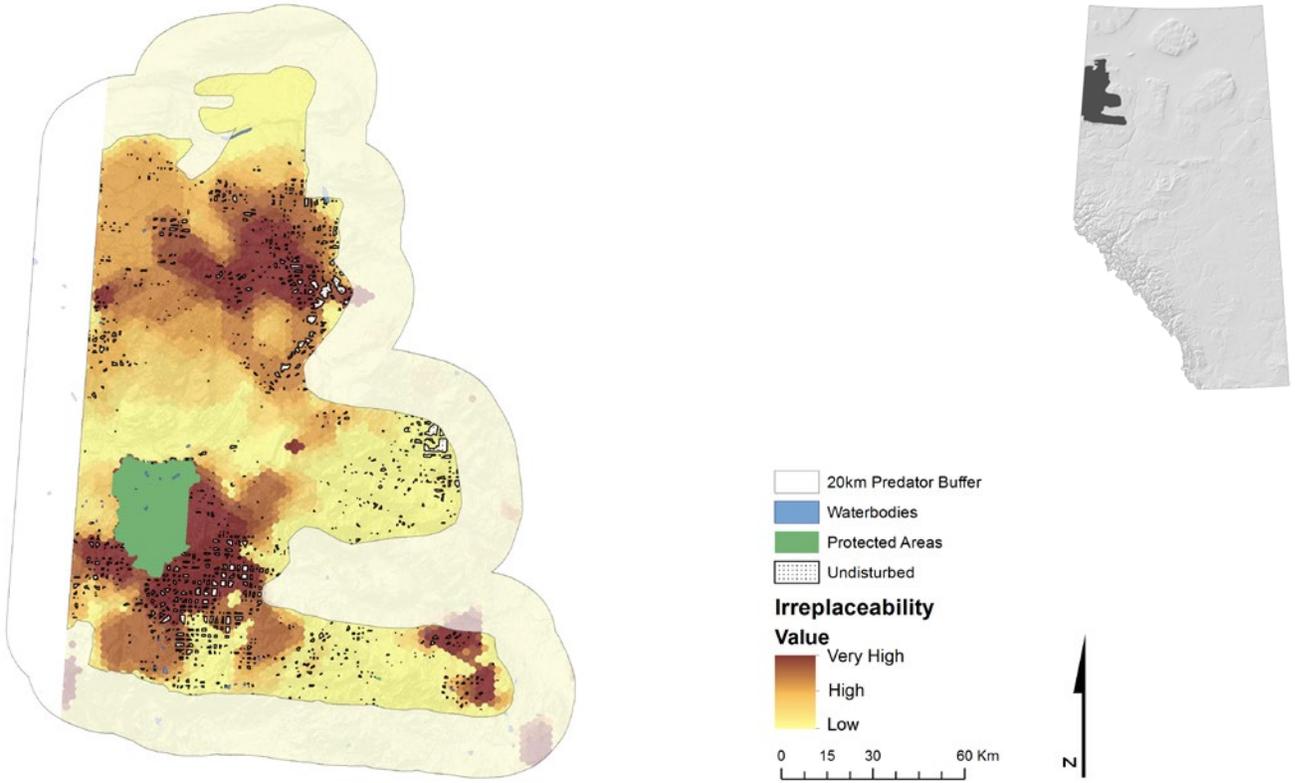


Figure 18. Irreplaceability value in the Chinchaga range.

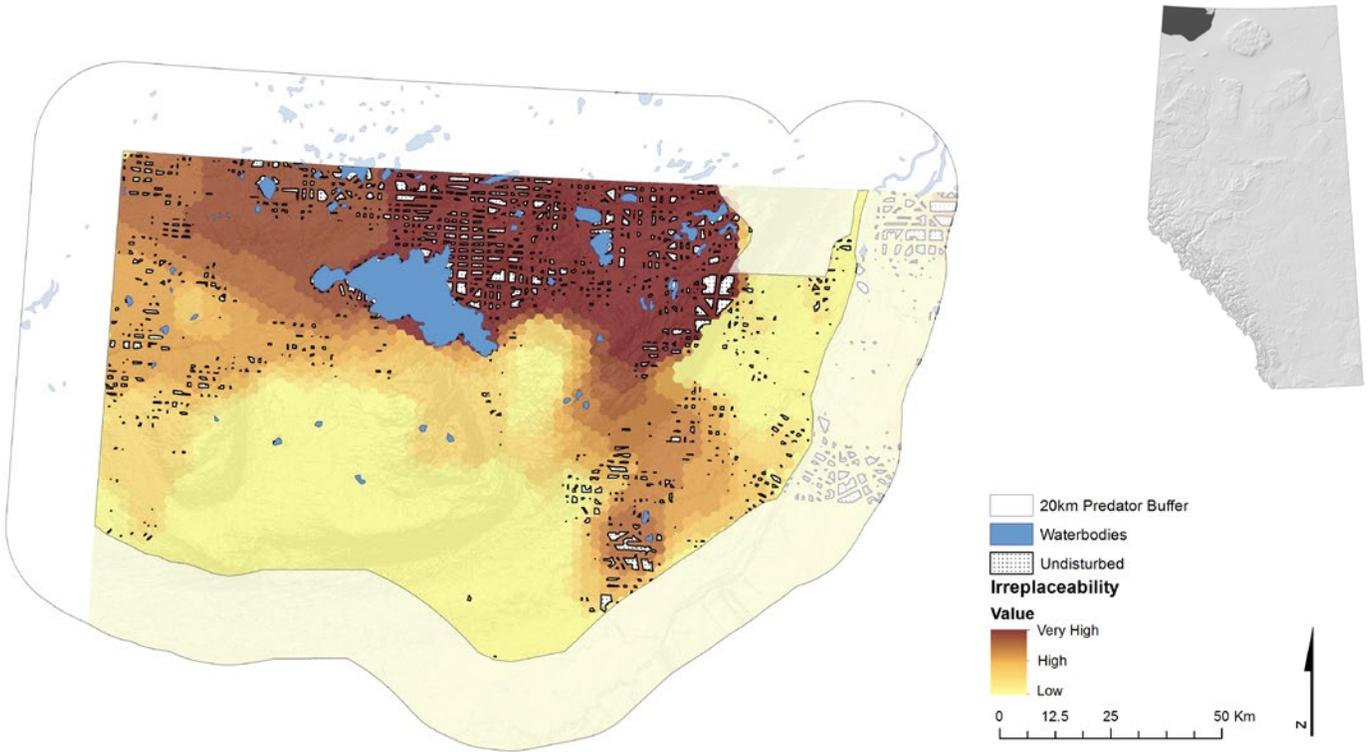


Figure 19. Irreplaceability value in the Bischo range.

