Integrated Range Assessment for Woodland Caribou and their Habitat

Berens Range 2012

Ministry of Natural Resources and Forestry
Species at Risk Branch

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Version 1.1

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For a copy of the *Integrated Assessment Protocol for Woodland Caribou Ranges in Ontario* (2014) and/or *Delineation of Woodland Caribou Ranges in Ontario* (2014), please email caribou@ontario.ca

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Preface

This Integrated Range Assessment Report is intended to support management decisions leading to the conservation of caribou and their habitat. It describes quantitative analysis and interpretation of four lines of evidence related to risk and range condition. It also documents ecological and management insight of resource managers who are familiar with present and past caribou occupancy and management history within the range. Implementation experience has also been documented where caribou conservation and habitat management activities have been applied.

Caution is warranted in the interpretation of the Integrated Range Assessment results due to the limitations of available data and conditions or circumstances that are not readily integrated in the analysis framework. This caution should be expressed by considering the context and results of the Integrated Range Assessment as a whole and not taking individual lines of evidence or data summaries out of context or interpreting them outside of their intended purpose as described in the *Integrated Assessment Protocol for Woodland Caribou Ranges in Ontario* ('Protocol'). The Protocol describes the specific intent and role for each section of the Integrated Range Assessment Report and its scientific basis.

The quantitative analysis was completed using the best and most current land-base and resource inventory information available for the year in which the winter distribution survey was conducted unless otherwise stated. These data vary substantially across Ontario in terms of availability, year of update, and conditions or standards under which the inventory was completed. Forest inventory data is periodically updated, improved and managed to track changes in forest condition; caribou distribution and recruitment surveys may be conducted during years of good or poor survey conditions and be subject to many extraneous influences; linear feature, and infrastructure data may reflect a wide diversity of physical expressions and biological implications and roads data used in the analysis may include some older legacy roads for which current vegetative state is unknown or not discerned from the database. This type of variability is quite normal and expected, but presents challenges in interpretation and application of results. Data and analysis uncertainties are explicitly described in each Integrated Range Assessment Report to support thoughtful interpretation of the results within the flexibility provided by Ontario's *Range Management Policy in Support of Woodland Caribou Conservation and Recovery* (Range Management Policy).

While the assessment is information intensive, the interpretation of the four quantitative lines of evidence is strongly science-based, relying heavily upon fully documented scientific findings. Specific data sets used in the analysis were selected to represent the most appropriate trade-off between ecological and management relevance.

As this document represents an assessment of the conditions of this caribou range according to the year of the report, it does not consider socio-economic factors. Caribou ranges that are assessed as uncertain or insufficient to sustain caribou should not be interpreted as policy direction to stop sustainable resource management. The Range Management Policy and other planning documents (e.g., forest management guides, caribou best management

practices) provide resource managers with the tools that support sustainable use of Ontario's natural resources while maintaining or improving conditions for caribou.

Managers are encouraged to be fully aware of the scientific assumptions, data and analysis uncertainties and ecological and historical context when considering management actions informed by the Integrated Range Assessment.

Executive Summary

The vision in *Ontario's Woodland Caribou Conservation Plan* is to conserve Woodland Caribou (Forest-dwelling, boreal population; *Rangifer tarandus caribou*) (referred to as caribou herein) within the province to ensure self-sustaining populations in a healthy boreal forest. This vision is set in motion through Ontario's *Range Management Policy in Support of Woodland Caribou Conservation and Recovery* (Range Management Policy). The Range Management Policy rovides the direction needed to conserve and recover caribou in Ontario through a Range Management Approach (RMA),that provides spatial and ecological context for planning and management decisions. This *Integrated Range Assessment* is a fundamental component of the RMA because it provides the information required to identify the level of risk to caribou within a range, support management decisions and lead to conservation of caribou occupying the range. It provides essential historical, ecological and contextual knowledge relevant to the range and its management. It relied on quantitative lines of evidence to identify the level of risk and range condition relative to its ability to sustain caribou.

The Berens Range is located in northwestern Ontario and is approximately 28,000 km^2 in size. It is understood that the Berens Range is part of a larger geographic unit for caribou with the neighbouring Atikaki-Berens Range in Manitoba.

The landscape of the Berens Range is largely characterized as boreal forest with an aggressive fire regime and a high density of small and medium sized lakes scattered throughout. It is primarily dominated by jack pine and black spruce forest with extensive bedrock exposure, shallow and coarse soils, wetland complexes, and a prairie boreal climate across some areas.

Historical occupancy shows that caribou occurred throughout the range. Some of the highest concentrations of year-round caribou activity currently occur in the southern portion of the range from Woodland Caribou Provincial Park to the eastern range boundary near Upper Goose Lake, including significant calving lakes such as Nungesser, Trout, and Valhalla. Caribou are also known to use extensive peatland complexes in the Sampson and Matchett Lake area which is thought to be regionally significant to them. There are currently few small communities and development within the range but there are some development pressures facing the Berens Range: forest harvest has been proposed for the Whitefeather Forest Management Unit, ongoing forest harvest in the Trout Lake and Red Lake Forest Management Units, and corridor development for hydro and fiber optics to remote northern communities.

A two-stage (fixed-wing followed by rotary-wing) aerial winter distribution survey for caribou was conducted during February 2012 in which observations of caribou or their signs were recorded. During the rotary-wing flights, caribou were identified as adults, males or females, calves, or unknown age and sex. Data collected during the survey work was used to estimate population state metrics including a minimum animal count (MAC) of 237 caribou, as well as provide an estimate of calf recruitment. An additional aerial survey was conducted during late winter 2013 to further assess calf recruitment to support estimates of population trend. Recruitment rates over the two survey years (5-24 calves per 100 adult females) were lower

than expected values thought to support a stable to increasing population trend (28 calves per 100 adult females).

Thirty (30) adult female caribou were collared during February 2012. An annual survival estimate of these animals was good based on one biological year of data (87%). However, when survival was modelled with the calf recruitment levels it resulted in a declining population trend with a geometric mean of $\lambda = 0.93$. This estimate suggests a declining trend and is the result of comparatively low calf recruitment.

A geospatial analysis estimated that 28.7% of the range can be currently characterized as natural and anthropogenic disturbances. The resulting likelihood of stable or increasing population growth is estimated to be 0.7 and at this level it is likely that the Berens Range is capable of sustaining the caribou population.

Analysis of the amount of caribou habitat (which includes refuge habitat and winter habitat) indicates alignment with that expected in a natural landscape. Habitat is fragmented relative to what would be expected in a natural landscape.

The Integrated Range Assessment concludes risk to caribou is intermediate within the Berens Range and it is uncertain whether the range condition is sufficient to sustain caribou.

1.0 Overview

The Ministry of Natural Resources and Forestry (MNRF), then Ministry of Natural Resources (MNR), adopted a Range Management Approach (RMA) as directed by *Ontario's Woodland Caribou Conservation Plan* (CCP) (MNR 2009a). An *Integrated Range Assessment Report* (IRAR) is a major component of the RMA and will help to inform subsequent management decisions. This assessment evaluates habitat conditions, population trends, and cumulative impacts and relates these to measurable indicators of population health or habitat status. The RMA sets the spatial and ecological context for planning and management decisions within an adaptive management framework. The general components and mechanisms involved in the Integrated Range Assessment are described in the *Integrated Assessment Protocol for Woodland Caribou Ranges in Ontario* ('Protocol', MNRF 2014a) and directed by the *Range Management Policy in Support of Woodland caribou Conservation and Recovery (Range Management Policy, 'RMP',* MNRF 2014b).

The Berens Range and the adjacent Atikaki-Berens Range in Manitoba share common management and caribou conservation interests. Ontario recognizes that there is a benefit in collaborating on information sharing, and reporting on range condition. This Integrated Range Assessment demonstrates this collaborative approach in presenting data and discussing the management implications associated with a shared geography.

The year of the report represents when the winter distribution survey was completed; three subsequent years of recruitment surveys were conducted; disturbance assessment included data current as of the winter distribution survey; habitat assessment data included the best available information for the range.

2.0 Range Description and Delineation

The delineation of ranges within the Continuous Distribution of caribou in Ontario includes areas that are currently not occupied by caribou. Ontario's Range Management Approach provides an adaptive and transparent framework for defining, assessing and documenting risk to caribou. This framework accounts for the dynamic nature of boreal forest landscapes and the ability of caribou to tolerate some temporary or permanent disturbance within a range.

The Berens Range is approximately 28,000 km^2 and located in northwestern Ontario (Figure 1). It neighbours the Sydney, Churchill, Kinlock, and Spirit Ranges as well as the Manitoba border where it shares a common boundary with the Atikaki-Berens Range in Manitoba. The two ranges are generally accepted to function as one large range. It is believed that caribou in both these ranges utilize similar habitat types and share some level of connectivity across the provincial border. The proximity and a desire to collaborate on shared caribou conservation issues influenced the delineation of the Berens Range (MNRF 2014c). The Berens Range was intended to represent the caribou occupancy at the north end of Woodland Caribou Provincial Park (WCPP) and the unique and patchy caribou occupancy patterns associated with this naturally highly disturbed landscape.

There are currently few small communities within or near the range boundary. The remote First Nation communities of Pikangikum and Poplar Hill are north-centrally located within the range. Just south of the range boundary are the towns of Red Lake, Balmertown, and Cochenour (Figure 2, Figure 3, and Figure 4). This area is associated with a high level of human infrastructure and development including industrial sites, mineral exploration, and forest management that impacts southern areas of the Berens Range. For this reason, the south-central area of the range is considered to be highly and permanently disturbed. Forest harvest within the Berens has occurred in the extreme south of the range currently extending only as far north as Nungesser Lake. The remainder of the Berens Range is largely devoid of large-scale anthropogenic activity, including timber harvest.

The range includes the Whitefeather Forest Management Unit (FMU) and some parts of the Red Lake, and Trout Lake FMUs. There are also a number of protected areas within the range including Woodland Caribou Provincial Park (WCPP), Trout Lake Conservation Reserve, Sampson Lake, Pauingassi Planning Area, Little Grand Planning Area, and Lake Country Dedicated Protected Area.

The Berens Range is within ecoregions 3S, 4S, and a small portion of 2W. Specifically, the range is comprised of ecodistricts 3S-1, 3S-2, 2W-3, 4S-1, and 4S-2. The range is primarily characterized as having an aggressive fire regime, high density of medium or small-sized lakes, extensive jack pine and black spruce, bedrock exposure with shallow and coarse soils, wetland complexes, and a prairie boreal climate as defined by the local ecoregions.

The range was delineated with consideration towards the current understanding of caribou occupancy and movement patterns. Delineation was further refined considering a number of biophysical and climatic conditions as well as jurisdictional boundaries. The northern boundary shared with the Spirit Range is loosely based on the ecodistrict boundaries of 3S-1 and 2W-3 and was intended to coincide (approximately) with the northern boundary of the Atikaki Range in Manitoba. This boundary reflects both an ecological transition and a desire to collaborate on caribou conservation with Manitoba. The southern boundary of the Berens Range shares the Gammon River system with the Sydney Range. This system appears to represent a semi-impermeable barrier to caribou movement due to its mixed forest conditions from highly productive soils. The southern boundary also includes a large and permanently disturbed area in the vicinity of the Red Lake while at the same time maintaining connectivity to the regionally significant calving and nursery areas associated with Trout Lake. The eastern boundary of the range is defined by the eastern boundary of the Whitefeather FMU and the Kinlock Range, which also roughly coincides with lower levels of fire activity in the area.

Figure 1. Location of the Berens Range within Continuous Distribution in Ontario.

Figure 2. The Berens Range and associated ecodistricts and protected areas.

3.0 Background Information and Data

3.1. Land management history and management direction

It is likely that caribou numbers and distribution on the Berens Range have been influenced by a wide variety of natural and anthropogenic factors but primarily by a very aggressive wildfire regime that exhibits frequent, large, and intense fires (Figure 3, Figure 4). It also exhibits large and widespread forest disturbance associated with major wind events, particularly over the last 20 years. Forest management activities have largely been restricted to the southeastern portions of the range. There is relatively little human infrastructure such as roads, town sites, transmission corridors, hydroelectric facilities, and mineral development features (Figure 4, Table 1). The biggest shift in land-use direction has been associated with the Whitefeather Land Use Strategy (2006) and the development of the Whitefeather Forest Management Plan (2012-2022). This means most of the development pressures in the Berens Range are likely forthcoming.

It is imperative to document and interpret the disturbance history within the range in order to better understand current caribou use. Implementation of the Range Management Approach is set against a backdrop of evolving management direction (Table 1). Figure 3, Figure 4, and Table 1 include land management history as well as natural and anthropogenic disturbances up until 2012.

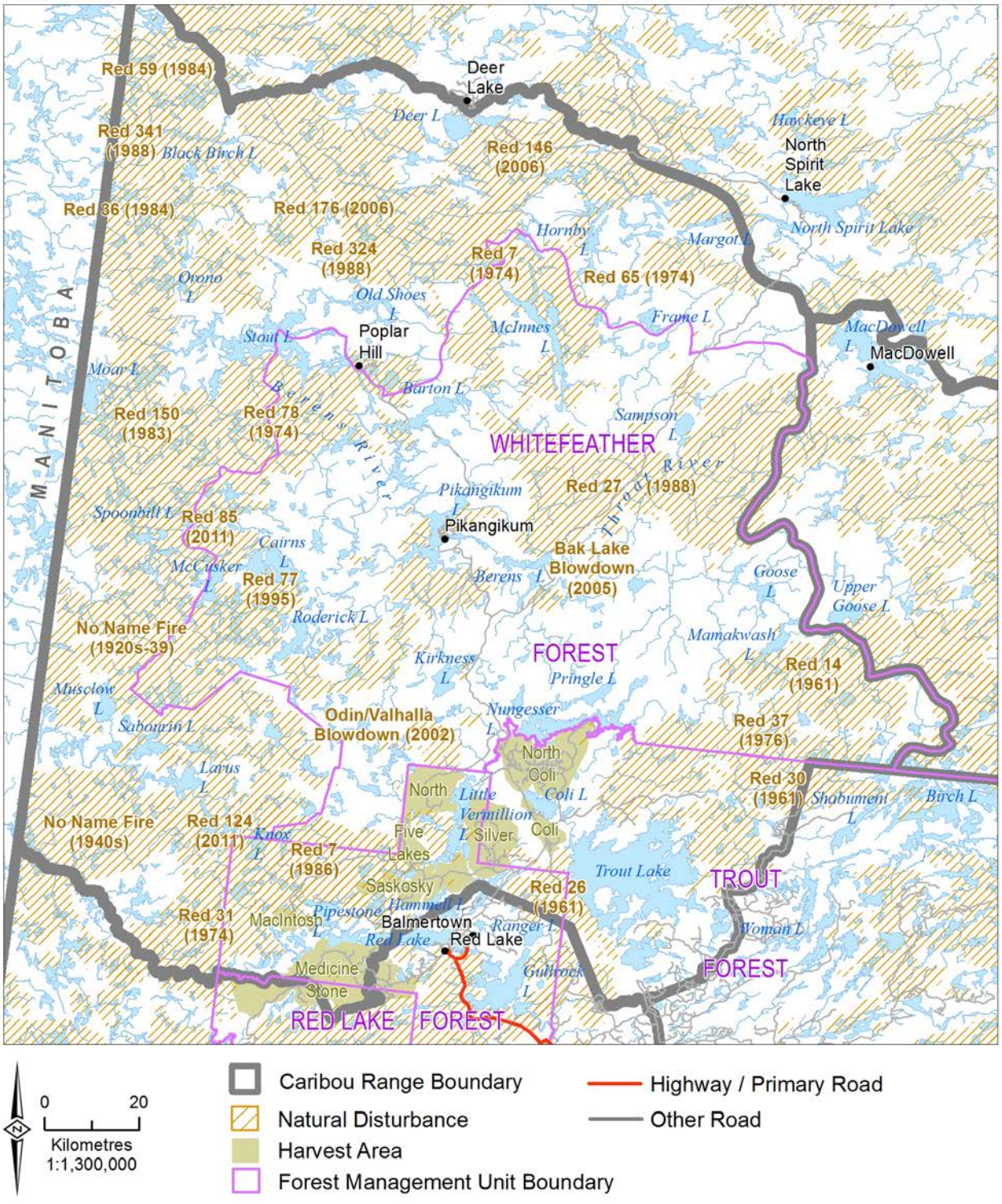


Figure 3. Dates and locations of significant historical natural and anthropogenic disturbances that have occurred within the Berens Range with associated Forest Management Units.

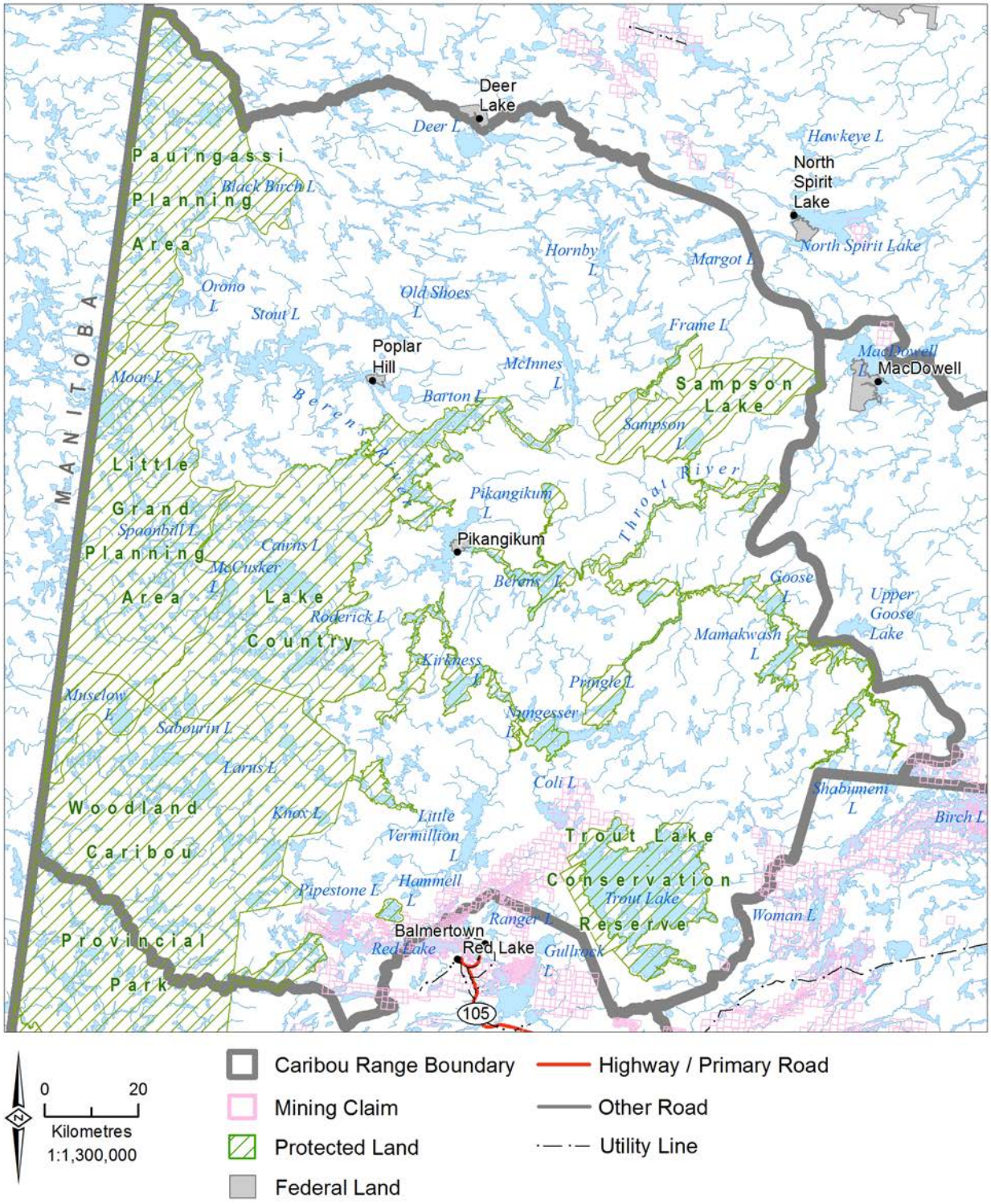


Figure 4. Human infrastructure occurring within the Berens Range.

Table 1. Historical timeline of significant events occurring in or near the Berens Range

Significant event, activity or direction Natural disturbance	Date	Description	Likely influence on caribou or its habitat
Historical Fires	Pre-1940	Frequent large and small fires.	The relatively young and strongly conifer dominated forests of the Berens Range were likely always fragmented by large patches of young, regenerating conifer and mixed forests, suggesting the caribou in this range always had a patchy distribution. The aggressive fire regime has likely been the normal habitat renewal mechanism in this range.
No Name Fire	1920-39	Series of fires in and around northern portion of WCPP; occurred primarily on bedrock and shallow soils.	Source of large pine-dominated forest areas of high quality winter and summer habitat at the north end of WCPP.
No Name Fire	1940-49	Large, intense fire in the central and western portion of WCPP from Simeon to Royd Lake.	Large areas of jack pine dominated, open understory forest currently being used by caribou in summer.
RED 14, 30, 37	1961, 1976	Three large fires spanning the area from Trout to Mamakwash Lake.	Collectively contribute to a large patch of future caribou habitat on the eastern edge of the range and providing strong future connectivity to the regionally significant Trout Lake calving and nursery area.
RED 26	1961	20,000 ha fire on the Trout Ridge on mostly deep sandy soils.	Currently mostly moose habitat with conifer dominated forest with abundant jack pine and high potential to become high quality winter habitat in the 20-30 year horizon.
RED 7, 65, 78	1974-1978,	Series of large fires from west of Poplar Hill to east of McInnis Lake.	Created large areas of young conifer forest on bedrock dominated shallow soils with will be future caribou habitat in the north central portion of the range. Nearby areas are currently

			occupied and this area will likely be occupied soon.
RED 150	1983	130,000 ha fire on western portion of range, adjacent to Manitoba border.	Currently looks like caribou habitat and likely to support animals in near future.
RED 36, 59	1984	36,000 ha and 61,500 ha fires in extreme northwest of range beside the Manitoba border.	Created a large swath of future caribou habitat (conifer dominated forest on bedrock) in the northwestern area of the range where habitat is currently in somewhat short supply due to natural disturbances. Should see occupancy by caribou in near future.
RED 7 and 31	1986 and 1974	67,500 ha and 54,000 ha fires around the northern and eastern shores of Red Lake and the west side of WCPP.	RED 7 was previously used by caribou prior to fires. Created a large tract of future habitat (primarily jack pine on bedrock) and will provide high value caribou habitat at the southern extent of the Berens Range and close to currently occupied habitat to the north. RED 31 produced a large tract of future caribou habitat that in conjunction with RED 7 may provide for caribou occupancy at the southern portion of the range in as little as 20 years.
RED 27	1988	133,000 ha fire on a variety of soil types including large areas of fine textured soils and mixed forest conditions, but many large shallow soil jack pine forests.	One of several large fires near the central portion of the range accounting for a significant gap in current occupancy. Large area of potential caribou habitat, especially refuge habitat in the eastern portion of the range accounted for in current habitat planning.
RED 324	1988	23,800 ha fire north of Old Shoes Lake.	One of several large fires near the northern portion of the range that will be good habitat.
RED 77, 124	1995 and 2011	17,000 ha and 21,800 ha fires north and east of WCPP.	Northern portion of this fire supports Cairns Lake (a known calving lake) but the southern portion may have limited capability to provide for future habitat. The southern portion supports high moose populations and may impede connectivity between WCPP and the Valhalla Lake area.

Bak Lake Blowdown	2005	21,700 ha summer blowdown event resulted in large areas of uprooted and broken trees.	Loss of previously used habitat and, in the absence of a subsequent fire likely to be renewed as lower quality habitat with less suitable vegetation conditions including a higher proportion of mixed forest than previously existed.
Odin /Valhalla lakes Blowdown	2002	900 ha summer blowdown event resulted in large areas of uprooted and broken trees.	Significant deterioration in a historically important area of high winter use. More than 200 caribou used portions of this area in the past. It will likely renew as lower quality habitat with less suitable vegetation conditions than previously occurred until a fire burns the area.
Numerous large fire year	2006	Twelve large fires (64 ha- 19,000 ha in size) in northern portion of range on predominantly shallow soils with abundant exposed bedrock.	Should produce high quality winter and summer habitat in another 30 years..
Numerous large fire year	2011	Seventeen large fires (94 ha- 31,500 ha) primarily along western border of range	Large tracts of burned forest that was previously used by caribou within the past 10 years.

Significant event, activity or direction			
Infrastructure development & Forest Management	**Dates**	**Description**	**Likely influence on caribou or its habitat**
Pikangikum First Nation (community)	1890 - present	Community site established with progressive growth of population and infrastructure.	Community members maintained their strong presence on the land including subsistence harvest but greater proportion of human activities became focussed closer to community.

Mining and mineral exploration in the Red Lake area	1926 - ongoing	Baird, High Lake, Scott Bay, Tigar Lake and Para Lake	Historically caribou were around Red Lake and have been observed on Red Lake even recently (e.g. McNealey Bay, Pipestone Bay). Mining developments have likely added stressors to caribou near Red Lake through the increased cut lines, roads, human activity, etc.
Horse logging	1930 -50	Early horse logging occurred in vicinity of all town sites and mine development for local use, and included the shorelines and water systems associated with Red Lake. Logging occurred in vicinity of major lakes around Red Lake and on fine textured soils.	Likely reduced the amount of quality caribou habitat adjacent to the major lakes including Red lake because sites largely renewed to balsam fir and popular mixed forests. They also may have influenced the desirability of these lakes as summer habitat.
Fishing and Hunting Lodges	Mid-1900s-present	Tourist outfitter camps; often consisting of multiple buildings.	Encourages activities in remote hunting and fishing sites and increases chances of encountering caribou and potentially creating a sensory disturbance on calving lakes.
Nungesser Road	Late 1960s - 80s	Primary access to the north for communities and resources such as forest harvest associated with Trout Lake and Red Lake FMUs.	Influenced forest harvest pattern in previous high quality winter habitat and supports year round recreational, commercial and subsistence hunting activity in the southern portion of the range, bisecting the east-west movement of caribou between winter habitats in the vicinity of Valhalla Lake and summer habitats associated with Trout and Nungessor Lake.
Poplar Hill (Community)	1978 - present	Community site established with progressive growth of population and infrastructure.	Community members maintained their strong presence on the land including subsistence harvest but greater proportion of human activities became focussed closer to community.

Winter Road System	1960s - present	Network of linear features that continues off north end of Nungessor Road and is maintained for vehicular traffic between late January and late March. Provides essential access to remote northern communities; some historical, some currently used and maintained.	Winter roads are linear disturbances with vehicle traffic. They may also have the potential to increase vulnerability of caribou to harvest by First Nation during the winter and to support predator movement throughout the year.
Pine Ridge Road	late 1980s	Constructed to access forest resources north of Red Lake including Saskosky and Silver blocks and McIntosh block.	Influenced harvest pattern, but RED 7 (1986) burned a large portion of future harvest. The presence of the road in an area of high quality future habitat will increase incentive for early forest harvest in future high quality winter habitat.
North Road	1980s - 2000	Forest access road from Nungessor Road to harvest the North Block north of Vermillion Lake.	Supported forest harvest associated with caribou guidelines under assumption that caribou habitat would be provided by the forest immediately north, areas currently allocated under the Whitefeather Forest Management Plan.
Coli Road	1980s	Forest access east of the Trout Ridge and north of Trout Lake, a large area of sandy soils and primarily jack pine dominated forests.	Supported harvest within the Coli Lake Block, an area of previous caribou habitat that provided continuity between Trout Lake and winter habitats further to the west. Much of the area was harvested under caribou guidelines and is expected to produce caribou refuge habitat.
North Coli Block	Late 1970s - present	Forest harvest south of Nungesser Lake. First	Caribou habitat values were not considered when original harvest was planned. Some areas within this block are >30

		harvesting area within district.	years old and are succeeding to good caribou habitat. However, block contains uneven aged stands and is currently an E block within the Trout Lake FMU. Block should be revisited in next plan. Caribou could contribute to travel to and from calving wintering areas.
Coli Block	1980s	Forest harvest south of Coli Lake	Harvested prior to caribou considerations. Important area in terms of connectivity from Valhalla wintering area and Trout Lake calving values.
Medicine Stone Block	1980s-present	Forest harvest area south of western part of Red Lake	First harvest occurred in the absence of caribou considerations. A block was left (primarily in the Sydney Range) which is currently used by caribou. Important habitat area for Sydney Range animals.
North Block	1990s - present	Forest harvest west of Littler Vermillion Lake with active renewal and tending.	Adjacent to high value caribou wintering habitat. Also important area in terms of travel to and from calving on Nungessor and Trout lakes.
MacIntosh, Saskosky, Five Lake, Silver blocks	Late 1990s-present	Harvest under caribou guidelines along north shore of Red Lake and vicinity of Little Vermillion Lake. Active renewal and tending.	Creates large disturbance along north shore of Red Lake with high potential to produce future habitat at the southern extent of the range.

Significant event, activity or direction			
Land management direction	**Dates**	**Description**	**Likely influence on caribou or its habitat**
Trapline boundaries	1947	Initiation of Ontario trapline system.	Formed the basis for early reporting on wildlife occupancy and relative abundance which provided preliminary insight

regulated			into historical occupancy.
Wildlife Management Units were implemented for big game management	1975	Under Game and Fish Act, 1983; moose targets then reduced in 2010.	Formed the basis for reporting on moose populations and trends as well as other species (where applicable).
Woodland Caribou Provincial Park (WCPP)	1983	Large protected area (485,000 ha) in western portion of the range. Some parts of the park already had some level of protection established as early as the 1940s when it discovered that caribou used the area.	Anchors caribou habitat on the western portion of the range but is subject to a very aggressive fire regime so habitat is not assured. Where old forest exists, habitat quality is generally high. Supports connectivity of caribou with the surrounding area, including Manitoba.
Trout Lake Nature Reserve	1983	Area of pine dominated forest and rocky shorelines on southwest shore of Trout Lake.	Protects future winter and summer habitat on the southwest shore of a regionally significant calving lake.
Draft of Caribou Guidelines	1992	First draft of forest management guidelines for conservation of woodland caribou habitat.	Initial application of the draft caribou conservation concepts from selected Forest Management Plans within the Northwest Region. These guidelines established a mosaic concept in support of planning for a sustainable supply of year-round habitat.
Public consultation	1993	Broad public consultation of caribou habitat management across northwest region.	Increased awareness and regional commitment to caribou conservation.
Northwest Region Interim Caribou	1994	All forest management plans within Northwest	These guidelines established a mosaic concept in support of planning for a sustainable supply of year-round habitat. Trout

Habitat Management Direction		Region committed to addressing caribou conservation.	Lake Forest 1994, 1999; Red Lake Forest 1992-1998, 1996-1998, 1998-2003).
Draft of forest management guidelines for the provision of woodland caribou habitat	1994	Mandated application of caribou conservation concepts from all Forest Management Plans within the Northwest Region	These guidelines established a mosaic concept in support of planning for a sustainable supply of year-round habitat. (Trout Lake Forest in 1994; Red Lake Forest 1991)
Ontario's Living Legacy	1999	Creation of Dedicated Protected Areas and Enhanced Management Areas with specific conservation considerations for caribou	Contribute to the overall landscape availability of winter and summer habitat. Includes the Trout Lake Conservation Reserve on a regionally significant calving lake. There were four WCPP additions that help secure caribou habitat in the southwest portion of the range. The Peisk Lake addition to WCPP included high quality winter habitat.
Forest Management Guidelines for the Provision of Caribou Habitat: A Landscape Approach	1999	Comprehensive and endorsed management direction that implemented a landscape-based approach to habitat conservation including mosaic development and a strategic evaluation of habitat retention or allocation and renewal.	The FMPs for which this had an effect include Trout Lake Forest 2004, 2009, 2019; Red lake Forest 2003-2008, 2008-2018; Whitefeather in 2012-2022.
A Management Framework for Woodland Caribou Conservation in Northwestern Ontario	1999	Regional policy direction regarding caribou conservation and forest management.	Reaffirmation of regional interim direction for the application of caribou guidelines in northwestern Ontario with additional guidance in support of other management actions to conserve caribou.

Deer season	2004, 2009	Opened deer season in WMU 3 (2004) and WMU 2 ('09).	Reduction in alternate prey species for wolves and reduced likelihood of disease transmission.
Whitefeather Forest Land Use Plan	2006	Identified land use designations within Whitefeather Forest, including Dedicated Protected Areas (DPA), Enhanced Management Areas (EMA), cultural waterways, and others.	Provides specific guidance with regard to conserving caribou and habitat and a commitment to strategic access planning. Supported forestry operations compatible with caribou conservation. Identified a large amount of dedicated protection associated with the west-central portion of the range. Protected Areas include: Lake Country DPA, Nungesser Lake East EM A, Nungessor Lake North EMA, Pringle Lake DPA, Remote Whitefeather EMA, Sampson Lake DPA, Valhalla DPA.
Little Grand Rapids and Pauingassi Community Land Use Plans		Land use plans of two Manitoba First Nation communities with traditional land spanning into Ontario.	The plans support protection of habitat for species at risk including summer and wintering habitat and calving areas for caribou by the creation of the Little Grand Rapids and Pauingassi DPAs.

The Berens Range currently has low levels of anthropogenic development, much of which is well established and associated with Forest Management on the Trout Lake and Red Lake Forests, and mining and town site development in the vicinity of the communities of Red Lake, Balmertown, and Cochenour. Proposed new developments within the range are largely associated with resource extraction activities and infrastructure development.

3.2. Caribou occupancy history and assessment

Caribou observations within the Berens Range have been identified and recorded within Land Information Ontario (LIO 2014). Observations documented in this report are current to August 2013 (Figure 5, Figure 6, and Figure 7). The summary of previous caribou assessments within the range that estimate or describe population size, health, or occurrence providing historical context and assisting with the interpretation of the current Integrated Range Assessment results (Table 2). These observations may include data results from surveys, collared caribou, research projects, as well as credible casual observations from MNRF staff and the general public (Figure 5, Figure 6, and Figure 7). Historically, these observations reflect our knowledge of caribou occurrence within the range and the possible response to changes in range condition.

Table 2. Past assessments and reports for caribou relevant to the Berens Range.

Date	Caribou occupancy assessment	Reference
1980	A total of 163 caribou were observed from aerial surveys in March 1980 resulting in an estimated 200 caribou inhabiting the Knox and Peisk Lake areas. A similar estimate of 200 caribou was noted in March 1978 for the Peisk Lake area. No tracking or animal observations were made in the March 1980 survey of the Royd Lake area, although 'the area is thought to support a herd of less than 100 caribou".	Drysdale, P. 1980 Caribou Survey and Comments on Past Studies.
1985	Aerial transect survey flown over WCPP in the early winter of 1985. Estimated population density was 0.053 caribou/km^2. Report also references a 1978 winter area in West Patricia (11.6? calves) and a 1979 study of the West Patricia Winter Area (density of 0.047/km2).	Wepruk, R. 1986. Woodland Caribou Provincial Park Technical Report #3. MNR, Red Lake District.
2002	Two-stage caribou survey of the Whitefeather FMU and northeast corner of WCPP conducted in 2002. Fixed-wing portion based on 5 km spaced transects identified 195 caribou in 15 groups. Rotary-wing portion identified 436 caribou in 53 groups. Proportion of calves was 7.7% but no conscious effort was made to identify calves. Six areas were revisited in 2003 specifically to identify the proportion of calves, resulting in an estimate of 15.9% calves.	Racey, G., M. Klich, and E. McCaul. 2006. Woodland caribou winter distribution in the Northern Boreal initiative study area. Northern Boreal Initiative Progress report. Northwest Science and Information, Ministry of Natural Resources, Thunder Bay. 49 pp.

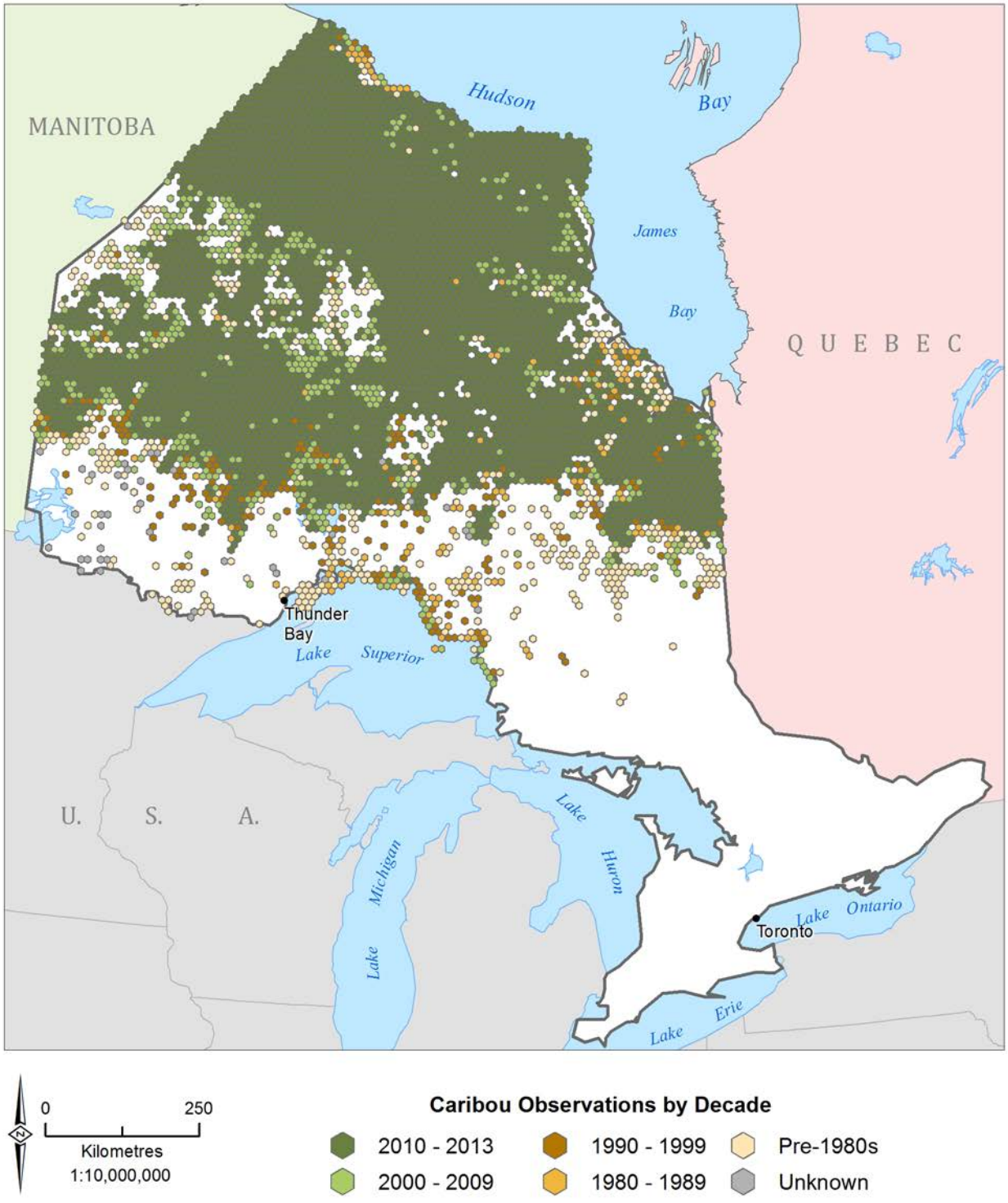


Figure 5. Caribou occurrence across Ontario summarized by date of most recent observation as of June 2013. Absence of observations may reflect low survey effort, lack of reporting, or the absence of caribou.