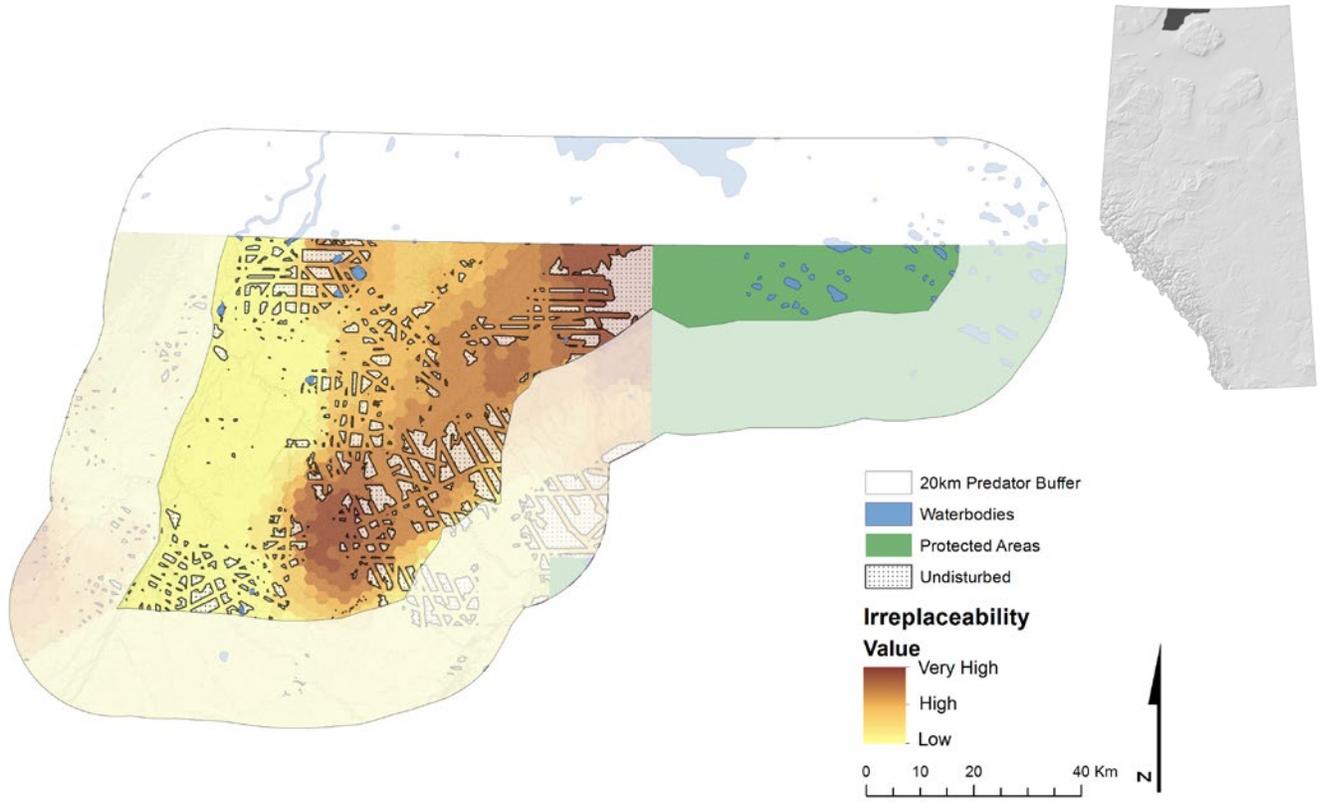


Figure 20. Irreplaceability value in the Yates range.

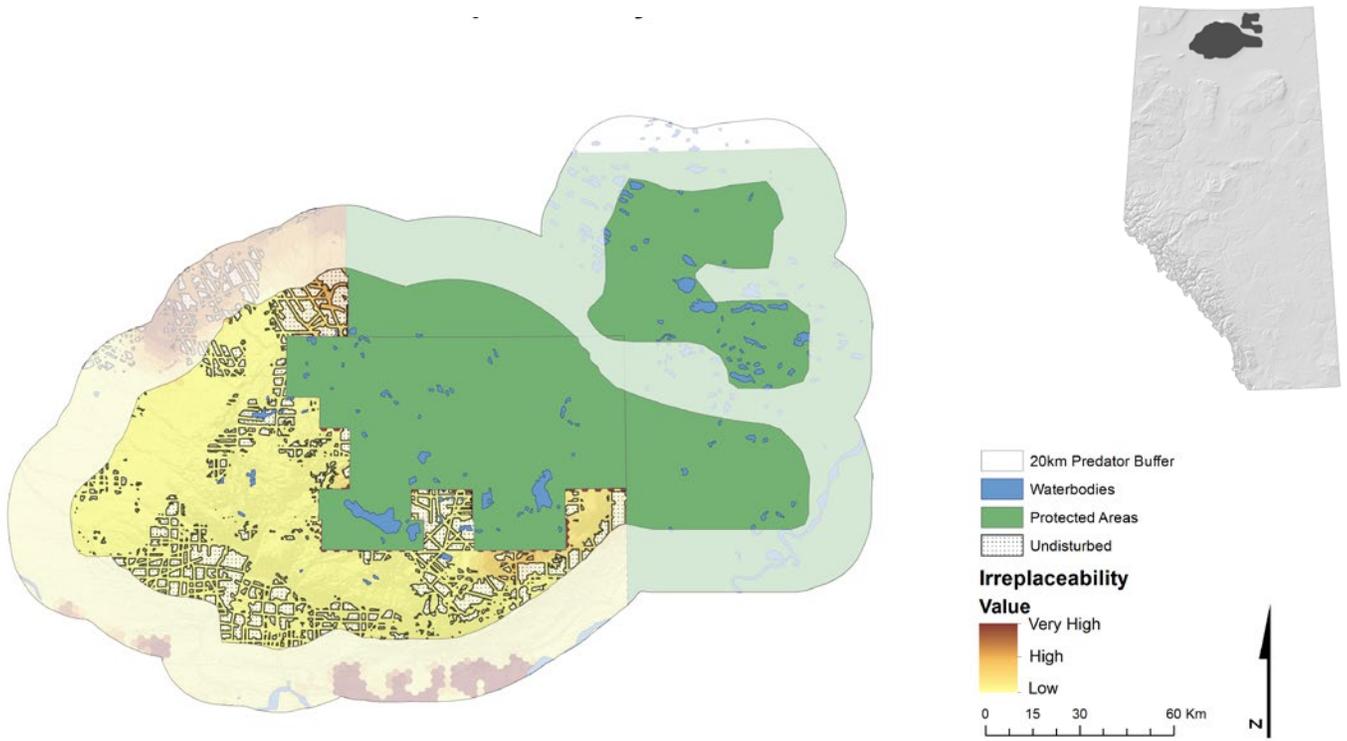


Figure 21. Irreplaceability value in the Caribou Mountains range.

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 collared 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 ranges 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 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



WOODLAND CARIBOU - K BLUCK

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- 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.”
- 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.”

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 km 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 100 km 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 22 through 29, 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.



CARIBOU - T SIMONETT

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 separated 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.