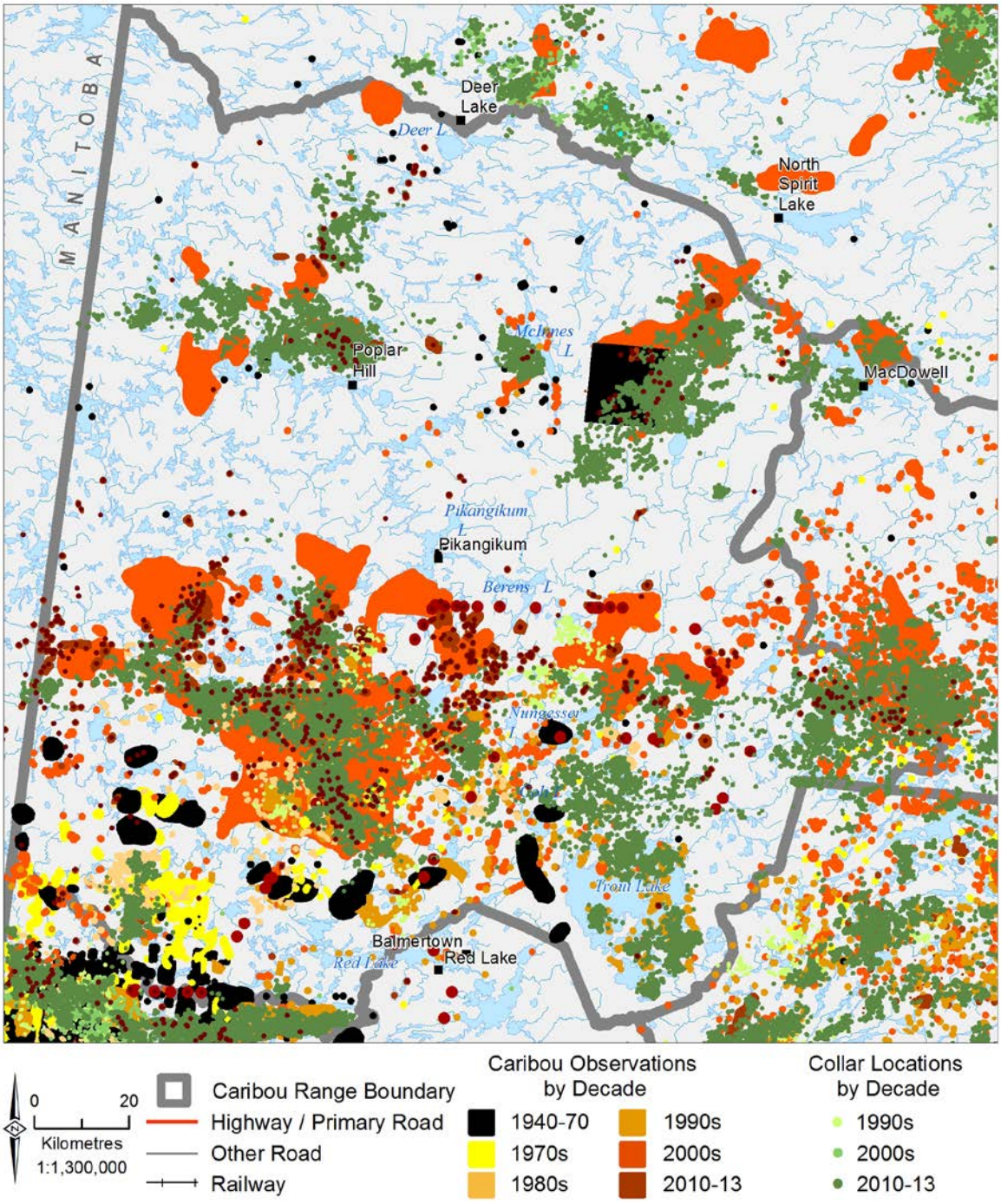


Figure 6. Historical caribou observations[1] within the Berens Range and surrounding area including observations from aerial surveys, collared caribou locations, research projects, and casual observations.

[1]Home ranges for individual caribou are large, averaging 4,000 km^2 (Brown et al. 2003), and location observations of caribou should not be interpreted as just a single observation point, as it is only one point in time and include group sightings. The actual area used by caribou is much larger as they move throughout the year.

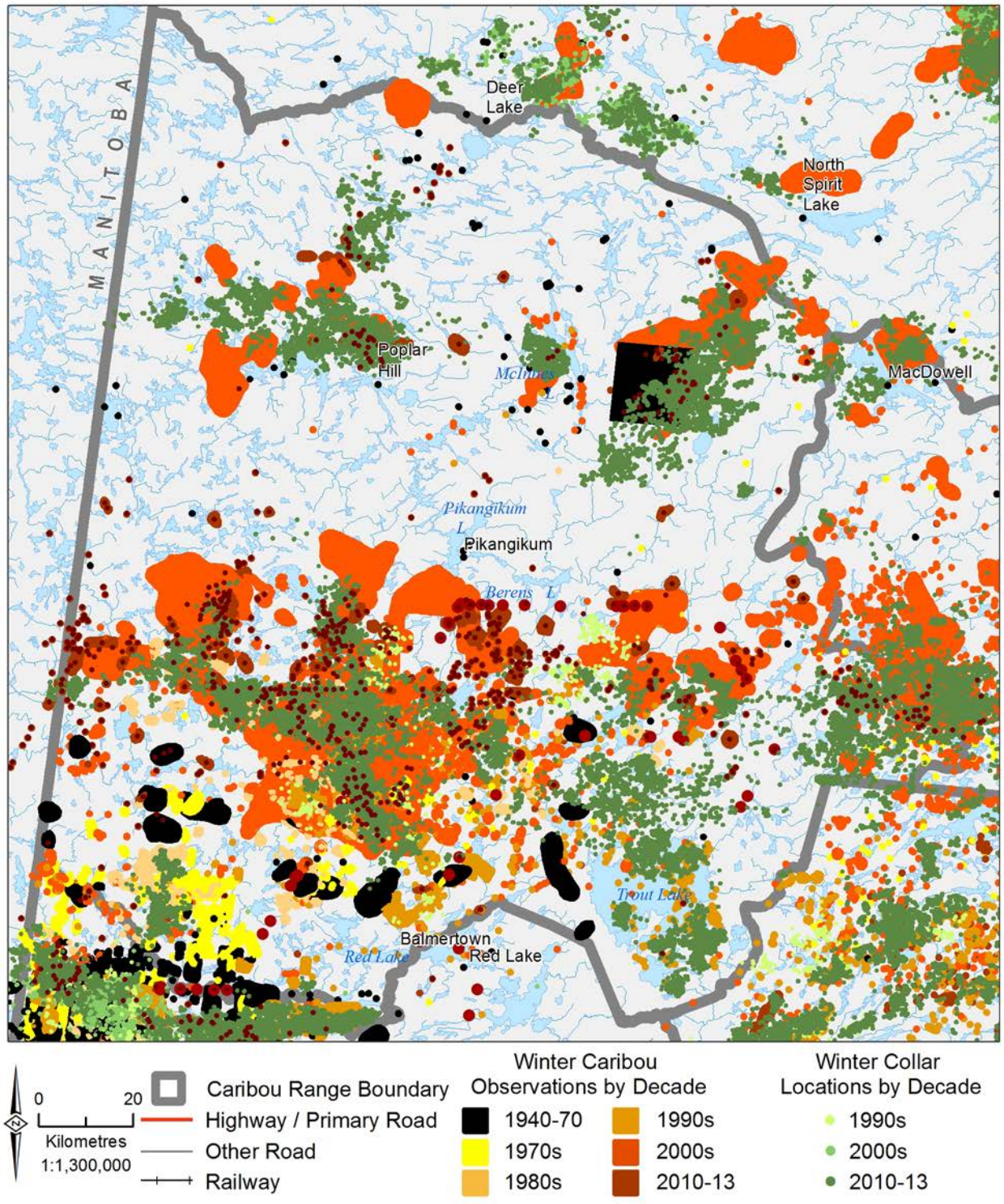


Figure 7. Caribou observations in the Berens Range during February and March from all observation sources (i.e. aerial surveys, collared caribou locations, and casual observations) as of August 2013.

3.3. Probability of occupancy survey and analysis

Presence of caribou was identified during an aerial fixed-wing transect survey conducted in February 2012. Details of the fixed-wing survey design and sampling effort standards can be found in the Protocol (MNRF 2014a). The fixed-wing portion of the aerial survey consisted of flying linear transects on a 10 km interval hexagonal sample grid (Figure 8). Each hexagon is approximately 100 km² and 10.6 km across. Between two and four repeat visits were conducted on a portion of hexagons in each range. The occupancy survey was conducted by an experienced crew of MNRF staff using a Turbo Beaver aircraft to fly the linear transects through each sampling hexagon. Spatial patterns in occupancy (i.e. probability of occupancy) within the Berens Range were estimated using methods described by MacKenzie et al. (2002).

Caribou signs and sightings were patchy throughout the range and were mostly concentrated across the central portion of the range (Figure 8). This area contained numerous signs of caribou presence but few caribou sightings. There were also pockets of caribou signs and sightings north of Poplar Hill and Sampson Lake.

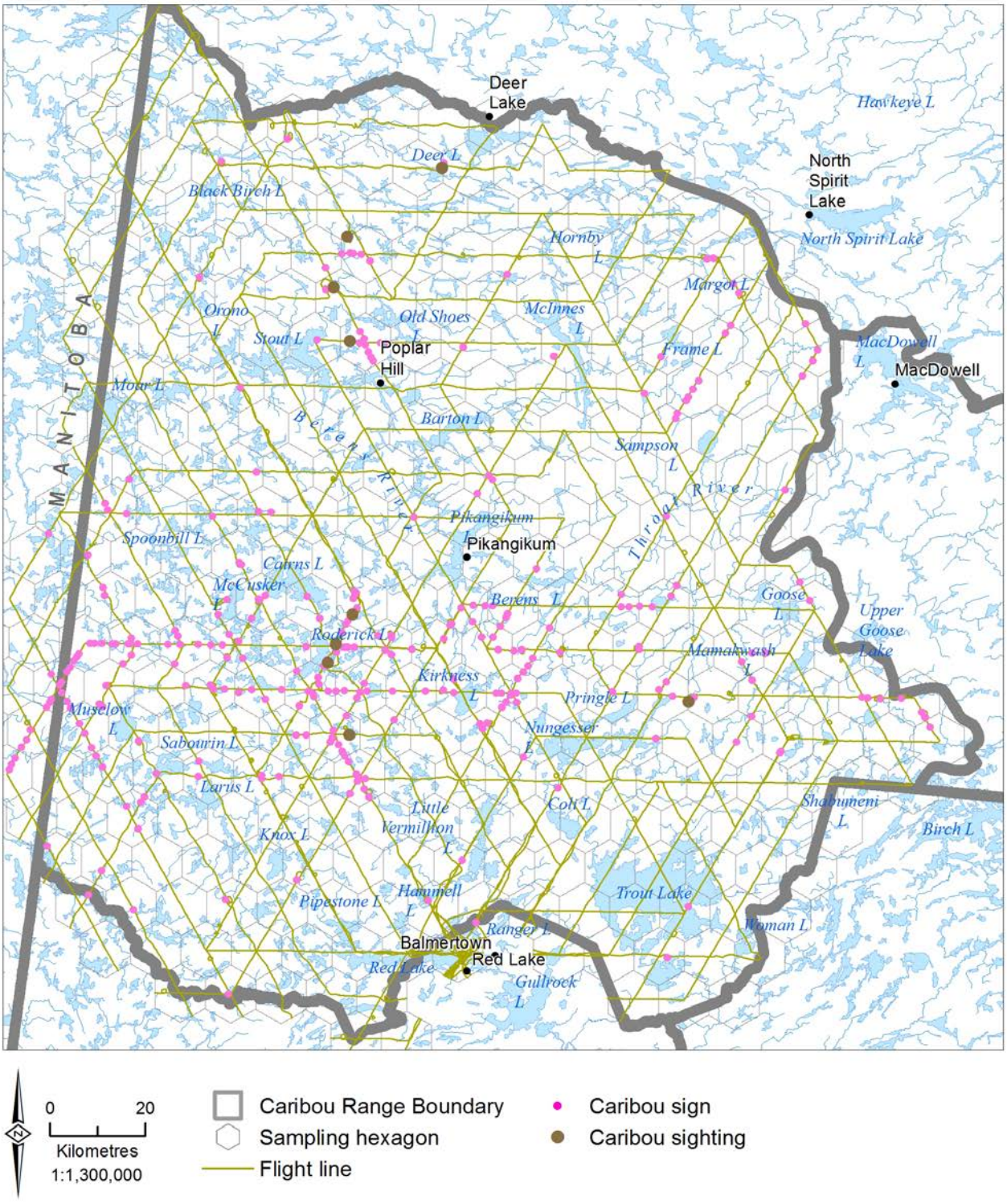


Figure 8. Fixed-wing aerial survey transects on the Berens Range hexagon sampling grid during the winter of 2012. Observations of caribou and their sign are also shown; any evidence of caribou present within a hexagon contributes to the probability of occupancy calculation.

The probability of occupancy index (ψ) varies from 0 to 1, where higher values reflect greater likelihood of observing caribou. Generally, hexagons with caribou likely to be present at the time of the survey have a relatively high probability of occupancy (> 0.5). The general patterns from the probability of occupancy analyses provide insight into the broad-scale distribution and relative abundance of caribou. Figure 9 depicts the estimated probability of occupancy for a model conditional on detection (i.e. occupancy = 1 where caribou sign was detected) and without habitat covariates. Uncertainty exists as to the true winter distribution of caribou inferred from this map, particularly in survey hexagons with low probabilities that are adjacent to hexagons with caribou detection or high probabilities without caribou present. Conditions during the year may have influenced detection, and modified caribou distribution and behaviour.

The occupancy model without habitat covariates suggests the overall probability of caribou occupancy on the Berens Range was moderate and that the estimate had relatively high precision (ψ =0.46, S.E. = 0.04, 95% C.I. = 0.38-0.54). The standard error and confidence interval suggest that existing levels of survey effort should detect changes in occupancy of caribou that may be relevant to managers. Reliable estimates of occupancy for individual hexagons will be particularly important for tracking changes in caribou distribution within the Berens Range in response to management activities.

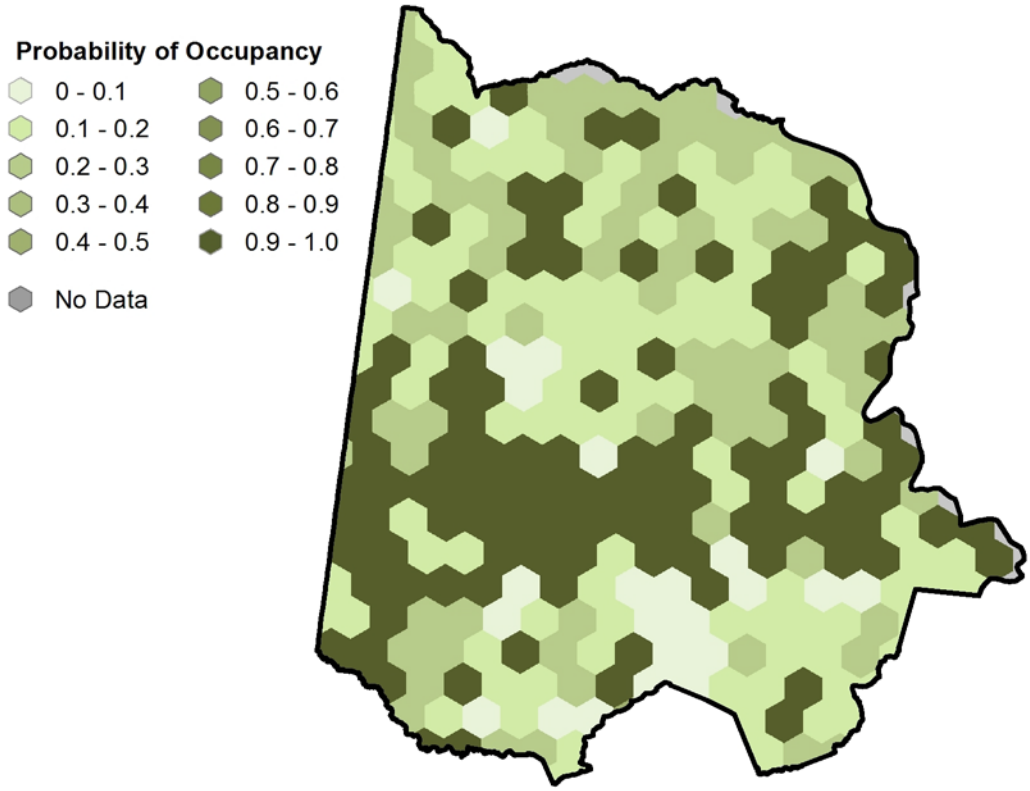


Figure 9. Probability of occupancy across the Berens Range conditional on detection (i.e. ψ = 1) where caribou were confirmed to be present from data collected during the winter 2012 aerial survey.

The probability of caribou occupancy was correlated with habitat covariates (Table 3). No single best model containing habitat covariates could be identified and so habitat covariates retained in the two best models supported by the data were used to generate model-averaged estimates of occupancy (Table 3; Figure 10). The averaged model used to generate mean estimates of caribou occupancy was:

Table 3. Untransformed estimates of coefficients for habitat covariates used in the caribou occupancy model for the Berens Range. The model detection probability is 0.58. Parameters shown in bold have confidence intervals that do not contain zero.

Covariate	Coefficient[1]	S.E.	Lower CI	Upper CI
intercept	-0.29	0.18	-0.65	0.06
Treed bog	**0.60**	**0.18**	**0.24**	**0.96**
Conifer	0.02	0.19	-0.35	0.39
Roads	**0.60**	**0.21**	**0.18**	**1.02**
Towns	0.14	0.19	-0.24	0.52
Disturbance	-0.31	0.19	-0.68	0.06

[1]The sign before the covariate estimate indicates the direction of the relationship with species occupancy (positive or negative).

Caribou occupancy in the range was high where treed bogs were more abundant and occupancy was lower in disturbed areas (Figure 12). Distribution was relatively contiguous in the central portion of the Berens Range where large tracks of suitable habitat exist and human and natural disturbance is low. Caribou occupancy was patchy in the northern portion of the range, consistent with the fragmented distribution of suitable habitat in relation to burns and early seral forests. Apparent habitat fragmentation on the northern portion of the range may explain why the occupancy predictions for the model with habitat covariates underestimated occupancy in this area (Figure 10); however, the conditional occupancy (Figure 9) and evidence from telemetry monitoring (Figure 7) of adult females confirmed the use of the northern area by caribou. There is evidence in other jurisdictions of the negative effects of anthropogenic landscape disturbances on caribou distribution and population persistence (Brown et al. 2007; Wittmer et al. 2007). Also, the positive correlation between caribou occupancy and treed bog and conifer forest is consistent with evidence of the positive effect of these forest types on caribou habitat selection using finer resolution telemetry data (Brown et al. 2007). Connectivity between the southeastern end of the Berens Range and the Sydney Range is limited by the relatively high density of roads and human settlement; however, connectivity is evident in the extreme southwestern end of the range in Woodland Caribou Provincial Park where contiguous patches of confer forest are present.

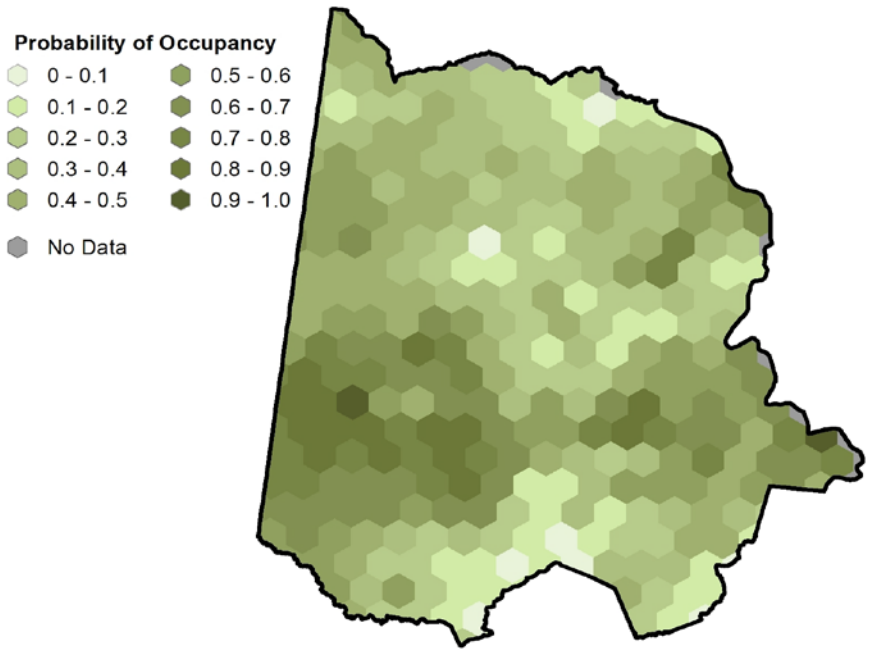


Figure 10. Probability of occupancy determined using habitat covariates across the Berens Range based on model-averaged estimates using observations for the 2012 winter aerial survey.