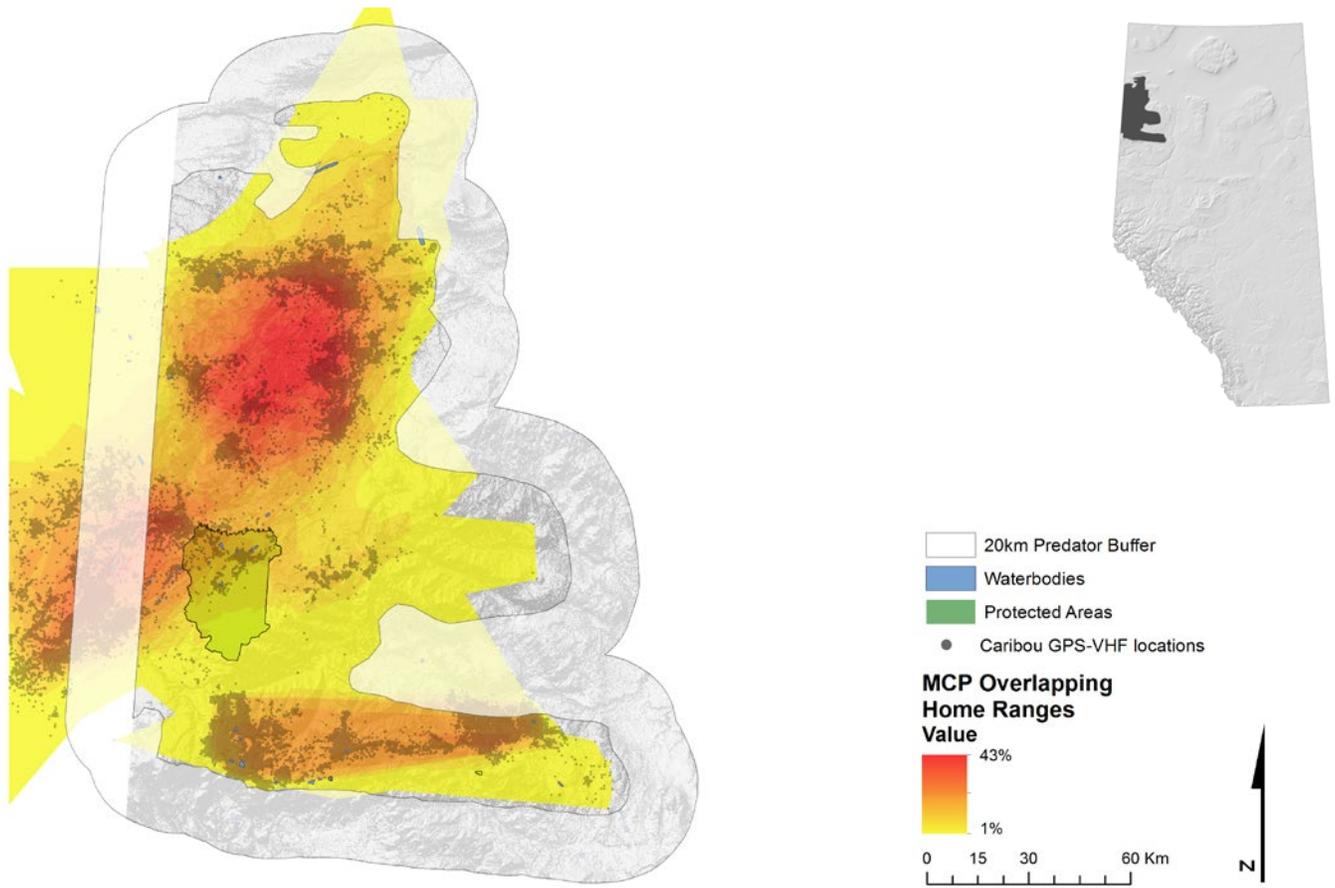


Figure 22. Caribou telemetry locations and MCP overlapping home ranges in the Chinchaga range.

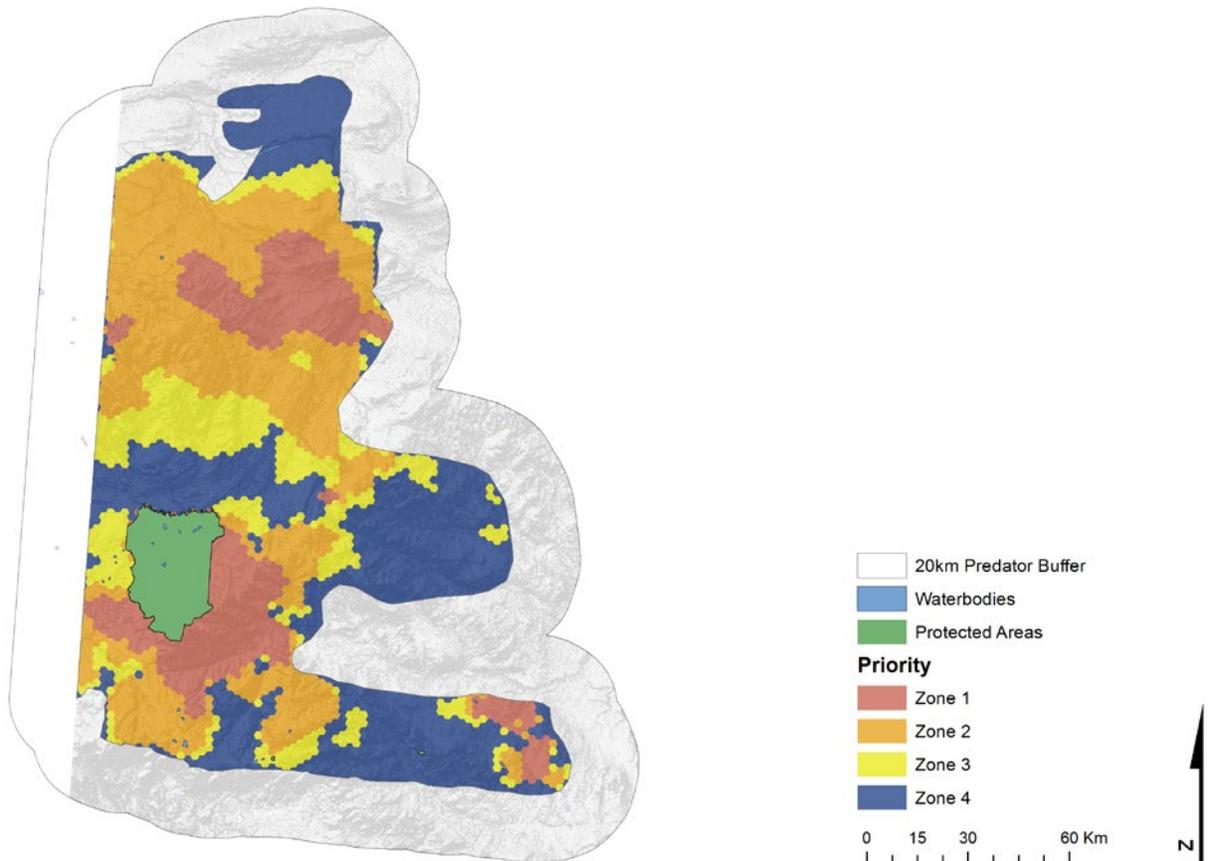


Figure 23. Recommended priority zones in the Chinchaga range.

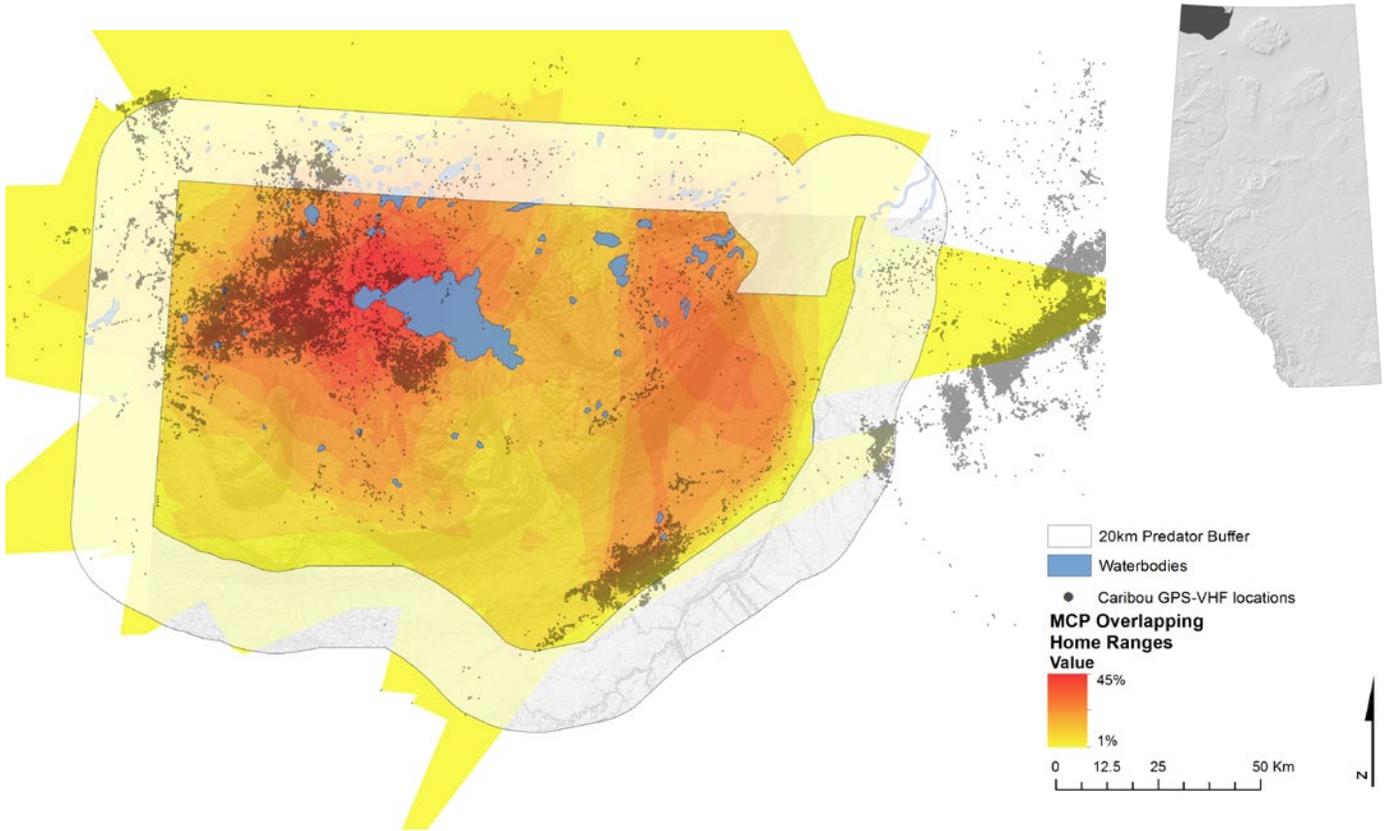


Figure 24. Caribou telemetry locations and MCP overlapping home ranges in the Bischo range.

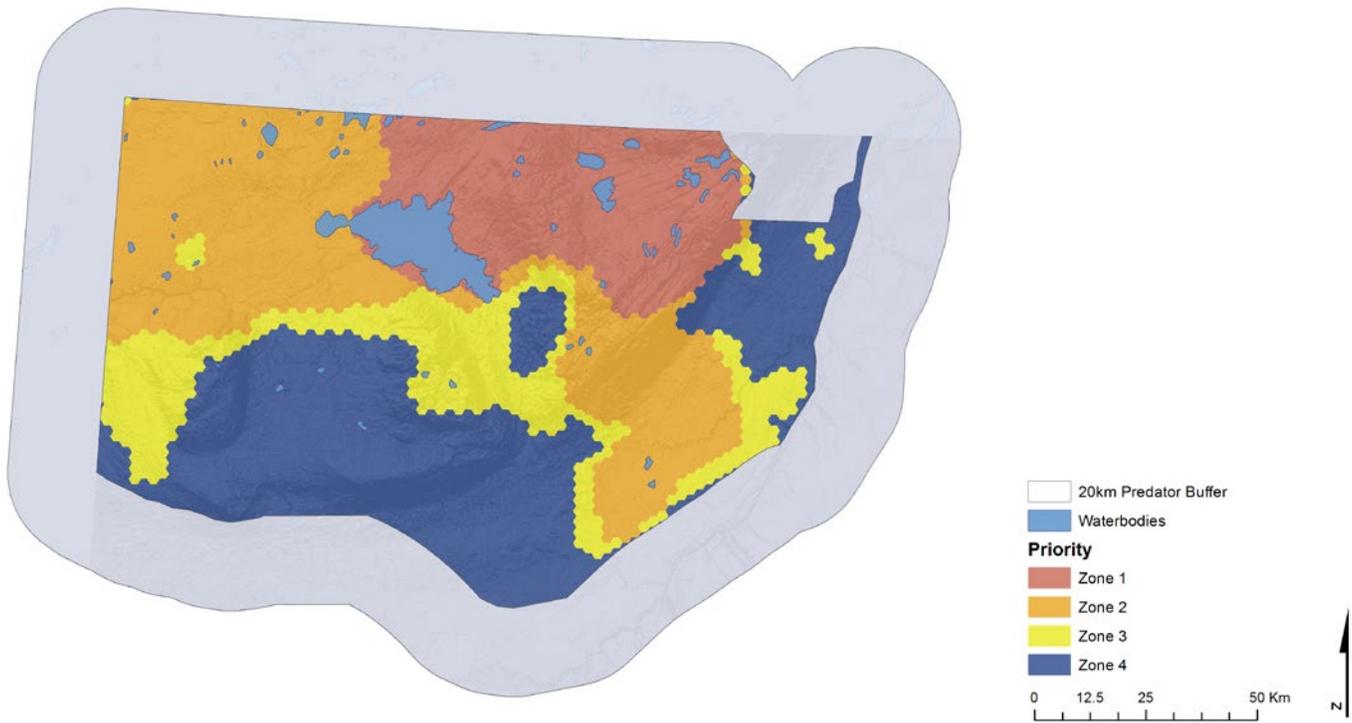


Figure 25. Recommended priority zones in the Bischo range.