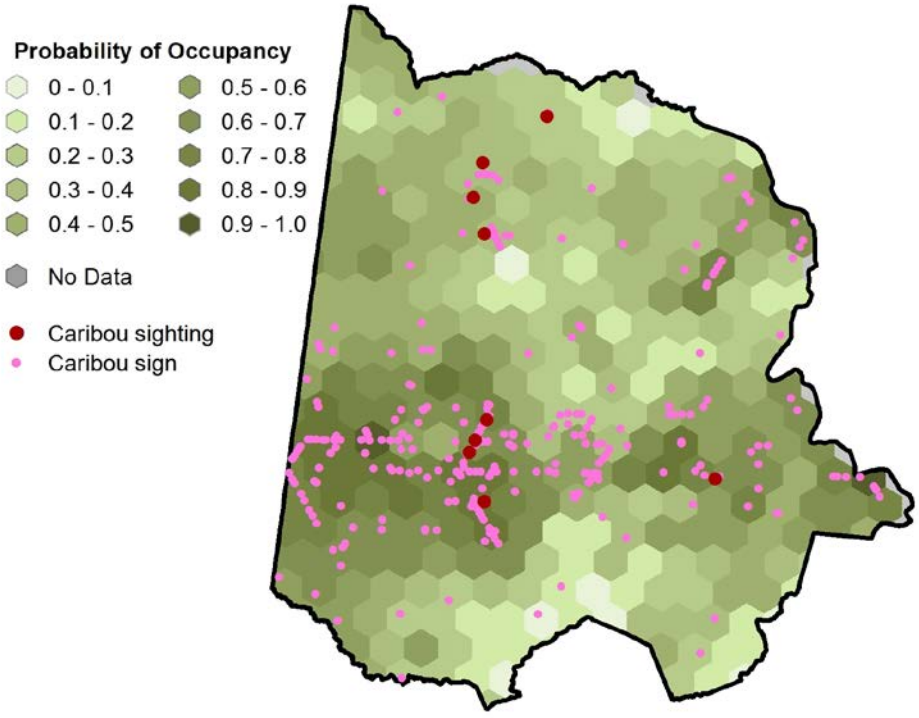


Figure 11. Probability of occupancy determined using habitat covariates across the Berens Range overlaid with caribou signs and sightings from the 2012 winter aerial survey.

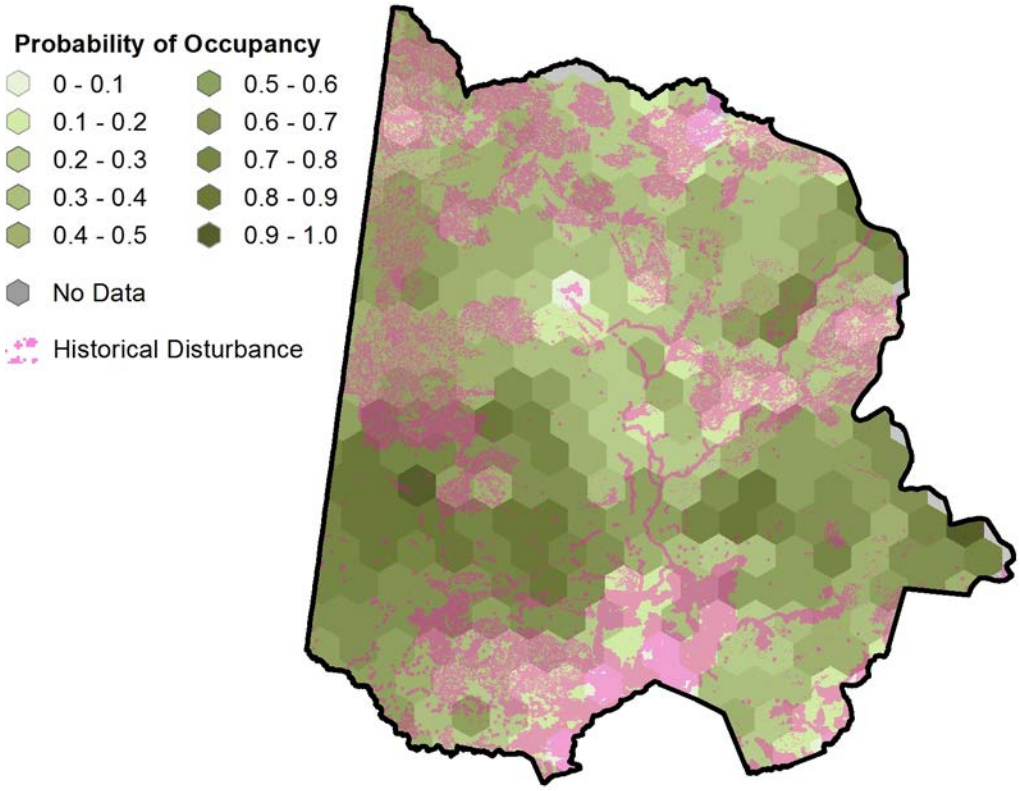


Figure 12. Probability of occupancy determined using habitat covariates across the Berens Range using observations for the 2012 winter aerial survey overlaid with disturbed areas (i.e. cuts, burns, regenerating depletions).

3.4. Caribou ecology and range narrative

Caribou within the Berens Range are believed to reflect our general understanding of caribou habitat use in the boreal forest as described by the Ontario Woodland Caribou Recovery Team (2007). Caribou occur at low densities over large areas associating most closely with large tracts of older conifer forest, peatland complexes, areas exhibiting low densities of moose and deer, and associated predators. These older conifer forests are believed to provide caribou with a source of arboreal and terrestrial lichens which are important winter forage for many populations (Schaefer and Pruitt 1991) while primarily reducing the likelihood of predator encounters as a means of reducing adult and calf mortality. Female caribou appear to separate themselves from predators by dispersing into areas where wolves exist at lower density due to fewer sources of prey such as moose, or to isolate themselves from other caribou prior to calving (Bergerud and Page 1987). They exhibit hierarchical habitat selection favouring predator avoidance at a broad scale and forage availability at scales of daily feeding area selection (Rettie and Messier 2000). Caribou exhibit fidelity to calving and post-calving areas (Brown et al. 1986; Schaefer et al. 2000) and the fate of calves may often be determined during the summer months. As a result, the sensitivity of caribou to habitat disturbance may be heightened during the summer, post-calving period (Johnson et al. 2005).

Within Ontario, regional differences in habitat use appears to be associated with variations in climate, disturbance regime, forest types, topographic features, and the distribution and abundance of other wildlife populations. Caribou may exhibit habitat use patterns that take advantage of habitat types available (Moreau et al. 2012) and may use atypical vegetation conditions in more isolated areas such as on islands where refuge value is provided by topographic features instead of vegetation composition and structure (Rudolph 2005).

Within the range, the occupancy patterns and habitat selection for refuge, forage, calving, and travel may be heavily influenced by the disturbance history, especially large and frequent fire events. These fire events are prevalent along the western portion of the Whitefeather Forest, all of Woodland Caribou Provincial Park (WCPP) and north of the Berens River (Figure 2 and Figure 3) largely due to the sub-humid climatic zone adjacent to the Manitoba border. This aggressive fire regime has likely contributed to the renewal of existing habitats, but adds an element of risk to the maintenance of the currently available and occupied habitat within the range. Large, intense fires are expected to occur in the future and possibly even increase in frequency or intensity with the changing climate. In general, the aggressive fire regime within the Berens has provided an abundant supply of large tracks of younger forest on surficial geology conditions capable of supporting both winter and summer habitat conditions. The prospects for future habitat within the range are good unless the fire regime becomes more aggressive through time and many of these areas re-burn before they have the chance to develop into suitable habitat. Fire management dictated by government policies, such as the measured fire zone, have had a profound effect on the distribution and abundance of caribou within the Berens Range. The Measured Fire Management Zone (MNR 2004) that was in effect until 2004 is likely partially responsible for the extensive tracks of older conifer forest extending from the northeastern portion of WCPP to Upper Goose Lake at the eastern-most portions of the Whitefeather Forest. This area exhibits extensive use by caribou in all seasons, especially winter. The proportion of land disturbed by wildfire increases towards the north and the apparent occupancy by caribou decreases. In the northern portion of the range, where large disturbances are numerous and extensive, caribou occupancy is highly clumped and associated with residual patches of older conifer forest east of McInnes Lake, north of Poplar Hill, and south of Deer Lake. The burned areas have high potential to produce lichen rich forest conditions between 50 and 70 years post disturbance.

Many significant non-fire forest disturbance events have occurred within the Berens Range, primarily blowdown. These major wind events have occurred despite the fact that the Whitefeather Forest is a relatively young forest (Racey and Rahi 2008). There is some concern that these areas may succeed to less suitable habitat conditions. An apparent increasing trend in non-fire disturbances is expected to add an additional threat to the Berens Range that already exhibits a very aggressive fire regime, adding further uncertainty to the future forest condition and habitat supply. The Berens Range has a relatively recent history of industrial development over a small proportion of the range, mostly concentrated in the southernmost portion of the range within the Red Lake Forest and the Trout Lake Forest.

Conifer forest contributing to caribou habitat within the Berens Range are composed primarily of pure stands of jack pine and black spruce which are typically open with low herb and shrub richness (Racey 2008; Racey and Rahi 2008). These forest attributes are likely the result of

the aggressive fire regime, a sub-humid climate and the abundant shallow soils with bedrock outcrops and likely provide a distinct advantage to caribou by providing quality refuge habitat. This may be especially important given the naturally high levels of forest disturbance. These attributes may be difficult to maintain in a managed forest and will require extraordinary attention to silvicultural strategies and approaches in order to maintain the existing level of conifer purity and shrub and herb richness across the forest landscape.

There are some large portions of the Berens Range where browse abundance for moose is high. These are mostly associated with the Berens, Throat, and Bloodvein River systems that are associated with deep, highly productive fine textured soils which are remnants of the post-glacial Lake Agassiz and support mixed forest conditions. Other pockets of fine textured soils occur throughout the range but are mostly small and scattered. These fine textured soils will be highly susceptible to post-harvest conversion to mixedwood species consisting of trembling aspen, balsam fir, white spruce and white birch which is more suited to moose than to caribou.

The western portion of the Berens Range may provide some of the highest caribou winter habitat capability (potential habitat), but it also exhibits the most aggressive fire regime, resulting in low levels of currently mature and suitable habitat. However, areas of shallow surficial deposits and bedrock outcrops currently occupied by mature conifer forests provide important winter habitats within the range. The western portion of the range has a large number of lakes with many islands and irregular shorelines. Many of these have documented use by caribou in the calving period and represent important summer habitats, in some cases, even when much of the surrounding forest is recovering from fire. A large portion of this area is protected as part of the Lake Country (*Weeskayjahk Ohtahzhoganiing*) Designated Protected Area (DPA) and four other DPAs associated with the Whitefeather Forest. Much of the Berens Range west of the Whitefeather Forest and into the adjoining Manitoba landscape are proposed for protection under the Little Grand Rapids and the Pauingassi Land Use Plans and the proposed Pimachiowin Aki World Heritage Site. This landscape exhibits predominately young jack pine and black spruce forest on a bedrock plateau interspersed with some large tracts of mature conifer forest. Caribou occur throughout this area where conditions are suitable.

The majority of knowledge of caribou distribution and occupancy was compiled in the last 20 years. It has been supplemented with a wealth of insight from Pikangikum First Nation elders, and complements earlier surveys associated with the West Patricia Land Use Planning exercise. Major areas of notable caribou occupancy include the areas in the vicinity of Valhalla and Trough lakes, Sampson Lake, Trout and Nungessor lakes, Stout Lake, Upper Goose Lake, and Cairns Lake.

The Valhalla-Bigshell-Woody Lake areas historically represent the largest and most concentrated occurrence of caribou in the winter (more than 200 caribou). It is conifer dominated and relatively old. Although it exhibits some year round use, its primary function may be the provision of winter habitat. During the 2012 survey, using a less intensive survey methodology, fewer caribou were observed in this area but it is unknown if that is due to the methodology or to 2-3 recent natural disturbance events in the vicinity. Monitoring the long term changes in occupancy of this area will be essential in determining if the winter habitat

value is maintained and if the connections to calving and nursery habitat at Trough, Trout, and Nungessor lakes are maintained.

Caribou within the Berens Range are believed to interact and be part of the same population structure as the caribou that occupy the Atikaki-Berens Range in Manitoba. It is believed that habitat quality and function on one side of the inter-provincial border may have implications to caribou population performance on the other side. Evidence from a collared cow suggests that caribou have entered the Berens Range and stayed for more than a year before returning to Manitoba. One significant connectivity linkage may be provided in the vicinity of Aikens Lake. The extent of movement across this border will be fundamental to supporting the inter-jurisdictional caribou conservation vision as a combined Atikaki-Berens Range, if warranted. There is likely some limited movement of caribou between the Berens Range with the areas to the north and east. A significant band of fine textured soils and mixedwood forest conditions extends from Red Lake west along the Gammon and Bloodvein River system towards Lake Winnipeg in Manitoba and seems to present some form of passive and partial barrier between the Sydney and Berens Ranges.

Occupancy at the southern extent of the Berens Range appears to be anchored by portions of WCPP north of the Gammon River which contains tracts of older bedrock-dominated conifer forest, the Valhalla Lake winter range, the Trout and Nungessor lake calving and nursery areas, and older forest components linking Trout Lake to Goose Lake.

Movement patterns within the Berens Range are mostly east-west and reflect the existence of major east-west bands or patches of older conifer forest separated by large fires, or bands of silty and clayey soils associated with mixed forest conditions along major river systems such as the Berens and Bloodvein rivers. There seems to be significant east-west movement of caribou from wintering in the northeast corner of WCPP and around Valhalla Lake, across the Nungessor Road, to summering in the vicinity of Nungessor or Trout lakes. Although caribou cross the Nungessor Road when moving to seasonal areas, they appear to distance themselves from it when not crossing. As development, forest harvest, and other human activity increases along the Nungessor Road it may become more of a barrier for east-west connectivity between winter and nursery areas.

Calving and nursery functions within the Berens Range are mostly provided by large lakes with islands and complex shorelines or by large peatland complexes. Major lakes within the range include Trout, Nungessor, Cairns, Roderick, Stout, Cherrington, Mamaquash, Goose, and McInnes. These lakes are relatively stable habitat features compared to winter habitat which may be more dynamic and less permanent. Female caribou may access these areas from many directions. Although largely unknown, there may be some travel linkages to these lakes that are more important than others.

The Sampson and Matchett lake area is an extensive peatland complex in the northeast portion of the Berens Range and features many small and irregular islands of upland conifer forest embedded in a matrix of intermediate-to-rich fen and poor conifer swamp. It is regionally significant, is occupied by caribou in both the winter and summer and likely offers substantial refuge value. Value is likely magnified because it is in the northern portion of the range, which

is highly disturbed by fire. This peatland complex appears to function as year-round habitat similar to the peatland complexes in the vicinity of Keewaywin (Berglund et al. 2013).

Stout Lake is a significant calving and nursery area situated within a landscape heavily disturbed by wildfire. Despite this, the area seems to provide refuge for caribou cows during the calving and nursery season and there is substantial winter use of the older conifer forest in the vicinity of the lake.

Cherrington Lake is a calving lake and is believed to provide refuge habitat to caribou that spend part of their year in Manitoba. This area also has high mineral potential. It was included in an Enhanced Management Area where mineral exploration and mining activity would be permitted, but not forestry or peat extraction.

The islands of Trout Lake and Nungessor Lake are considered to be important for calving and nursery functions. Many of these islands have not been subject to wildfire for quite some time and may be in a state of succession as a result of natural mortality, blowdown, and breakage. Changes to the vegetation condition on these islands include increased coarse woody debris and conversion to birch aspen, balsam fir and hardwood shrubs. Some concern has been expressed about the sustainability of the vegetative conditions provided by these islands that support the calving and nursery function (Rudolph 2005).

This range narrative does not represent a detailed synopsis of all important caribou use areas within the Berens Range.

3.5. Influence of current management direction

Recent and current management direction – up to the time of this Integrated Range Assessment, has had both positive and negative influences on the current state of caribou within the Berens Range. Direction from the *Crown Forest Sustainability Act* (1994) to "emulate natural disturbances" was significant to support the landscape and stand-level approaches necessary to sustain caribou habitat and provide an integrated and receptive policy environment for other caribou habitat conservation direction (1994).

Implementation of *Northwest Region Interim Caribou Habitat Management Direction* (MNR 1994) and the early implementation drafts of the *Forest Management Guidelines for the Conservation of Caribou Habitat: a Landscape Approach* (Racey et al. 1999), and the subsequent *A Management Framework for Woodland Caribou Conservation in Northwestern Ontario* (MNR 1999b) were instrumental in initiating and integrating caribou conservation efforts into forest management planning, especially through the development of the caribou mosaic on the Trout Lake, Whiskey Jack, and the Red Lake forests. Implementation of caribou habitat tract mapping, mosaic planning, and priority retention of larger areas of high-value habitat components contributed to continued occupancy and use of the area between the Valhalla winter habitat and the Trout and Nungessor Lake areas. We believe the retained older forest immediately north of the Red Lake and Trout Lake Forests has helped maintain those significant travel linkages. Early mosaic development was done with the knowledge that there was abundant old forest immediately north of the Red Lake and the Trout Lake forests. These

past activities have set the stage for moving forward with successful implementation of a comprehensive RMA.

Through the Whitefeather Land Use Planning process, and prior to approval of a land use plan or development of a Forest Management Plan, Ontario was able to gain valuable information on caribou winter distribution, and nursery and calving sites. This information helped to provide a benchmark and understand the general distribution of caribou across the Berens Range. This created a unique opportunity for informed decision making and provided a large increase in awareness of caribou ecology among those with interests within the Berens Range.

Past and present fire management strategies (MNR 2004) have had direct and indirect implications for the amount, arrangement, and condition of caribou habitat in the Berens Range. The Boreal and the Northern Boreal fire zones have likely maintained a higher proportion of older conifer forest across the southern portion of the range, especially between the Valhalla Lake area and north of Nungessor Lake. The age class and specific composition of these large tracks of older conifer forest not only provide for current suitable habitat but also have provided a focus for the 2012 Whitefeather Forest Management Plan as readily available wood supply. Overall, the amount of older forest on the Berens Range is probably larger than what would be available if initial fire attack and suppression was not present. Furthermore, the fire strategy also encourages the use of prescribed fire to restore habitat following wind disturbance events (MNR 2004).

The Whitefeather Land Use Plan acknowledged caribou as an integral and significant component of the planning area. The designation of the Lake Country as a Dedicated Protected Area with high capability for caribou habitat is significant to the long term well-being of caribou within the range. Other Dedicated Protected Areas and Enhanced Management Areas have the potential to support land management actions in conserving caribou habitat functions within the landscape.

Similar acknowledgement of the existence of caribou and the desire to conserve caribou was identified in the Little Grand Rapids and the Pauingassi Land Use Plans and the proposed Pimachiowin Aki World Heritage Site. The plans support protection of habitat for species at risk including summer and wintering habitat and calving areas for caribou throughout the entire planning area. This conifer-dominated landscape, under the proposed protection strategies, should continue to provide a valuable habitat for caribou within the Berens Range. This planning initiative further solidifies the concept of cross-border conservation of caribou shared between the Berens Range in Ontario and the Atikaki-Berens Range in Manitoba.

Forest Management deferrals in the vicinity of Medicine Stone and Hammell lakes were implemented as part of the 1992 Red Lake Forest FMP. These deferrals are believed to have contributed to continued occupancy in the area, and, if maintained, should increase the likelihood of future occupancy in adjacent harvested areas as they become older.

3.6. Major data and analysis uncertainties

The Berens Range and the landscape adjacent to the Manitoba border has been subject to a number of blowdown events in the last 15 years since the last full Forest Resources Inventory (FRI) was completed. Typically, only large blowdown events result in forest inventory updates. It is unknown how much undocumented blowdown has occurred within the range, but it is suspect there is more young forest than is reflected in the forest inventory or disturbed forest than is reflected in the disturbance analysis.

Habitat assessment within WCPP and a large portion of the range between the western boundary of the Whitefeather Forest and the Manitoba border was conducted using Land Cover 2010 (PLC 2010) data, and the remainder of the forest was assessed using Forest Resources Inventory data. The greater the proportion of the range that relied upon PLC 2010 data, the more uncertainty there is about the habitat assessment results. Approximately 42.5% of the range was assessed using data other than the FRI, meaning that Simulated Range of Natural Variation (SRNV) (as determined from FRI) was not established for significant portions of the range.

National meta-analysis of the relationship between caribou recruitment and the total amount of anthropogenic and natural disturbance relied on data from the Global Forest Watch database (EC 2008). This relationship was intended to be refined as improved data was provided by various jurisdictions across Canada. There may be substantial differences between forest cover, forest disturbance, and linear features represented in this analysis compared to the Global Forest Watch data. In general, the current range analysis included more complete data related to road and mineral development activities, documented fires, and non-fire forest disturbances. The calculated habitat disturbance using Ontario data is estimated to be approximately 10 to12% greater than that generated using the Global Forest Watch data. There is some uncertainty in the interpretation of the results of the disturbance analysis using these different datasets in light of the desire to use the best data available.

There is considerable uncertainty in the appropriate treatment of water during the disturbance analysis. The sensitivity of the “total disturbance” parameter to removal of waterbodies of different sizes was identified to inform interpretation of the likelihood of stable or increasing population growth and evaluation of range status. In the Berens Range, waterbodies account for a substantial portion (15.6%) of the range extent. It is unknown whether the inclusion of these waterbodies in the range extent for the purpose of the disturbance analysis introduces a positive or negative bias.

Recruitment rates for the Berens Range were very low in winter 2012 (February 4-9th, 2012). However, recruitment rates were also very low in the Sydney, Churchill, and for ranges in Manitoba. It is thought that 2011-12 recruitment year must have been generally very poor. This is still a concern for the well-being of caribou, but it is worthy of note that the poor recruitment may not be attributed to habitat quality alone, but to other factors that may include weather patterns during the previous year.

This range assessment has been completed with only two years of recruitment data, one from the two-stage survey and one from the 2013 collared caribou recruitment estimates. Given that recruitment estimates from one of those years is thought be the result of factors other than habitat, caution should be applied to the interpretation of the recruitment and lambda estimates.

In the north, it is believed that boreal forest stands take longer to reach maturity as compared to further south. As a result, the assumption that a forest stand begins to develop attributes of suitable winter or refuge habitat at 36 years of age may not hold true for the Berens Ranges as in other ranges (Racey and Rahi 2008). However, the degree to which this may be true in the Berens Range is not known and there is an element of uncertainty introduced into the interpretation of the habitat and disturbance analyses.

3.7. Special considerations within the range

Special circumstances exist within the Berens Range that should be considered when interpreting the Integrated Range Assessment. These include significant physical and biological factors influencing the status of caribou, trends, or habitat use that are unaccounted for in population and habitat modeling. Such factors should give context to results of the Integrated Range Assessment Framework.

The soils and landforms within this range and the associated climate are highly conducive to the renewal of conifer dominated forest and conifer-lichen woodland conditions. The abundance of lakes, and shrub-poor conifer dominated forests suggests a high refuge value to the landscape for those portions of the landscape that consist of older forest and have not burned within the last 40 years. Although the pockets of fine textured soils and the young forest can be exceptionally good moose habitat, the potential for the creation of quality caribou refuge and winter habitat is high. This assumption does not hold for the central portion of the range where fine textured soils predominate such as along the Berens River and Throat River systems.

The aggressive fire regime adds a high level of uncertainty to the outcome of all planned habitat management efforts. The creation of Dedicated Protected Areas or conservation reserves in land use planning or the deferral of large tracts of high value habitat may have short-lived or transient benefit if it is later lost to a large wildfire. The large burns in the western portion of the range and on shallow soils all appear to be regenerating to the high conifer content and relatively even-aged conditions that would be expected to produce high quality winter and refuge habitat for caribou. The current low probability of occupancy in those areas should not be taken an indication of low value or be considered inconsistent with the recovery goals identified within the Caribou Conservation Plan.

Aboriginal subsistence harvest of caribou is permitted within the Berens Range.

3.7.1. Special considerations related to the Atikaki-Berens Range

The full degree of interaction between the Berens Range and the Atikaki-Berens Range is uncertain. Consideration of the number of caribou, population health and movement patterns of the Atikaki-Berens caribou should be a major consideration when interpreting the results of the Berens Range assessment. The climate, soils, geological history and broad vegetation patterns are relatively similar. The province of Manitoba has generously provided key information about the Atikaki-Berens Range to assist with our understanding of the assessment for the Berens Range.

The MAC on the Atikaki-Berens Range was determined to be 286 when the survey was carried out in 2012 (D Brannen pers. comm. 2013).

In total, 21 collared females have moved into Ontario from Manitoba between 1998 and 2013 during the calving season and summer (D. Brannen pers. comm. 2013); of these, eight caribou moved between the Atikaki-Berens Range into the Berens Range between 2002 and 2013. Furthermore, one female collared in the Atikaki-Berens Range traveled east into Ontario's Berens Range and then proceeded to move south into the Sydney Range. This was a pre-calving movement (the animal wintered in Manitoba prior to the movement). This animal stayed the winter in the Sydney Range as well as the subsequent calving and summer period before returning to Manitoba in the fall. This movement data support assumptions of connectivity with Manitoba made in the delineation of the Berens Range and proposed collaboration on caribou conservation efforts.

3.8. Other wildlife

The boundaries of the Berens Range overlap with Wildlife Management Units (WMU) 1C, 2, 3, 16A (Figure 13), within cervid ecological zones A and B (MNR 2009b).

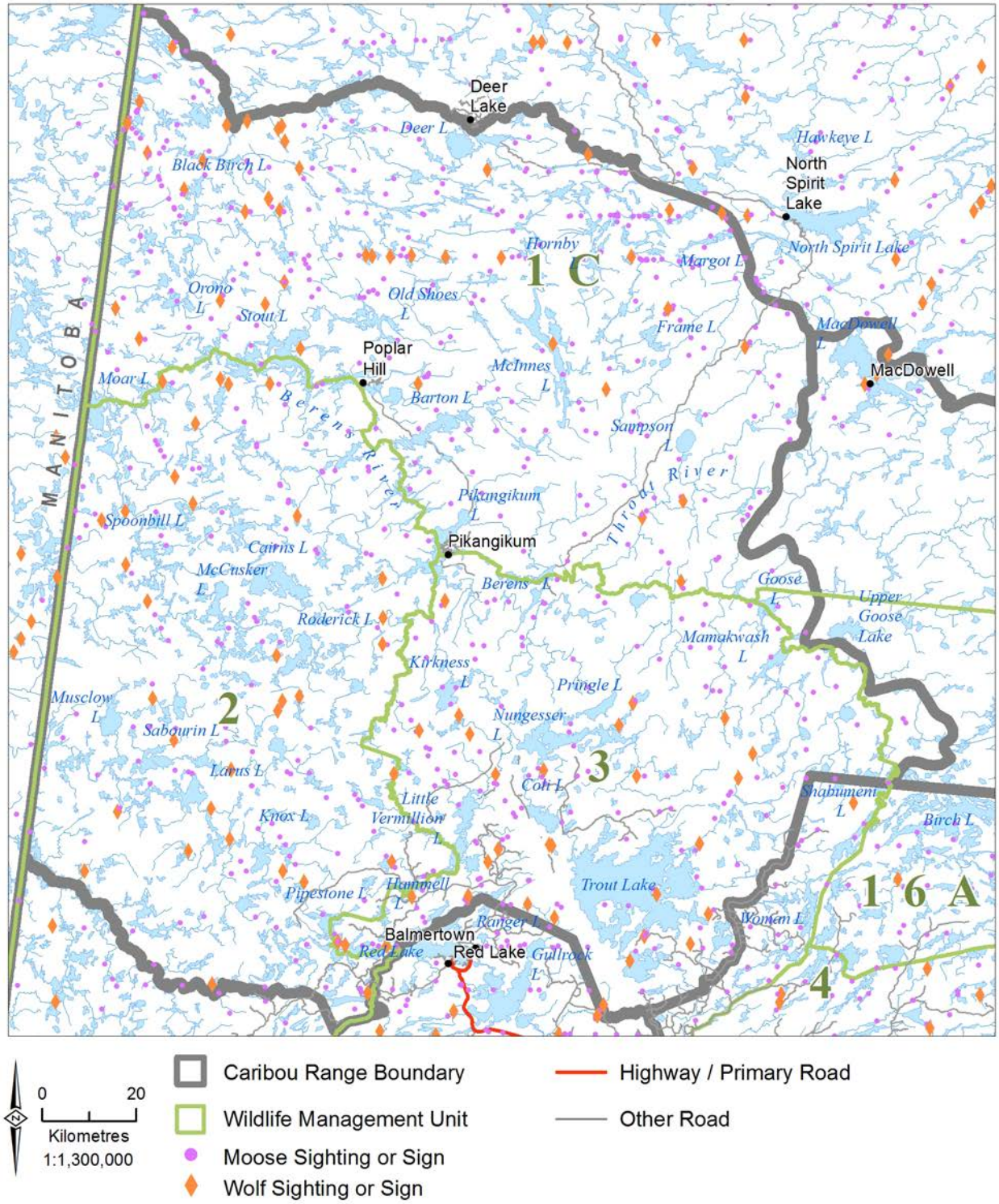


Figure 13. Wildlife Management Units overlapping the Berens Range with moose and wolf signs or sightings observed during the winter 2012 aerial surveys.

Moose densities have historically been moderately low across much of the Berens Range and at the WMU level are currently estimated from 13.8 to 20.0 moose per 100 km^2 (Table 4**)**. Moose population trends are considered to be declining in WMU 2 and stable in WMU 3.

Table 4. Recent moose population estimates for Wildlife Management Units (WMU) within Berens Range.

WMU	Cervid Ecological Zone	MAI strata area (km^2)[1]	Moose population estimates no. of moose (survey year)	Current density (moose / 100 km^2)
2	A	8,500 (includes water)	1,169 (2013)	13.8[2]
3	B	12,650	2,574 (2009)	20.0

[1]Area is for the WMU
[2]Should be higher based on current objectives

White-tailed deer occur in very low densities across the Berens Range with less frequent observations further north. Deer may function as both alternate prey for wolves and as a vector for disease, specifically brainworm (*Paralaphostrongylus tenuis)*, and may be expected to increase with northward expansion.

Black bear density estimates derived through the implementation of barbed-wire hair trap (BWHT) protocol indicates that densities in the Berens Range may be relatively low (11-13 bears/100 km^2 from Table 5 in M. Obbard, MNR unpublished data), compared to average densities from other WMUs within Ontario's northwest region and black bear ecological zone D.

Table 5. Recent black bear density estimates for Wildlife Management Units (WMU) within the Berens Range derived from barbed-wire hair trap protocol.

WMU	BBEZ[1]	Year	Density (# bear/100 km^2) ± SE	Density relative to BBEZ mean	Density relative to regional mean
1C	B		Unknown		
2	D	2006	13.2 ± 3.9	Below	Below
3	D	2007	11.4 ± 3.9	Below	Below

[1]Black bear ecological zone

Traditionally, there is little information about wolf densities. However, during winter 2007, an aerial survey was flown in the northern portion of the Berens Range. Wolf density was relatively high and estimated at 0.72 wolves per 100 km^2 (B. Patterson, MNR unpublished data). This density is at a level predicted to negatively affect caribou populations (Bergerud and Elliot 1986; Bergerud 1988). Anecdotal evidence may suggest high numbers of wolves

and that wolf populations in WMU 1C, 2, and 3 are likely stable, though sightings have increased slightly in recent years as indicated by the results of the Moose Hunter Post Card Survey (PCS) wolf sighting index (Figure 14). There were frequent observations of wolves during the 2012 survey across the entire range (Figure 13). This information is included to provide context with other wildlife population trends, and is not used in determining range condition.

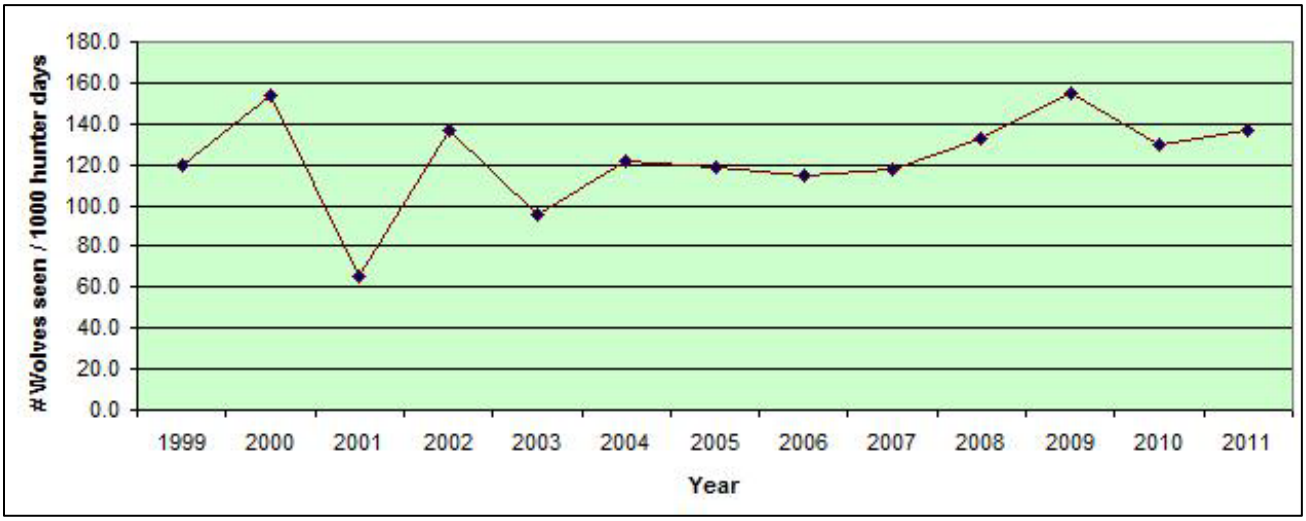


Figure 14. Trend in number of wolves sighted by moose hunters, 1999-2011; pooled data for WMU 1C, 2, and 3 (MNR, Science and Research Branch, moose hunter post card survey database).

3.9. Results of past range assessments

No previous range assessments have been completed for the Berens Range. However, range level summaries of data and models pertaining to the Berens Range are described in Elkie et al. (2012).

4.0 Integrated Range Assessment Framework

The Protocol (MNRF 2014a) identifies the process to conduct an Integrated Range Assessment (Figure 15) involving: 1) collection of data to inform four quantitative lines of evidence and their interpretation; 2) an Integrated Risk Assessment; and 3) determination of range condition. The Integrated Risk Assessment (Section 7) considers the influence of habitat disturbance and population trend on the likelihood of stable or positive population growth, and the influence of population size on the probability of persistence. This assessment is supported by scientific findings adapted from Environment Canada (2011).

The process of determining range condition (Section 7.5) will be based on the best available information that supports the lines of evidence. Range condition is reflected in the IRAR as a statement pertaining to the ability of the range to sustain caribou. Range condition is declared with full acknowledgement and understanding of the current risk to caribou but with the additional insight provided by the habitat assessment which describes the amount and

arrangement of habitat. If the fourth line of evidence representing the amount and arrangement of habitat is not available for the range, results of the integrated risk assessment will be used to determine range condition as follows: if risk to caribou is low, then range condition is sufficient to sustain caribou; if risk to caribou is intermediate, it is uncertain whether range condition is sufficient to sustain caribou; if risk to caribou is high, then range condition is insufficient to sustain caribou.

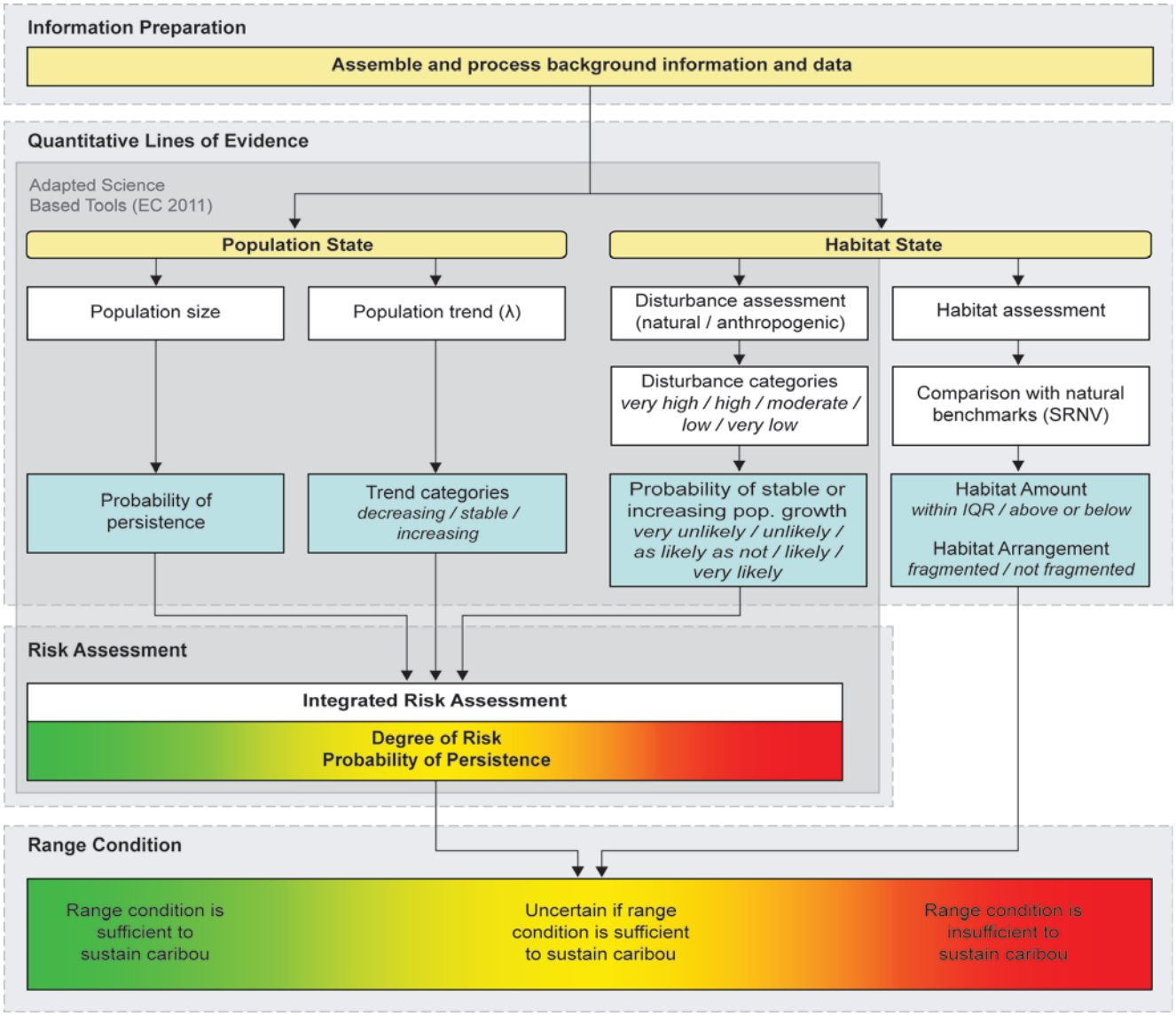


Figure 15. The integrated assessment framework with four quantitative lines of evidence. Three lines of evidence related to population size, trend and habitat disturbance assessment contribute to an integrated risk assessment. The results of the integrated risk assessment are combined with habitat assessment (fourth line of evidence), to inform the determination of range condition (MNRF 2014a).

5.0 Quantitative Lines of Evidence Methods and Results

5.1. Population state: size and trend

Caribou population health is conventionally measured in terms of population size (i.e. the number of caribou) and trend. It is preferably described by average intrinsic rate of growth, lambda (λ). The best available data is used to estimate the number of caribou and the demographic trend within the range. These are used in the integrated caribou range assessment decision framework (Figure 15).

The ability to establish population trends improves with the addition of more indicator estimates. In this assessment the short-term population trend is approximated by: 1) estimates of recruitment expressed as percent calves in the population or number of calves per 100 adult females as an index of population condition (EC 2008), 2) an estimate of lambda (MNRF2014a) and 3) a minimum estimate of the population size based on a minimum animal count (MAC). The long-term population trend is approximated by using historical data compared to recent data.

5.1.1. Population state methods

5.1.1.1. Telemetry

Historically, only one caribou was collared in the Berens Range (1997). In February 2012, 30 GPS collars were installed on female caribou within the range. Data generated from collared caribou will be used in future reports to determine annual survival, recruitment and refine trend estimates.

5.1.1.2. Winter aerial surveys

Between February 4th and 19th, 2012, a fixed-wing hexagon-based aerial survey was conducted for the Berens Range (Figure 8). All caribou and signs of their presence were recorded. Where possible, observed caribou were counted and classified as adults or calves. Survey efforts were strictly controlled to support occupancy analysis (Section 3.3). Additional searching for caribou off the transect lines was discouraged once sign was confirmed.

The second stage of the survey was conducted by helicopter from February 6th to the 19th, 2012, and included areas where caribou were sighted and/or where there was significant evidence of caribou presence. Caribou group size and age/sex composition were determined at this time. Caribou observed were counted and classed as unknown adults, adult males, adult females, calves, or unknown age and sex composition. Sex of adults was determined through observation of the presence or absence of a vulva patch, animal behaviour, and/or body morphology.

These two survey methods collectively provided data in support of the MAC and recruitment estimates.

5.1.1.3. Recruitment

Recruitment estimates follow the Protocol (MNRF2014a). The observed sex ratio of known adults obtained from aerial surveys was used to estimate the number of adult females present in the groups containing unknown adults. The adjusted number of adult females (AF_{adj}) was used to estimate recruitment.

5.1.1.4. Trend

Generally, in forest-dwelling caribou, a stable population requires a late-winter estimate of at least 12 to 15% calves in a non-hunted population with a density of 0.06 caribou per square kilometre (Bergerud 1992; 1996). Recruitment rates exceeding 28.9 calves per 100 AF_{adj} would suggest the population is increasing. Recruitment rates below this value would suggest the population is decreasing based on assumed adult mortality rates (EC 2008). The relationship between annual estimates of recruitment and adult female survival was used to provide an estimate of trend (λ) (Hatter and Bergerud 1991).