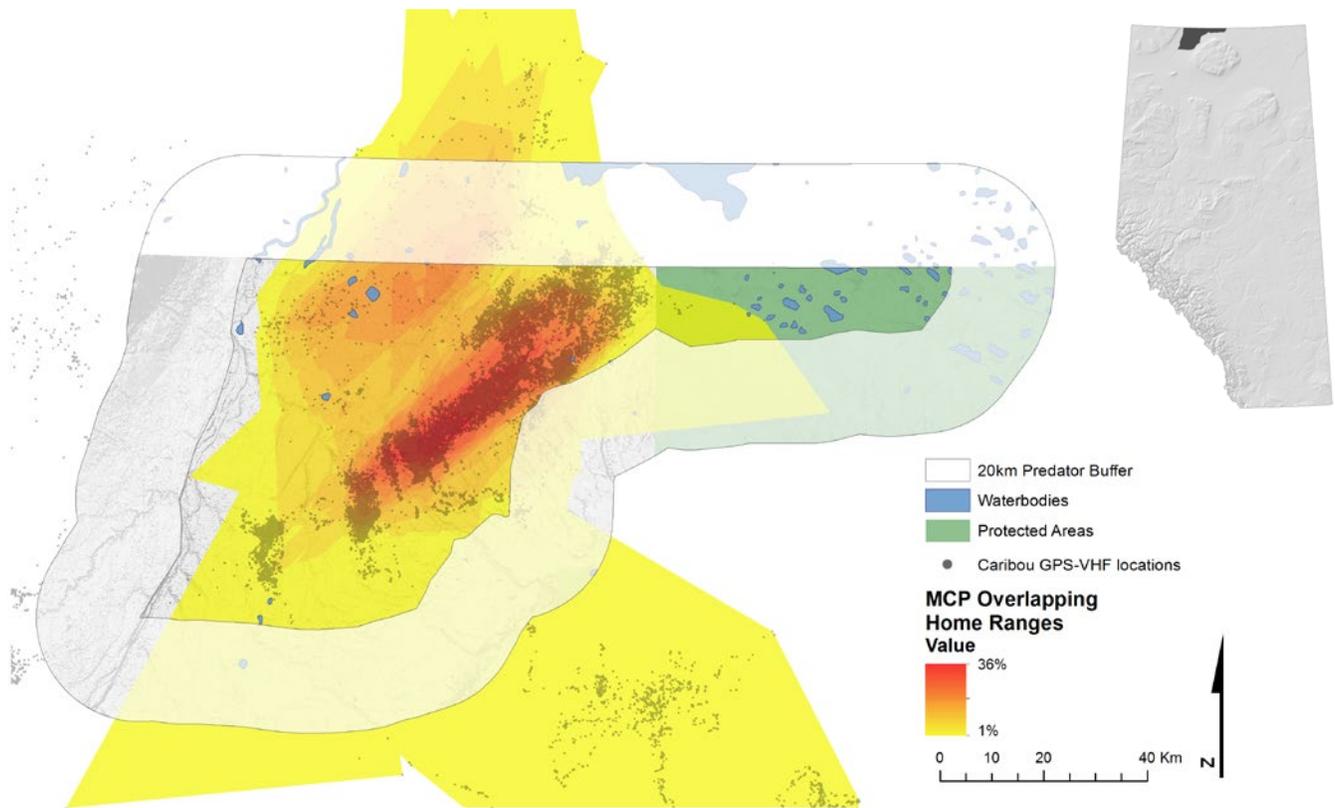


Figure 26. Caribou telemetry locations and MCP overlapping home ranges in the Yates range.

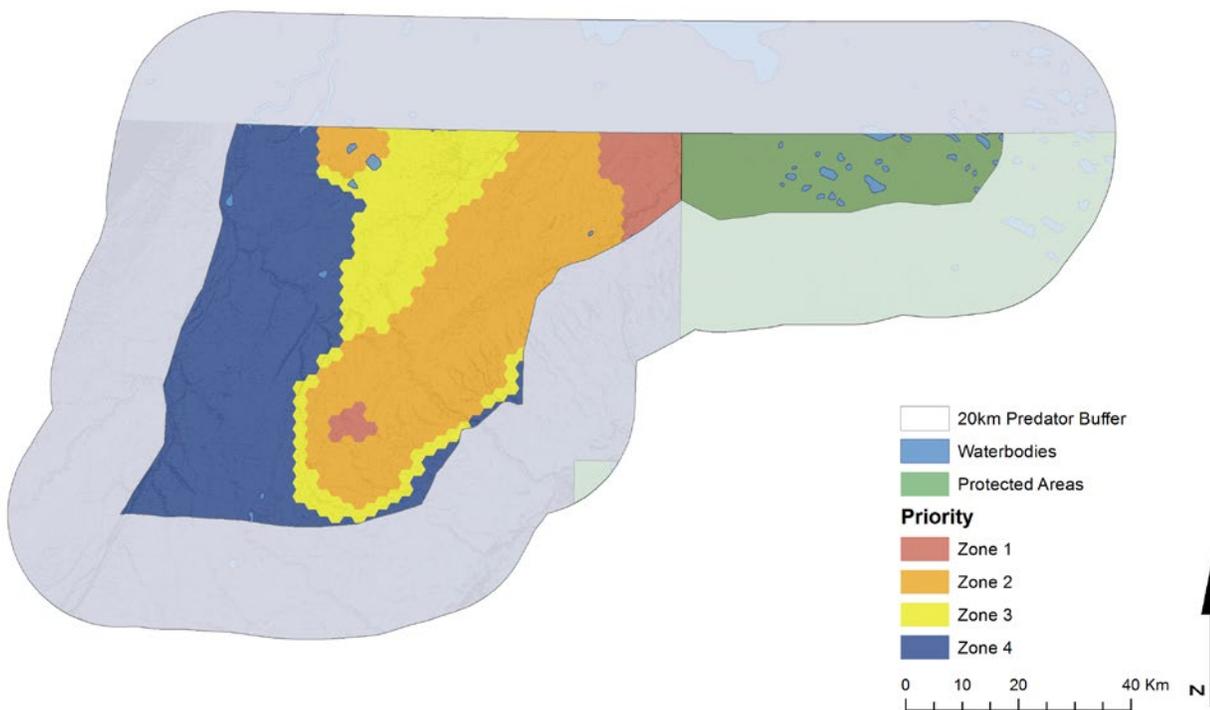


Figure 27. Recommended priority zones in the Yates range.