Trend Estimation

Annual population growth, (lambda, λ), was estimated based on the following female-only survival and recruitment equation (Hatter and Bergerud 1991):

$$\lambda = (1 - M) / (1 - R) \qquad \text{Equation 1}$$

Where M is adult female mortality (or 1 - S, the survival rate) and R is the recruitment rate of female calves: 100 adult females (assuming a 50:50 sex ratio) at 12 months of age.

Baseline estimates of annual survival (S) were calculated using three equations described in the Protocol.

$$\textit{Daily survival rate} = 1 - (\#\ \textit{of mortalities} / \#\ \textit{of animal days}) \qquad \text{Equation 2}$$

$$\textit{Annual survival rate} = (\textit{Daily Survival Rate})^{365} \qquad \text{Equation 3}$$

$$\textit{Annual mortality rate} = 1 - \textit{Annual Survival Rate} \qquad \text{Equation 4}$$

As some caribou moved between ranges, data from all adult female collared caribou that had the majority of their telemetry locations (>50%) within the Berens Range was utilized.

5.1.1.5. Size

The aerial survey methodology used to conduct a probability-based occupancy survey (Section 3.3) supplemented with a helicopter to obtain improved age and sex information (MNRF 2014a) was used to generate a minimum animal count (MAC). This is interpreted as an absolute minimum number of caribou occupying the range in February 2012. The MAC was calculated based on all caribou observations that were not deemed to be duplicate observations (MNRF 2014a).

5.1.2. Population state results

Three hundred twenty-eight (328) caribou observations were recorded in the Berens Range during the 2012 aerial survey; 45 resulting from the fixed-wing survey and 283 resulting from the rotary-wing survey. After removing recounts, 27 caribou were observed in four independent groups during the fixed-wing and 210 caribou were observed in 28 independent groups during the rotary-wing survey. This resulted in a minimum animal count (MAC) of 237 caribou in the Berens Range, six of which were calves (Table 6). The largest group of animals consisted of 20 caribou; most observed groups varied from 2-13 caribou. Detection of caribou from aerial surveys is known to be incomplete and the detection rate is unknown, as a result the MAC only represents a proportion of the actual number of caribou present within the Berens Range.

Table 6. Minimum animal count observed during a fixed-wing and rotary-wing aerial survey conducted on the Berens Range, February 4-19, 2012.

	Caribou age and sex identification[1]						
Survey method	**UA**	**AM**	**AF**	**Calves**	**Unknown**	**Total adults**	**Total caribou**
Fixed-wing (FW)	11	4	-	-	12	15	27
Rotary-wing (RW)	65	54	78	6	7	197	210
Total	**76**	**58**	**78**	**6**	**19**	**212**	**237**

[1]UA=Adult of unknown sex, AM= Adult male, AF=Adult female, Unknown=Caribou of unknown age or sex.

Only caribou groups for which 50% or more of the group was successfully identified to age and sex were included in the estimation of adult sex ratio and recruitment (Table 7). In 2012, the sex ratio of known adult females to known adult males observed during the rotary-wing survey was 0.605. Using these sex ratios to determine the number of adjusted adult females resulted in a total recruitment estimate of 4.8 calves per 100 AF_{adj} in the fixed and rotary-wing surveys (Table 7; Figure 16). This level of recruitment was much lower than expected and likely demonstrates that 2012 was not a good year for caribou recruitment in this range. These numbers were also substantially lower than those documented by Racey et al. (2006). The ratio of calves to adults was 0.028 (or 2.8% calves) using the rotary-wing aircraft data.

The 2013 recruitment survey yielded 185 caribou, 23 of which were calves. The sex ratio was 0.745, resulting in a recruitment estimate of 23.9 calves per 100 $AF_{adj.}$ (Table 7; Figure 16). Although the 2013 estimate was much higher, both estimates were below the identified threshold of 28.9 calves per 100 AF_{adj} and consistent with studies in which populations were known to be in decline (Rettie and Messier 1998; McLoughlin et al. 2003; EC 2008)

Table 7. Counts of caribou and estimates of recruitment from both the fixed-wing and rotary-wing aerial surveys conducted in the Berens Range during February 2012 and 2013.

		Caribou age and sex identification[1]										
Year	**Survey**	**UA**	**AM**	**AF**	**Calf**	**Unknown**	**Total Adults**	**Total Caribou**	**Sex Ratio**	AF_{adj}	**Calf: 100** AF_{adj}[2]	**% Calves**[3]
2012	Winter Distribution (FW/RW)	76	58	78	6	19	212	237	0.605	124.0	4.8	2.8
2013	Recruitment survey	7	37	91	23	27	135	185	0.745	96.2	23.9	n/a[4]

[1]UA=Adult of unknown sex, AM= Adult male, AF=Adult female, Unknown=Caribou of unknown age or sex, AF_{adj} = Adjusted Adult Females
[2]Recruitment estimate using the ratio of calf: 100 adjusted adult female
[3]Percentage of calves observed, only reported for the winter distribution survey, as this survey was not targeting collared adult females and therefore represents a less biased survey for calculating percentage of calves in the population
[4] Due to bias created by targeting collared adult female caribou during recruitment surveys, % calves is not applicable from recruitment survey data

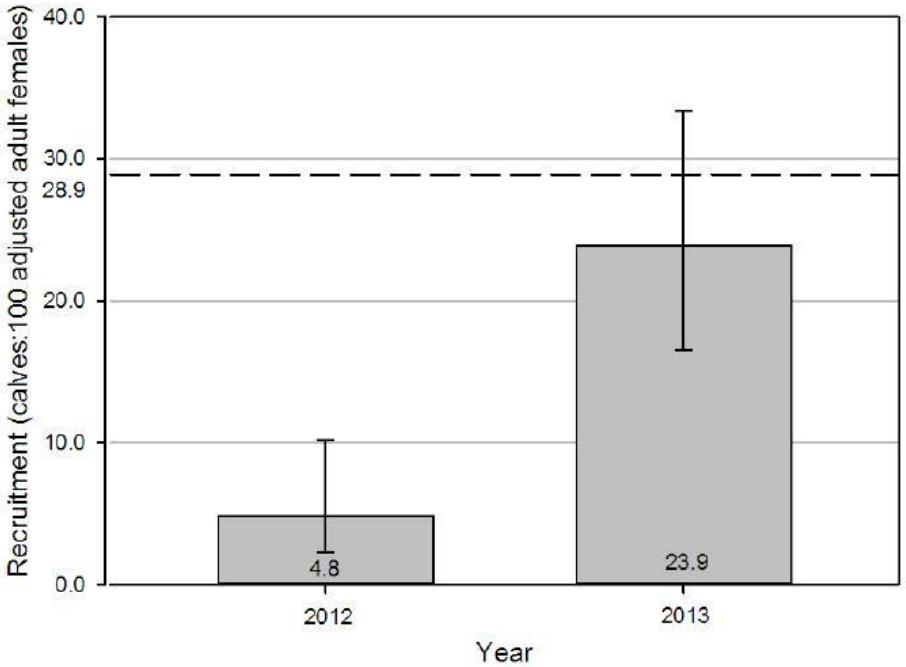


Figure 16. Recruitment estimates (calves per 100 AF_{adj}) with associated 95% confidence intervals from 2012 and 2013 in the Berens Range. Dashed line indicates recruitment levels expected for a stable to increasing population (EC 2008).

Annual survival was estimated for all collared adult females that spent the majority of their time within the Berens Range during the biological year (April 1st 2012 to March 31st 2013). The annual survival rate for adult females was 0.87 (95% CI 0.75-1.00; Table 8 and Figure 17). This estimate is comparable to the assumed average adult female survival of 0.85 (EC 2008). Using this estimate of survival and the 2012 and 2013 recruitment estimates, a mean annual population growth rate (λ) of 0.93 (range 0.89-0.98) was calculated, suggesting that the short-term population trend is likely declining.

Table 8. Annual survival rates (*S*) and population growth (λ) of collared adult female caribou (*n*) and number of mortalities (*d*) during the 2012 biological year (April 1st, 2012 to March 31st, 2013).

Biological year	n	d	Exposure days	Daily survival rate	Survival (S)[1]	Upper 95% CI	Lower 95% CI	Lambda[2] (λ)
2011					0.87			0.89
2012	23	3	8,000	0.9996	0.87	1.00	0.75	0.98
						Geometric mean		**0.93**

[1] The survival rate from 2012 was used to estimate population growth rate (λ) for the 2011 biological year

[2] λ calculated from recruitment (**Table 7**) from the end of the biological year (i.e. biological year 2012 and recruitment from 2013)

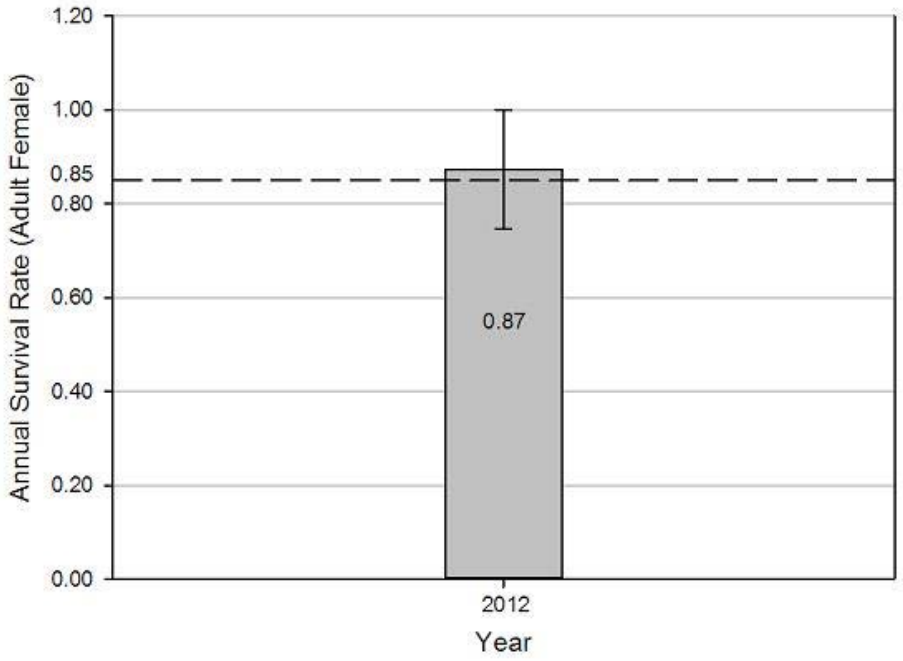


Figure 17. Annual survival rate and 95% confidence intervals of collared adult female caribou which spent the majority of the biological year (April 1st, 2012 to March 31st, 2013) within the Berens Range. Dashed line represents the 85% survival rate (EC 2008).

5.2. Habitat state: disturbance and habitat

5.2.1. Disturbance assessment

The disturbance analysis is intended to reflect the loss or conservation of functional habitat and be an independent and indirect predictor of recruitment and likelihood of stable or increasing population growth (MNRF 2014a).

For the purpose of this analysis and in areas for which FRI coverage was available, young forest was defined as being less than 36 years of age (MNRF 2014a). In areas without FRI coverage (i.e. areas beyond the Area of the Undertaking), the 2012 Provincial Satellite Derived Disturbance Mapping data, PLC 2000, and various Lands Information Ontario (LIO) layers were used (Figure 18).

Anthropogenic disturbance data included features associated with infrastructure, industrial and resource extraction, and recreation such as:

i. Infrastructure
   - airports sites
   - railroads
   - transmission lines (e.g. electric, pipeline, fibre-optics)
   - highways/primary/secondary/tertiary roads
   - roads, trails, and landings
   - water power stations / dams

ii. Industrial and resource extraction
   - pits and quarries; mining-related sites
   - forest harvest,
   - forest processing facilities
   - agricultural land
   - wind farms

iii. Recreational
   - recreational camps and cottages
   - commercial campgrounds, outposts, and camps

Anthropogenic disturbances were buffered by 500 metres (MNRF 2014a). When buffers overlapped water polygons, the buffer area over water was counted as anthropogenic in the disturbance statistics.

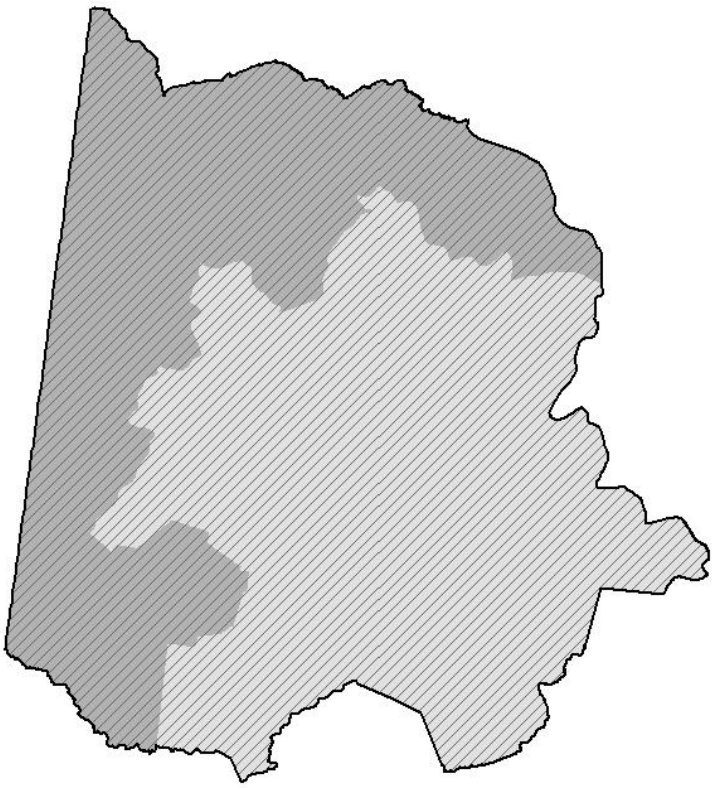


Figure 18. The Berens Range including the extent of the forest resource inventory (FRI) data ( ), the extent of 2012 Provincial Satellite Derived Disturbance Mapping data ( ) and the extent of relevant data from LIO, including Provincial Landcover 2000 ( ).

5.2.2. Disturbance analysis results

The physical disturbance from various sources within the Berens Range (Figure 19 to Figure 24) contributes to the cumulative disturbance footprint (Figure 25). Sections 5.2.2.1 to 5.2.2.6 describe the disturbance contributions of forest harvest, other industry, linear features, mineral development, tourism, and natural disturbances relevant in 2012.

5.2.2.1. Forest harvest

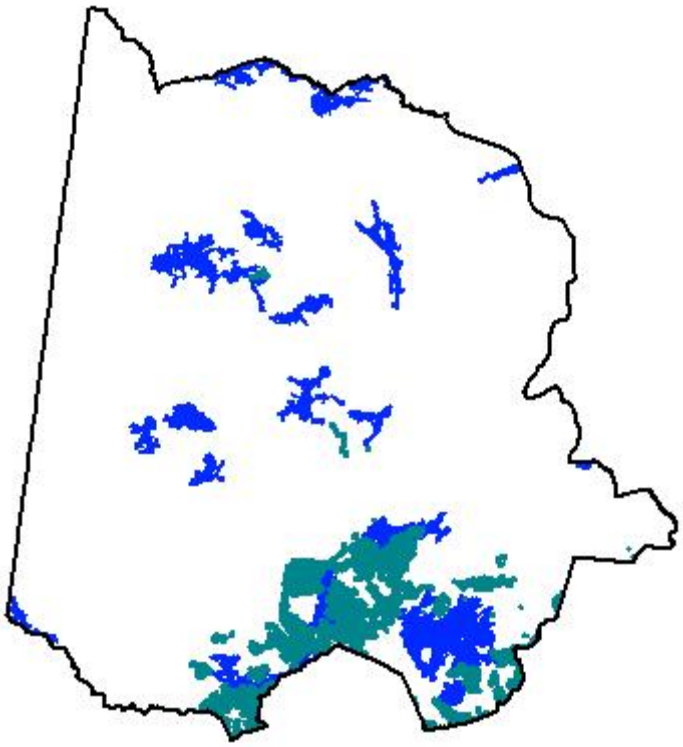


Figure 19. Forest harvest disturbances ( ) including 500 metre buffers in the Berens Range.

Table 9. Forest harvest statistics in the Berens Range.

Harvest feature	Count (n)	Area (ha)	Buffer area (ha)
Harvest stands (FRI)	9,875	52,199	85,930
Harvest areas (2012 Provincial Satellite Derived Disturbance Mapping)	52	322	8,290
Harvest areas (PLC 2010)	n/a[1]	11	680

[1]Derived from land cover (raster) and count of number features not available

5.2.2.2. Other industry disturbance

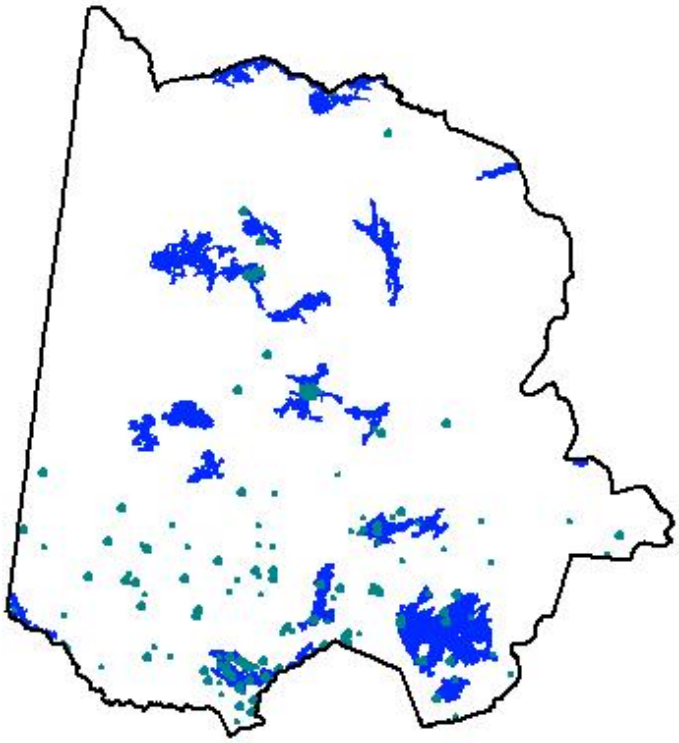


Figure 20. Other industry features ( ) including 500 metre buffers in the Berens Range.

Table 10. Other industry disturbance statistics in the Berens Range.

Other industry feature	Count (n)	Area (ha)	Buffer area (ha)
Agriculture / Grass	1	<1	104
Airports	3	13	520
Buildings	921	n/a[1]	9,077
Dams	0	0	0
Forest processing facilities	1	n/a[1]	79
Infrastructure	0	0	0
Towers	1	n/a[1]	700
Trap cabin	51	n/a[1]	4,001
Utility Sites	0	0	0
Waste disposal sites	2	<1	163
Water power generating stations	0	0	0
Work camps	0	0	0

[1]Features are represented by point data types; area not available

5.2.2.3. Linear features disturbance

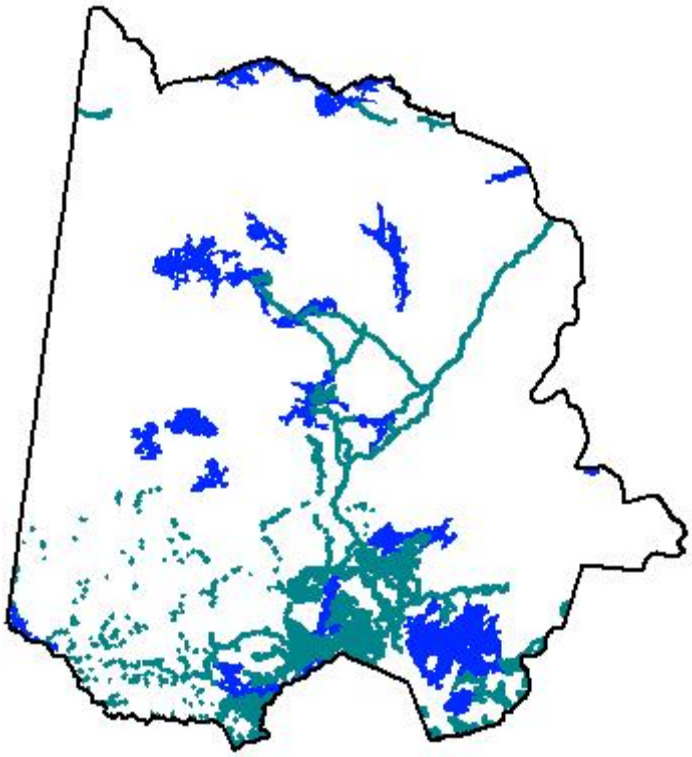


Figure 21. Linear features ( ) including 500 metre buffers in the Berens Range.