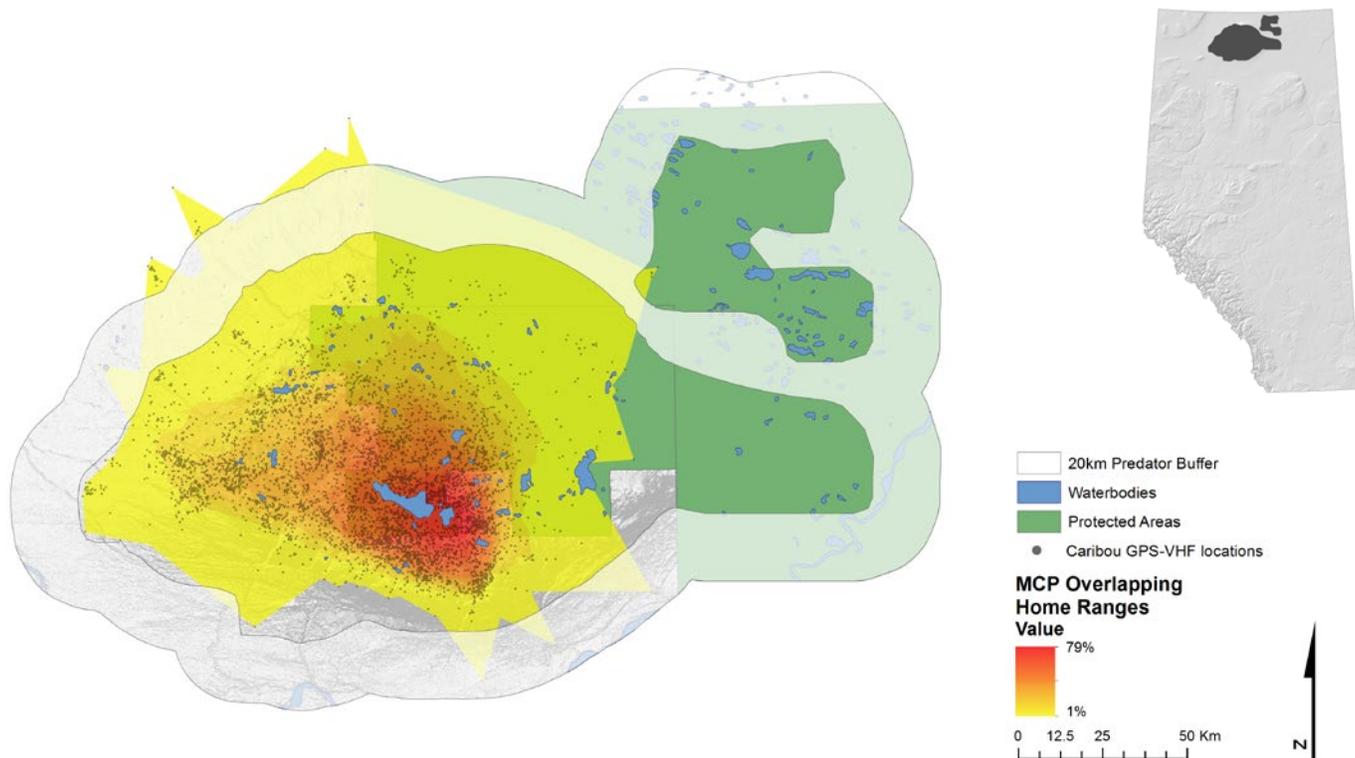


Figure 28. Caribou telemetry locations and MCP overlapping home ranges in the Caribou Mountains range.

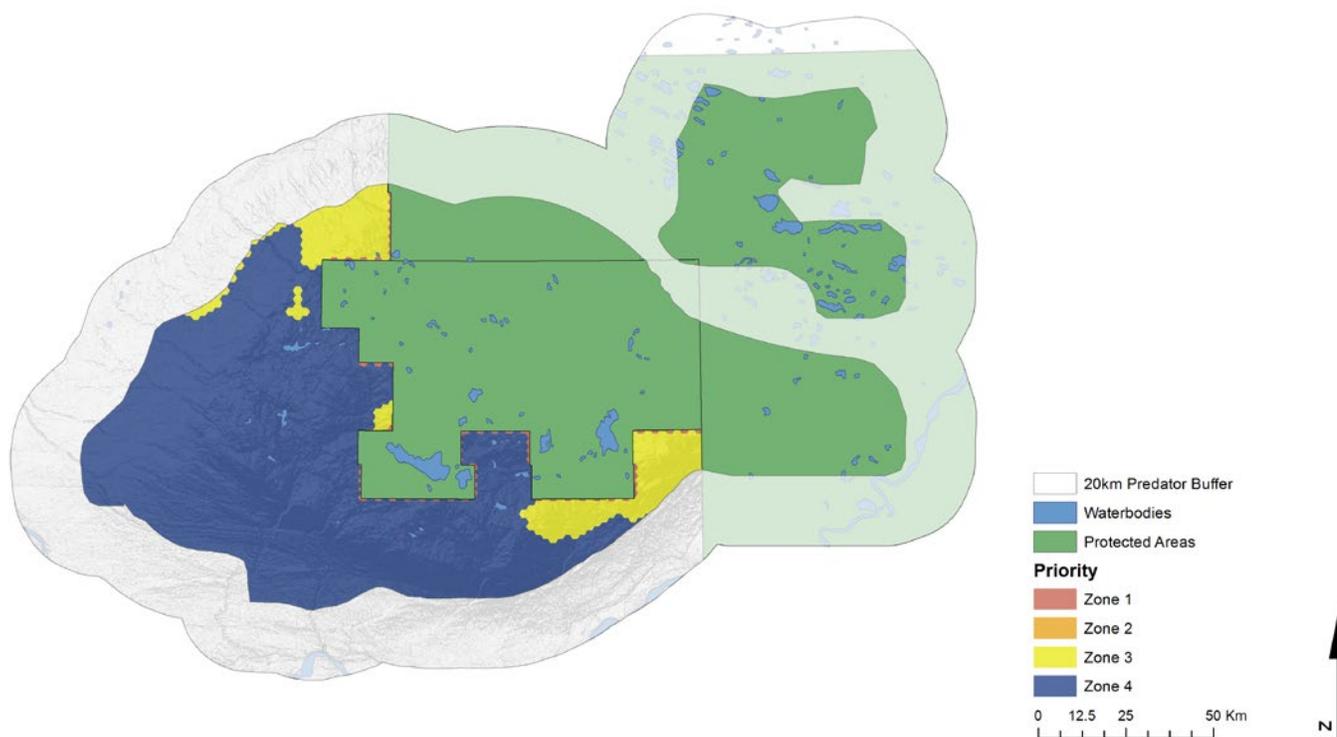


Figure 29. Recommended priority zones in the Caribou Mountains range.

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 herds 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 areas 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 projects 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 Research⁹⁴

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 Habitat⁹⁵

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 complement to the areas that are representative of all biodiversity identified in this document.

Best Management Practices

In order to successfully restore caribou habitat, and for humans to stay 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 herds 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 Aseniwuche 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 30).

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.

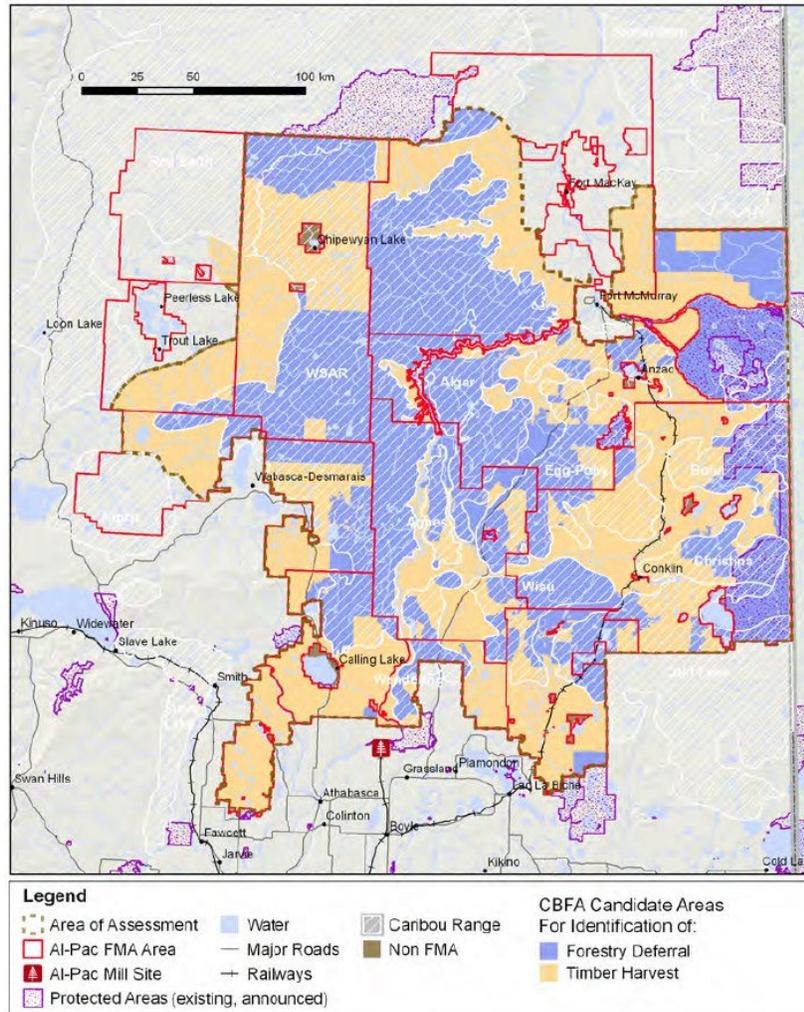


Figure 30. A CBFA zonation scenario taking into account both caribou and forestry interests in identifying areas for caribou conservation and areas of timber harvest. ¹⁰⁷

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 northwest 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 herds 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 Northwest 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.

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Table A1. Forestry companies within the Chinchaga range

Forest Management Agreement Holder	Other companies operating within FMA	Area (KM2)
Manning Diversified Forest Products Ltd.	Daishowa-Marubeni International Ltd., West Fraser Mills Ltd.	6405.32
Daishowa-Marubeni International Ltd. (West)	Boucher Bros. Lumber Ltd, Seehta Forest Products Ltd., Tolko Industries Ltd., West Fraser Mills	4165.59
Tolko Industries Ltd., Norbord Inc., and La Crete Sawmills Ltd.	Daishowa-Marubeni International Ltd., NDEH Limited Parntership, Netaskinan	1853.69
	Company operating within FMU	
P14	Boucher Bros. Lumber Ltd., Community Based Value Added Corp.	
Total area of FMA allocations		12424.60
Total area of Chinchaga range		17643.64
Percent of range allocated to FMAs		70.42

Table A2. Petroleum and natural gas companies within the Chinchaga range

Lease Holder	Number of Leases Held	Area (KM2)
CANADIAN NATURAL RESOURCES LIMITED	378	1803.38
SPYGLASS RESOURCES CORP.	147	554.85
SWN RESOURCES WESTERN CANADA, INC.	43	444.11
SYDCO ENERGY INC.	99	412.81
HUSKY OIL OPERATIONS LIMITED	118	365.43
PENN WEST PETROLEUM LTD.	81	311.28
NUVISTA ENERGY LTD.	49	290.65
STOMP ENERGY LTD.	27	252.47
SCOTT LAND & LEASE LTD.	29	214.19
STANDARD LAND COMPANY INC.	17	188.52
ROCKFORD LAND LTD.	21	166.44
ARC RESOURCES LTD.	44	163.54
WINDFALL RESOURCES LTD.	13	107.10
RANGER LAND SERVICES LTD.	17	90.97
CHINOOK ENERGY INC.	17	80.51
TAQA NORTH LTD.	22	80.15
TERRA ENERGY CORP.	18	74.50
BIRCHCLIFF ENERGY LTD.	13	66.58
BRITT RESOURCES LTD.	9	63.96
ENERCAPITA ENERGY LTD.	13	59.15
IMPERIAL OIL RESOURCES LIMITED	6	55.19
O & G RESOURCE GROUP LTD.	5	53.44
ENERPLUS CORPORATION	3	46.06
KELT EXPLORATION LTD.	14	43.70
BRISTOL LAND & LEASING LTD.	3	38.28
POLAR STAR CANADIAN OIL AND GAS, INC.	12	32.78
MANCAL ENERGY INC.	1	30.85
MAVERICK LAND CONSULTANTS 2012 LTD.	6	28.39
MURPHY OIL COMPANY LTD.	2	28.37
SURGE ENERGY INC.	7	22.43
BANCROFT OIL AND GAS LTD.	2	20.86
EMBER RESOURCES INC.	4	20.63
PREDATOR OIL LTD.	10	20.51
BOULDER ENERGY LTD.	3	19.13
ORLEN UPSTREAM CANADA LTD.	8	18.25
CHARTER LAND SERVICES INC.	3	17.96
WEST FORK RESOURCES INC.	5	17.93
CANAMAX ENERGY LTD.	5	16.10
LONG RUN EXPLORATION LTD.	4	15.42
PARAMOUNT RESOURCES LTD.	4	15.36
QUATTRO EXPLORATION AND PRODUCTION LTD.	5	12.83
POTTS PETROLEUM INC.	4	12.81
TAYLOR HILL EXPLORATION LTD.	2	12.79
CEQUENCE ENERGY LTD.	3	12.24

WHITECAP RESOURCES INC.	6	12.18
KAISER EXPLORATION LTD.	1	11.52
PETROLAND SERVICES (1986) LTD.	1	9.31
SIGNALTA RESOURCES LIMITED	4	9.01
CRESCENT POINT ENERGY CORP.	5	8.22
SHORELINE ENERGY CORP.	3	7.74
CANADIAN OIL & GAS INTERNATIONAL INC.	3	7.71
MARQUEE ENERGY LTD.	3	7.70
PLUNKETT RESOURCES LTD.	2	7.19
ROCKY LAYMAN ENERGY INC.	2	5.12
INSIGNIA ENERGY LTD.	1	5.10
HARVEST OPERATIONS CORP.	3	4.48
BASM LAND & RESOURCES LTD.	2	3.87
THE SOO LINE RESOURCE GROUP LTD.	2	3.72
HANNA OIL & GAS COMPANY - CANADA ULC	1	2.58
MADALENA ENERGY INC.	1	2.58
LANDSOLUTIONS INC.	1	2.58
BRIO ENERGY CORPORATION	1	2.57
MOSAIC ENERGY LTD.	1	2.57
TRILOGY RESOURCES LTD.	1	2.57
MIDLAKE OIL & GAS LIMITED	1	2.56
SRIVASTAVA, NEHA	1	2.56
MOONCOR ENERGY INC.	1	2.55
MADISON LAND CO. LTD.	1	2.55
MOBIUS RESOURCES CORP.	1	2.55
PAN PACIFIC OILS LTD.	1	2.54
MERIDIAN LAND SERVICES (90) LTD.	1	2.52
SPHERE ENERGY CORP.	3	2.08
CANUCK NORTH RESOURCES LTD.	1	1.92
BELLATRIX EXPLORATION LTD.	3	1.76
SILVER BAY RESOURCES LTD.	1	1.29
BOUNTY DEVELOPMENTS LTD.	1	1.28
HXC CORPORATION	1	1.28
YANGARRA RESOURCES CORP.	1	1.07
ATHABASCA OIL CORPORATION	2	0.98
BLZ ENERGY LTD.	1	0.65
OURO PRETO RESOURCES INC.	1	0.64
YOHO RESOURCES INC.	2	0.41
SUPERMAN RESOURCES INC.	1	0.004
Total area allocated to petroleum and natural gas		5415.67
Total area of the Chinchaga range		17643.64
Percent of range allocated to petroleum and natural gas		30.69