Table 11. Linear features disturbance statistics in the Berens Range.

Linear feature	Count (n)	Area (ha)	Buffer area (ha)
Roads	n/a[1]	n/a[2]	140,024
Trails	n/a[1]	n/a[2]	54,299
Rail lines	0	0	0
Utility lines	0	0	0

[1] Single line features crossing entire range boundaries or multi-part features
[2] Features used in analysis represented by centre-line, not right-of-way; area not available

5.2.2.4. Mineral development disturbance

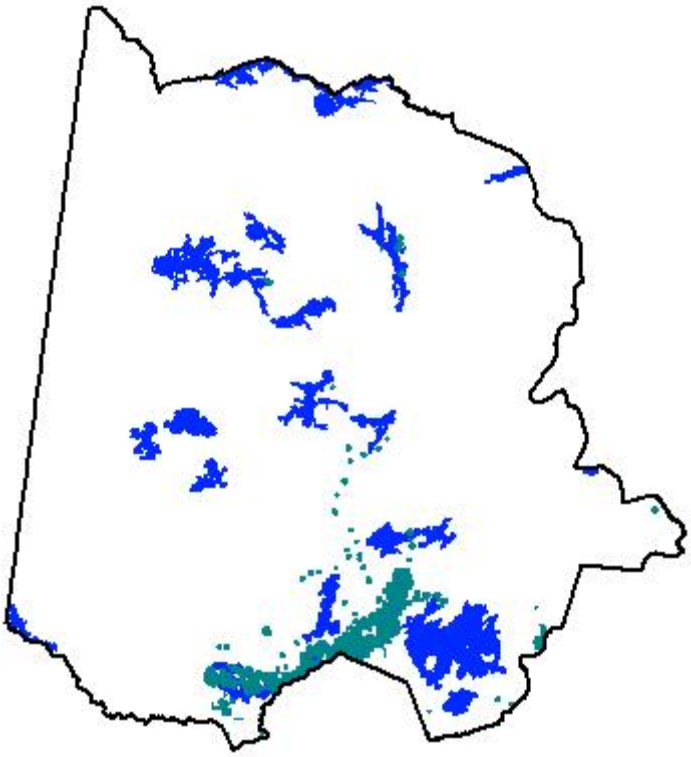


Figure 22. Mining and mineral exploration features ( ) including 500 metre buffers in the Berens Range.

Table 12. Mining disturbance statistics in the Berens Range.

Mining feature	Count (n)	Area (ha)	Buffer area (ha)
Active mining claims	618	47,115	n/a[2]
Aggregate sites – authorized	0	0	0
Aggregate sites – un-rehabilitated	0	0	0
Drill holes	735	n/a[1]	8,976
Mining locations	0	0	0
Mine (shafts, open pit)	18	<1	1,228
Pits and quarries	90	857	7,288

[1] Drill holes are “point features”. Disturbance extent is represented by the buffer area.
[2]Active mining claims are not buffered. As no specific disturbance records representing the amount or extent of clearings, drill pads, trails, cut lines etc. are digitally available for these analyses, the entire claim area is considered disturbed.

5.2.2.5. Tourism infrastructure disturbance

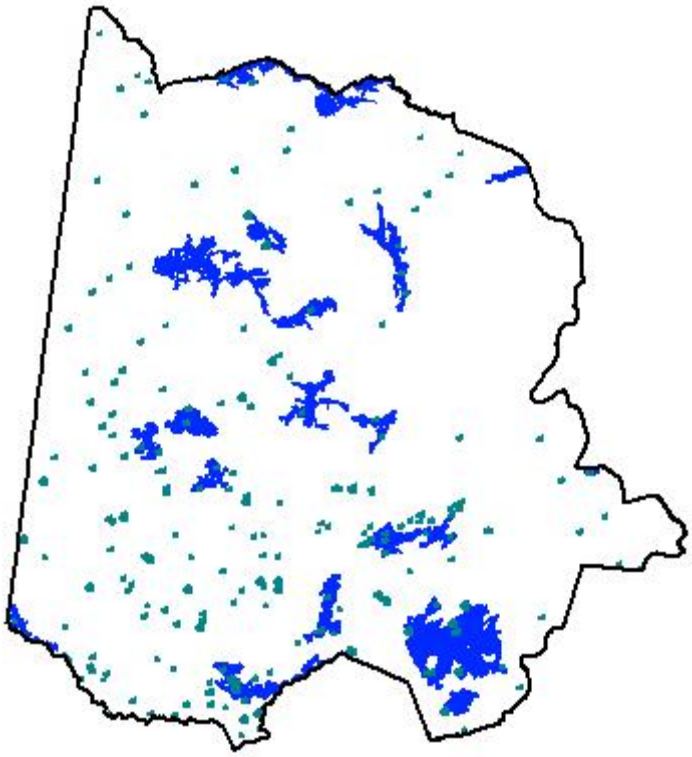


Figure 23. Tourism infrastructure features ( ) including 500 metre buffers in the Berens Range.

Table 13. Tourism infrastructure disturbance statistics in the Berens Range.

Tourism feature	Count (n)	Area (ha)	Buffer area (ha)
Cottage and residential areas	6	39	778
Cottage and residential sites	75	6	3,948
Commercial campgrounds/parking lots/outpost camps/main base lodges	127	43	9,844

5.2.2.6. Natural disturbance

Similar to the anthropogenic disturbance analysis, there were several cases where the same landscape disturbance existed in two or more of these datasets. In these cases the most up-to-date source and the source that contained the finest resolution was used.

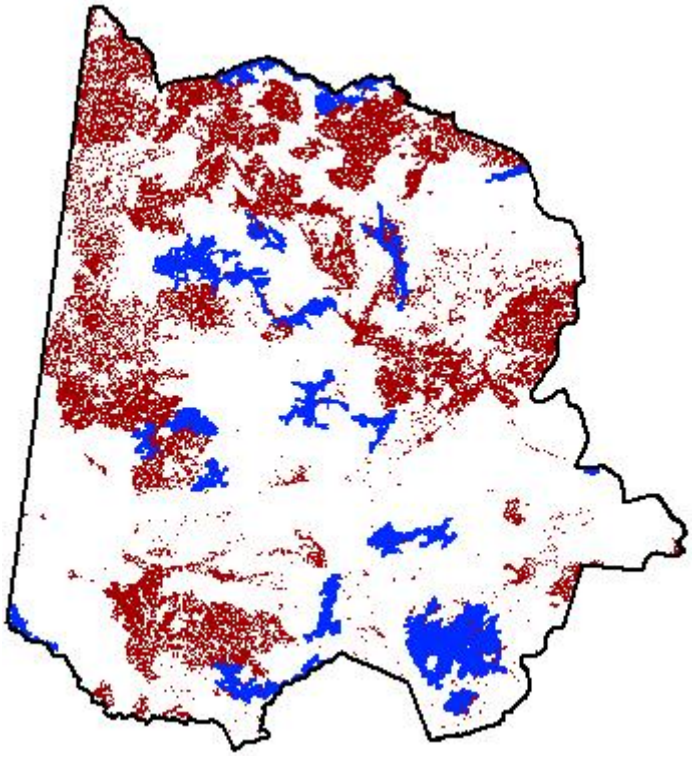


Figure 24. Natural disturbances from fire, blow-down, snow, and insect damage (■) in the Berens Range

Table 14. Natural disturbance statistics in the Berens Range.

Natural feature	Count (n)	Area (ha)	Buffer area (ha)[1]
Fire (FRI)	n/a	196,385	n/a
Fire (2012 Provincial Satellite Derived Disturbance Mapping)	n/a	272,361	n/a
Weather (2012 Provincial Satellite Derived Disturbance Mapping)	n/a	4,251	n/a
Unknown causes (2012 Provincial Satellite Derived Disturbance Mapping)	n/a	30	n/a
Fire (PLC 2000)	n/a	190,619	n/a
Fire (LIO)	n/a	80,539	n/a

[1]No zone of influence (buffer) associated with natural disturbance

5.2.3. Disturbance analysis summary

Water accounts for 15.6% of the landscape area within the Berens Range. Approximately 42.5% of the land area of the range is represented by data sources other than the FRI. Table 15 includes range statistics which assist with the interpretation of the disturbance map (Figure 25 and Figure 26). The amount of area, inferred as functional habitat loss identified from the disturbance analysis amounts to 800,892 ha, or 28.7% of the Berens Range. Natural disturbance accounts for 19.4% of the range and anthropogenic disturbance accounts for 9.3% of the range. The overlap of natural and anthropogenic disturbances accounts for 0.8% of the range area, and 2.9% of total disturbance, this value is counted as part of anthropogenic disturbance.

Table 15. Berens Range landscape statistics.

Range component	Area (ha)	%
Total range area	2,793,021	100.0
Water	434,971	15.6
Non-water	2,358,050	84.4
FRI extent[1]	1,605,737	57.5
Non-FRI extent[1]	1,187,284	42.5
Total disturbance within range	800,892	28.7
Natural[2]	542,231	19.4
Anthropogenic[2]	258,661	9.3
- Overlap of natural and anthropogenic disturbance[3]	23,258	0.8
Not disturbed within range	1,992,129	71.3

[1]FRI and non-FRI extents include water
[2]Anthropogenic disturbances include a 500 m buffer. When an anthropogenic disturbance overlaps with a natural disturbance it is counted as an anthropogenic disturbance.
[3]Overlap is included in the total amount of anthropogenic disturbance

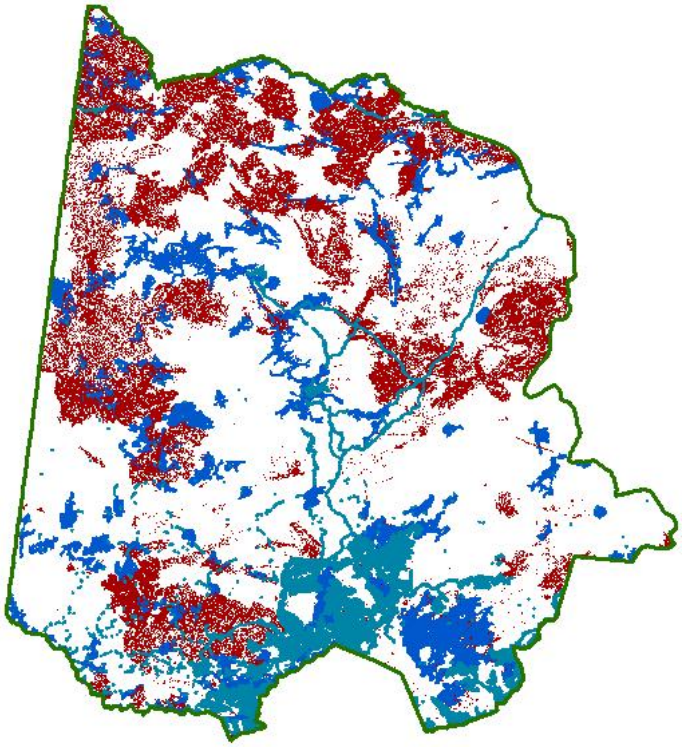


Figure 25. Anthropogenic[1] ( ) and natural ( ) (i.e. forest <36 years) in the Berens Range.
[1]Anthropogenic disturbances include a 500 m buffer. When anthropogenic disturbances overlap with natural disturbances it is counted as anthropogenic.

The pattern of disturbance across the Berens Range reflected in 100 km^2 hexagons (Figure 26). Higher concentrations of disturbance are noted in the south, associated with anthropogenic causes, and in pockets throughout the northern part of the range where natural disturbances are prevalent.

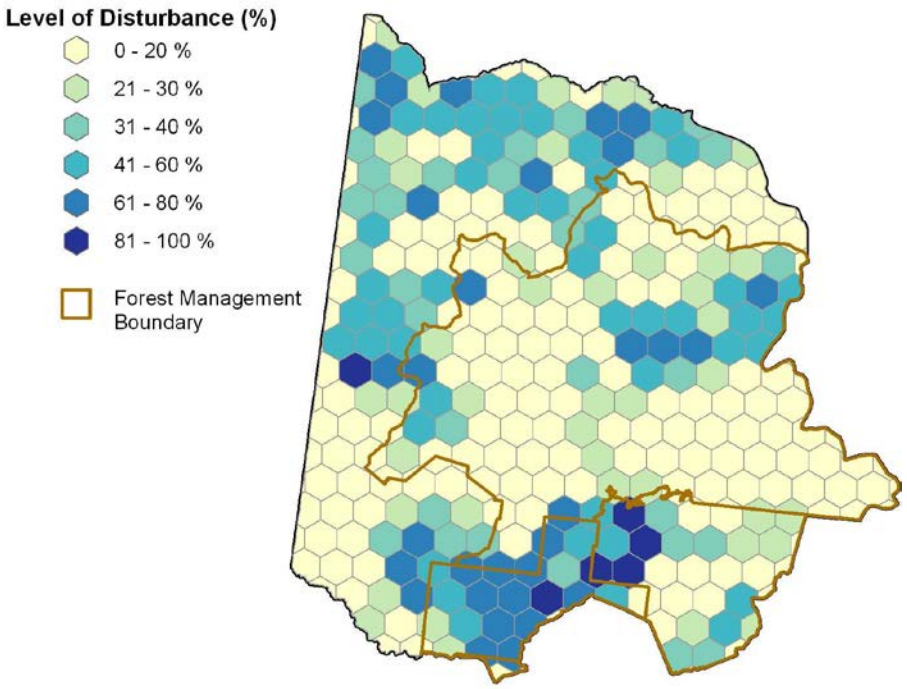


Figure 26. The concentration of natural and anthropogenic disturbances on the Berens Range within 100 km^2 hexagon grid cells **(**used for the probability of occupancy survey) (Section 3.3).

In addition to the physical landscape disturbance representing functional habitat loss as described using these methods, sensory disturbance (not addressed in this analysis) may also contribute to range quality to some degree. Sensory disturbance includes the displacement of caribou due to human recreational or industrial activities.

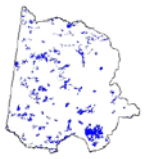
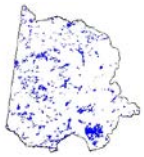
5.2.4. Disturbance considerations related to water

Water accounts for a substantial portion of the Berens Range (15.6%) and contributes to the ability of caribou to isolate themselves from predators and the provision of calving habitat. However, the footprint of natural and anthropogenic disturbances (such as wildfires and harvest blocks) does not directly apply to waterbodies within the range. Therefore, the intensity and extent of disturbances and the associated functional habitat loss is likely underestimated when represented as a proportion of the total range area.

A sensitivity analysis was conducted in which waterbodies of different size classes were removed (Table 16) and the proportion of disturbance on the landscape was adjusted accordingly. This was completed to assist with interpretation of the disturbance analysis results and to inform the interpretation of the integrated probability of persistence calculated using the results of the disturbance analysis.

As the sensitivity analysis shows, water accounts for a combined area of 4,352 km^2 of the range and disturbance ranges from 28.7-34%, depending on the inclusion of water.

Table 16. Disturbance sensitivity analysis. The percent disturbance is estimated by removing waterbodies of different sizes from the denominator (i.e. lakes > 10,000 ha, lakes > 5,000 ha, lakes > 1,000 ha, lakes > 500 ha, lakes > 250 ha, and all water).

Berens Range	Waterbody	Water ha (%)	Disturbance (%)		
			Natural	Anthropogenic	All
	Range extent	0 (0.0)	19.4	9.3	28.7
	> 10,000 ha removed	34,518 (1.2)	19.7	9.4	29.0
	> 5,000 ha removed	92,254 (3.9)	20.1	9.6	29.7
	> 1,000 ha removed	164,189 (5.9)	20.6	9.8	30.5
	> 500 ha removed	214,625 (7.7)	21.0	10.0	31.1
	> 250 ha removed	256,466 (9.2)	21.4	10.2	31.6
	All Water removed	434,971 (15.6)	23.0	11.0	34.0

5.2.5. Habitat State: habitat assessment

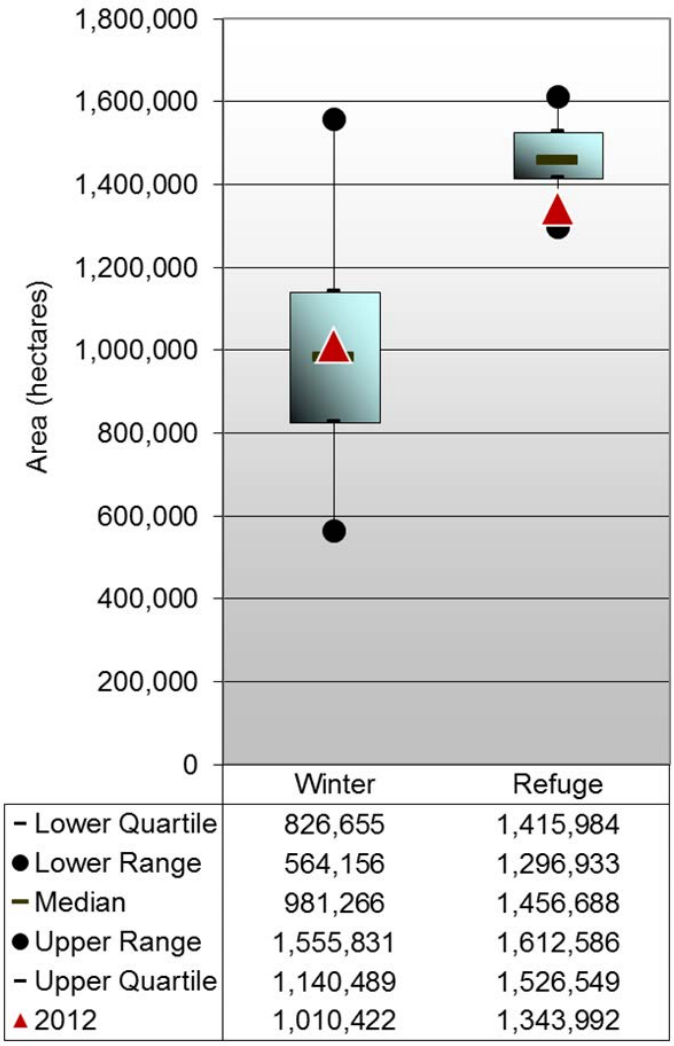
Habitat assessment compares the current amount and arrangement of habitat against that projected by the Simulated Range of Natural Variation, or SRNV (MNRF 2014a). For the Berens Range, both the amount and arrangement SRNV are compared against 2012 amounts and 2010 arrangement as inferred from the FRI (Figure 27). The relative difference is a measure of how close or how far away the range is to the natural levels of habitat. This comparison informs the interpretation of the probability of persistence. The SRNV values may be compared to the land, water, and inventory coverage for the Berens Range (Table 15).

Figure 27. The Berens range including the extent of the FRI data (▒), the extent of 2012 Provincial Land Cover data (▒), and the extent of PLC 2000 data (▒).

5.2.6. Habitat assessment results

5.2.6.1. Caribou habitat SRNV amount

Relative to the SRNV estimate (MNRF 2014a), the amount of winter habitat is within the interquartile range (Figure 28); refuge habitat is above the lower range of the SRNV. The values shown for each FMU include all land regardless of ownership. Consequently, the Integrated Range Assessment estimates are higher than those used in forest management planinng which would include managed crown land only.