Table A3. Oilsands companies within the Chinchaga range

Lease Holder	Number of Leases Held	Area (KM2)
LANDSOLUTIONS GP INC.	3	111.15
MAVERICK LAND CONSULTANTS 2012 LTD.	2	20.60
PETROLAND SERVICES (1986) LTD.	2	20.57
BANCROFT OIL AND GAS LTD.	2	16.75
1650253 ALBERTA LTD.	3	13.04
BASM LAND & RESOURCES LTD.	1	7.76
MOONCOR ENERGY INC.	1	5.17
Total area allocated to oilsands		195.05
Total area of Chinchaga range		17643.64
Percent of range allocated to oilsands		1.11

Table B1. Forestry companies within the Bischo range

Forest Management Agreement Holder	Other companies operating within FMA	Area (KM2)
Tolko Industries Ltd., Norbord Inc., and La Crete Sawmills Ltd.	Daishowa-Marubeni International Ltd., NDEH Limited Partnership, Netaskinan Development Corporation	5648.42
Total area of FMA allocations		5648.42
Total area of Bischo range		14358.10
Percent of range allocated to FMAs		39.34

Table B2. Petroleum and natural gas companies within the Bischo range

Lease Holder	Number of Leases Held	Area (KM2)
APACHE CANADA LTD.	400	664.51
STRATEGIC OIL & GAS LTD.	109	650.98
MAVERICK LAND CONSULTANTS 2012 LTD.	30	411.33
MERIDIAN LAND SERVICES (90) LTD.	16	244.15
WINDFALL RESOURCES LTD.	8	169.15
DEERGARDEN ENERGY LTD.	4	137.68
LXTERRA LAND LTD.	3	123.46
STANDARD LAND COMPANY INC.	8	117.90
HARVEST OPERATIONS CORP.	7	110.48
RANGER LAND SERVICES LTD.	4	108.75
STOMP ENERGY LTD.	6	101.08
EAGLE-CODA PETROLEUM INC.	11	76.46
PLUNKETT RESOURCES LTD.	4	69.01
INSIGNIA ENERGY LTD.	6	61.57
BRITT RESOURCES LTD.	10	60.15
BADGER PASS MINERALS INC.	7	55.71
CANADIAN NATURAL RESOURCES LIMITED	9	45.95
SCOTT LAND & LEASE LTD.	3	23.41
THE LAND GROUP INC.	5	23.00
SPYGLASS RESOURCES CORP.	7	22.23
NUANCE RESOURCES INC.	1	15.35
SYNERGY LAND SERVICES LTD.	3	12.80
PREDATOR OIL LTD.	5	12.22
TAQA NORTH LTD.	3	8.33
CQ ENERGY CANADA RESOURCES PARTNERSHIP	2	7.70
ATHABASCA OIL CORPORATION	1	6.91
1688901 ALBERTA LTD.	10	6.38
SECOND WAVE PETROLEUM INC.	7	5.79
BELLATRIX EXPLORATION LTD.	6	5.77
HUSKY OIL OPERATIONS LIMITED	1	5.10
LONG RUN EXPLORATION LTD.	3	3.83
NUVISTA ENERGY LTD.	4	3.23
KINMERC OIL & GAS INC.	3	3.21
BRIO ENERGY CORPORATION	1	2.57
ARC RESOURCES LTD.	4	2.57
KOCH OIL SANDS OPERATING ULC	2	2.56
SINOPEC DAYLIGHT ENERGY LTD.	2	1.95
PENN WEST PETROLEUM LTD.	2	1.30
WEST FORK RESOURCES INC.	1	1.29
SUPERMAN RESOURCES INC.	2	1.28
CAVALIER LAND LTD.	1	0.65
BOUNTY DEVELOPMENTS LTD.	1	0.64
KAM'S SAND COATING LTD.	1	0.64
Total area allocated to petroleum and natural gas		3232.48
Total area of the Bischo caribou range		14358.10
Percent of range allocated to petroleum and natural gas		22.51

Table C1. Forestry companies within the Yates range

Forest Management Agreement Holder	Other companies operating within FMA	Area (KM2)
Tolko Industries Ltd., Norbord Inc., and La Crete Sawmills Ltd.	Daishowa-Marubeni International Ltd., NDEH Limited Partnership, Netaskinan Development Corporation	1437.15
Total area of FMA allocations		1437.15
Total area of Yates range		5223.44
Percent of range allocated to FMAs		27.51

Table C2. Petroleum and natural gas leases within the Yates range

Lease Holder	Number of Leases Held	Area (KM2)
DEERGARDEN ENERGY LTD.	13	498.96
MAVERICK LAND CONSULTANTS 2012 LTD.	1	61.58
STOMP ENERGY LTD.	5	37.68
STRATEGIC OIL & GAS LTD.	15	34.38
BRITT RESOURCES LTD.	4	7.72
RANGER LAND SERVICES LTD.	1	2.47
SYNERGY LAND SERVICES LTD.	1	0.64
Total area allocated to petroleum and natural gas		634.40
Total area of the Yates range		5223.44
Percent of range allocated to petroleum and natural gas		12.15

Table D1. Forestry companies within the Caribou Mountains range

Forest Management Agreement Holder	Other companies operating within FMA	Area (KM2)
Tolko Industries Ltd., Norbord Inc., and La Crete Sawmills Ltd.	Daishowa-Marubeni International Ltd., NDEH Limited Partnership, Netaskinan Development Corporation	4075.37
Total area of FMA allocations		4075.37
Total area of Caribou Mountains range		20658.73
Percent of range allocated to FMAs		19.73

Table D2. Petroleum and natural gas companies within the Caribou Mountains range

Lease Holder	Number of Leases Held	Area (KM2)
DEERGARDEN ENERGY LTD.	2	81.54
HUSKY OIL OPERATIONS LIMITED	1	15.39
PERPETUAL ENERGY OPERATING CORP.	2	2.58
SCOTT LAND & LEASE LTD.	1	0.77
Total area of petroleum and natural gas allocations		100.27
Total area of Caribou Mountains range		20658.73
Percent of range allocated to petroleum and natural gas		0.49