	Winter	Refuge
Lower Quartile	826,655	1,415,984
Lower Range	564,156	1,296,933
Median	981,266	1,456,688
Upper Range	1,555,831	1,612,586
Upper Quartile	1,140,489	1,526,549
2012	1,010,422	1,343,992

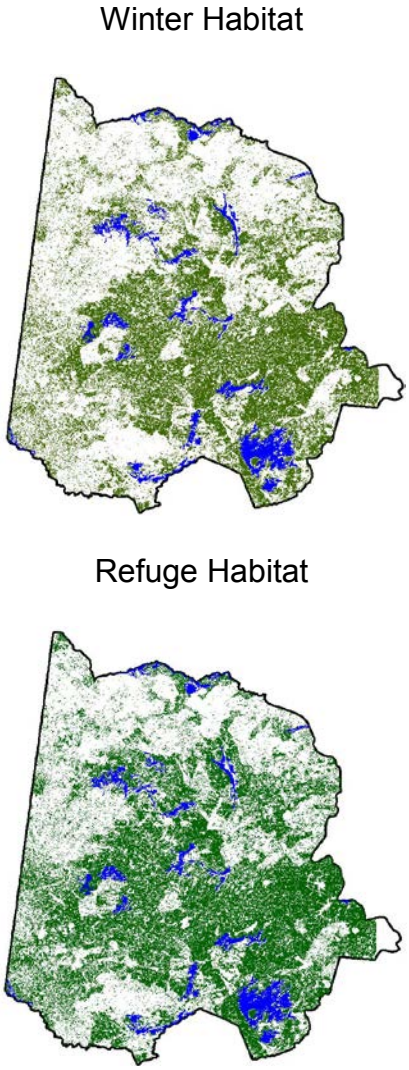
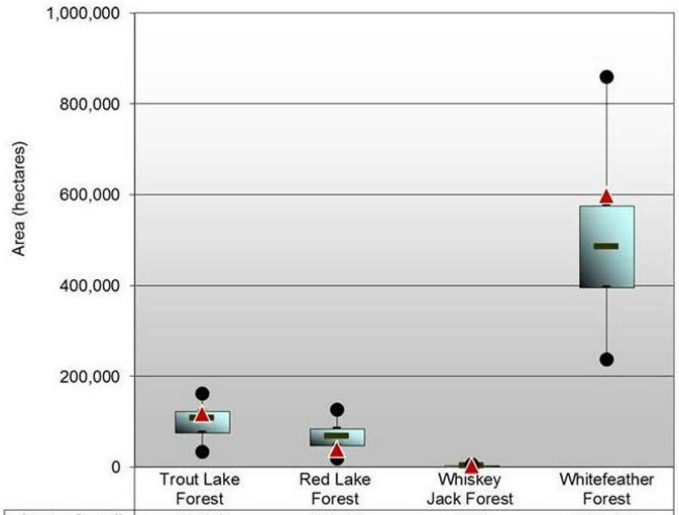


Figure 28. Box and whisker plot of caribou winter and refuge habitat amounts in the Berens Range as compared to the SRNV.

Current winter habitat amounts across the Berens Range were examined according to Forest Management Unit (FMU) (Figure 29). Current amounts within the Trout Lake Forest and the Whiskey Jack Forest (a very small portion of the range) are near the median of the SRNV; the amount in the Red Lake Forest is below the lower quartile but above the lower range; the Whitefeather Forest is above the upper quartile range.



	Trout Lake Forest	Red Lake Forest	Whiskey Jack Forest	Whitefeather Forest
– Lower Quartile	76,692	48,689	913	397,198
● Lower Range	33,574	18,550	159	236,587
– Median	107,567	67,644	2,218	485,158
● Upper Range	161,375	127,080	5,881	859,482
– Upper Quartile	123,685	85,407	3,517	576,159
▲ 2012	118,480	38,892	2,231	599,306

Figure 29. Box and whisker plots of winter habitat amount for each of the Forest Management Units within the Berens Range as compared to the SRNV.

Current refuge habitat amounts across the Berens Range were also examined according to Forest Management Unit (Figure 30). All current amounts are below the lower quartile of the SRNV, except Trout Lake Forest, which is below the median and above the lower quartile; the Red Lake Forest and the Whitefeather Forest are also below the lower range of the SRNV.

	Trout Lake Forest	Red Lake Forest	Whiskey Jack Forest	Whitefeather Forest
– Lower Quartile	148,140	103,374	2,952	890,764
● Lower Range	118,093	91,232	1,786	801,654
– Median	161,420	107,351	3,564	937,037
● Upper Range	178,509	122,724	4,221	1,045,539
– Upper Quartile	168,215	112,914	3,846	976,530
▲ 2012	156,233	79,655	2,923	801,449

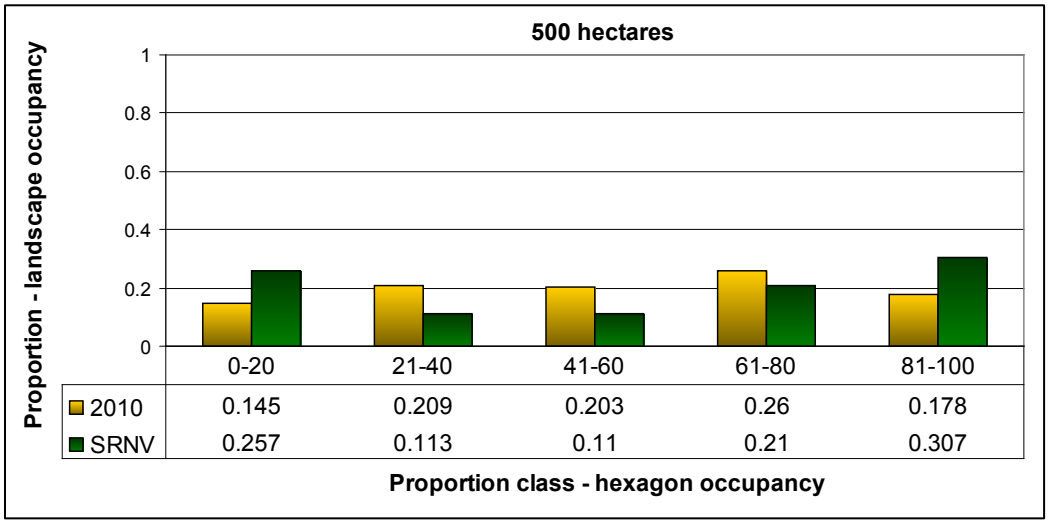
Figure 30. Box and whisker plot of refuge habitat amount for the Forest Management Units within the Berens Range as compared to the SRNV.

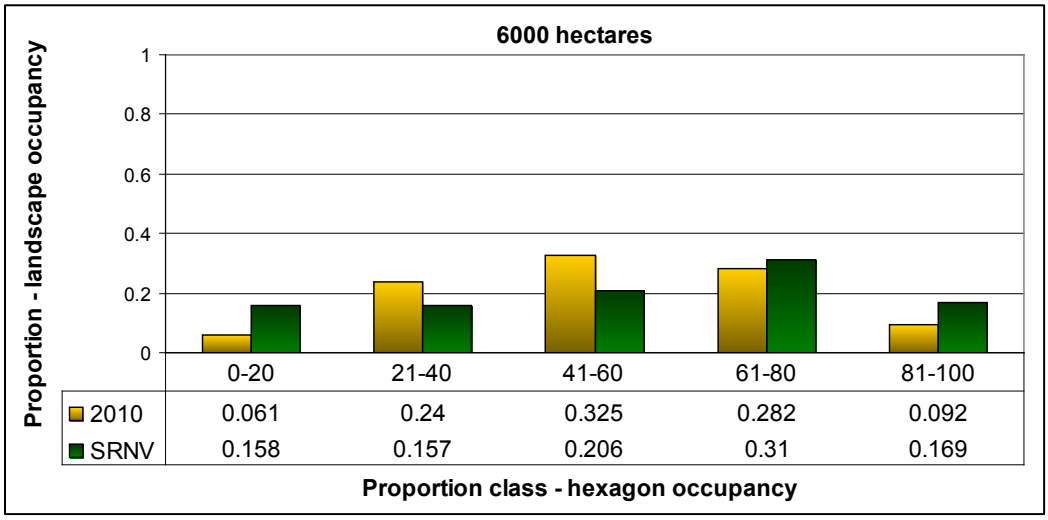
5.2.6.2. Winter habitat arrangement

At the 6,000 hectare level, 37.4% (0.282 + 0.092 = 0.374) of the hexagons have 61 % or more winter caribou habitat (Figure 31). The mean from the SRNV is greater with 47.9% (0.31 + 0.169 = .379) of the hexagons having 61% or more winter caribou habitat. Most of this difference occurs in the 81-100% size class. This represents a present arrangement value 22% below the SRNV.

At the 30,000 hectare level, 31.5 % (0.286 + 0.029 = 0.315) of the hexagons have 61% or more winter caribou habitat. The mean from the SRNV is greater with 43.1% (0.365 + 0.066= 0.431) of the hexagons having 61% or more winter caribou habitat. This represents a present arrangement value 11.6% below the SRNV.

Caribou winter habitat measured at the 6,000 and 30,000 ha levels is fragmented relative to our estimates of the natural landscape.





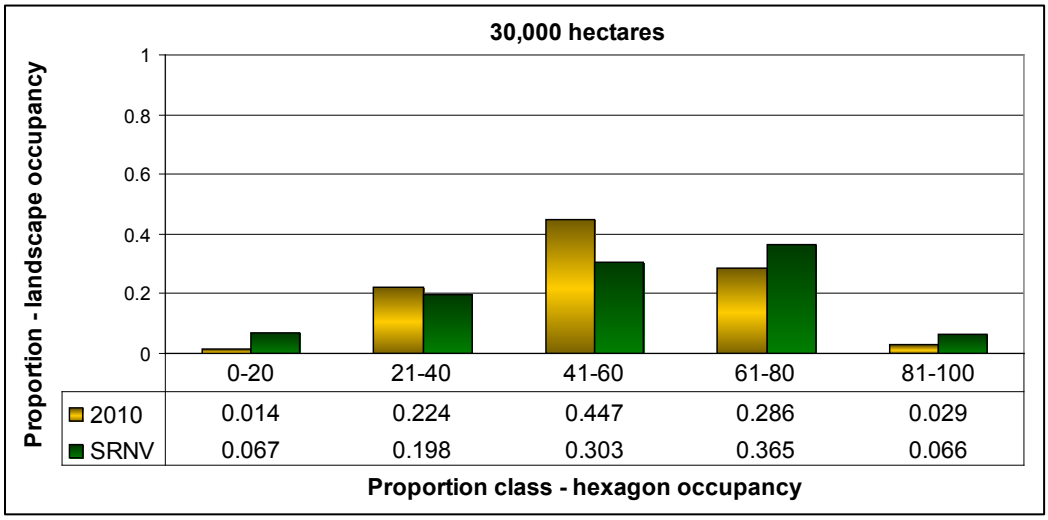


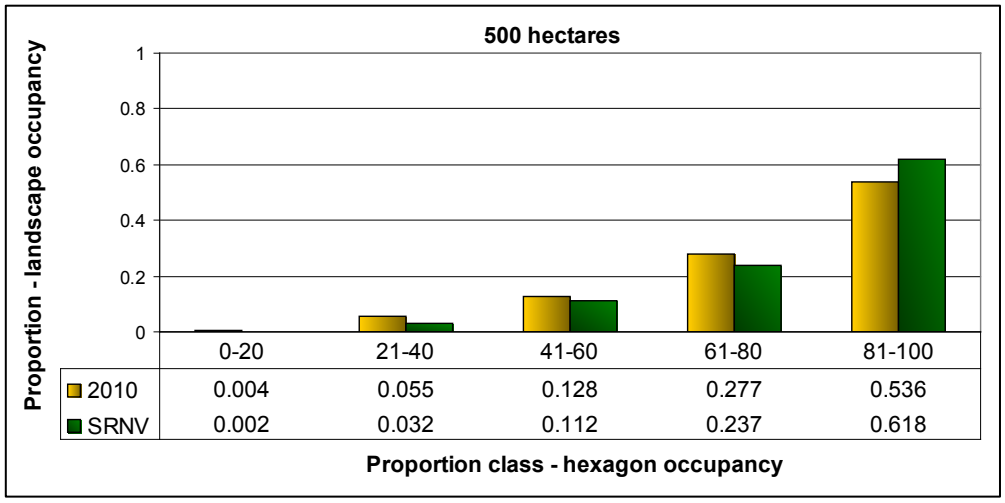
Figure 31. Caribou winter habitat texture histogram compared to means from the SRNV at the 500, 6,000, and 30,000 hectare levels for the Berens Range.

5.2.6.3. Refuge habitat arrangement

At the 6,000 hectare level, 87.3 % (0.4 + 0.473 = 0.873) of the hexagons have 61% or more refuge habitat. The mean from the SRNV is greater with 91.5% (0.315 + 0.6 = 0.915) of the hexagons having 61% or more refuge habitat. Most of this difference occurs in the 81-100% size class. This represents a present arrangement value 9% below the SRNV.

At the 30,000 hectare level, 90.9 % (0.466 + 0.443 = 0.909) of the hexagons have 60% or more refuge habitat. The mean from the SRNV is greater with 96.8% (0.38 + 0.588 = 0.968) of the hexagons with 61% or more refuge habitat. This represents a present arrangement value 5.9% below the SRNV

Caribou refuge habitat measured at the 6,000 and 30,000 ha levels is fragmented relative to our estimates of the natural landscape.



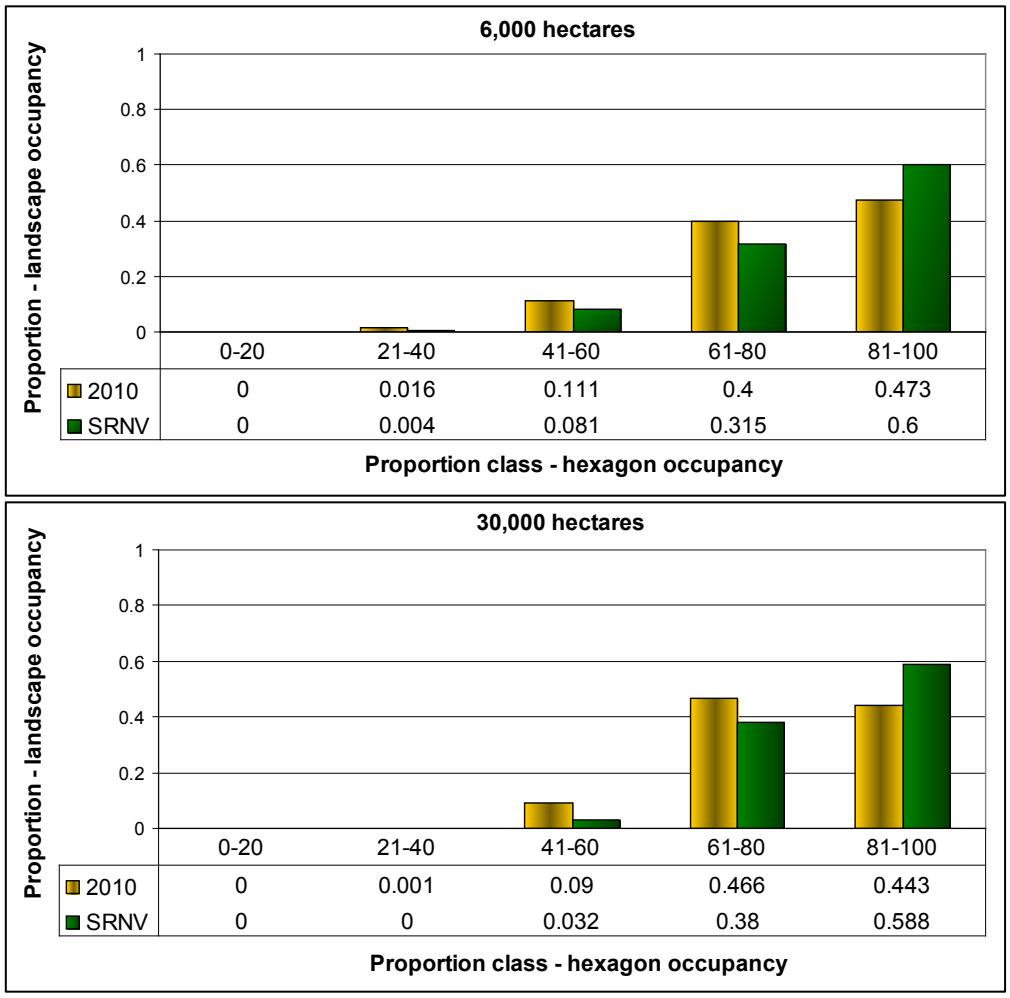


Figure 32. Caribou refuge habitat texture histogram compared to means from the SRNV at the 500, 6,000, and 30,000 hectare levels for the Berens Range.

5.2.6.4. Young forest SRNV area results

The current amount of young forest is just below the lower quartile range estimated by the SRNV (Figure 33). This indicates that there is less young forest on the landscape than what is expected in a natural system. Young forest includes all young forests regardless of origin and includes forest areas created by fire, forest harvest, or blowdown. An increase in the amount of young forest above the median will lead to deterioration in the quality of caribou habitat within the range.

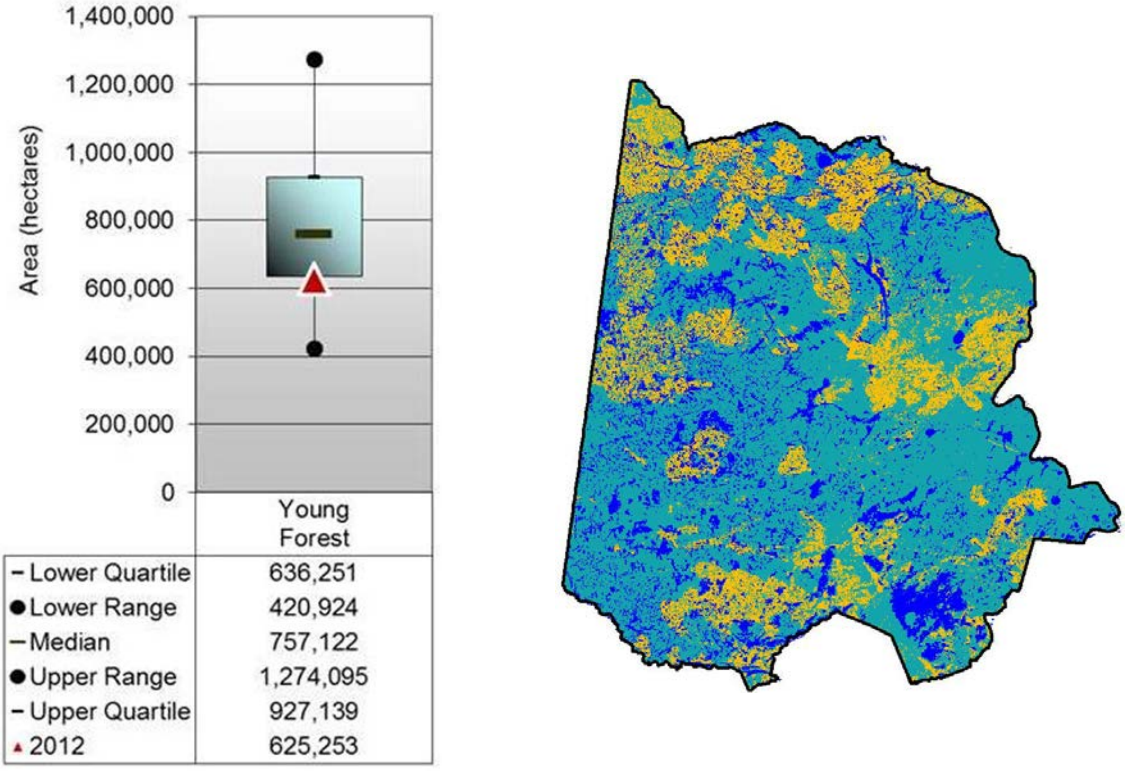


Figure 33. Box and whisker plots of young forest (i.e. <36 years) and permanent disturbance in the Berens Range as compared to the SRNV.

6.0 Interpretation of Lines of Evidence

6.1. Interpretation of the population state

The minimum animal count for caribou (MAC) occupying the Berens Range was determined to be 237 caribou. In 2002, the MAC from the Northern Boreal Initiative survey was 474 (Racey et al. 2006). One major difference between the two surveys was the distance between fixed-wing flightlines: the 2002 survey were spaced 4 km apart while the 2012 survey was spaced 10 km apart. It is likely that the population of the Berens Range is more than 500.

Recruitment rates in 2012 and 2013 (4.8 and 23.9 calves per 100 AF_{adj}, respectively) were well below the threshold for maintaining a stable population (28.9 calves per 100 adult females, assuming an adult female survival rate of 85%, EC 2008, EC 2011). The large annual variation in recruitment rates illustrates the need for longer term monitoring. Low recruitment in 2012 was also observed in Manitoba as well as the adjoining Churchill and Sydney ranges. It is likely that other factors, such as weather patterns during the previous year, may have contributed to low calf survival within this larger region. Higher estimates of percent calves in the population (15.8 and 18.8%) were obtained in three plot areas on the Berens Range in 2003 (Racey et al. 2006), as compared to the range-wide survey in 2012 (2.8%). This suggests that the 2012 survey may have just been a bad recruitment year. Percent calves from 2002 was also low (6.4%) but may be explained by several factors (Racey et al. 2006).

Although adult female survival was 87%, the resulting population growth rate (λ) was in decline (0.93). The low recruitment rates indicate a low recovery potential for caribou residing within the Berens range. Additional estimates of survival and recruitment from the collared caribou in future years will be important to refine out estimate of population trend (MNRF 2014a).

Probability of occupancy estimate was highest in a band across the central portion of the range. There is an apparent inverse relationship between occupancy estimates (Figure 10) and the amount of disturbance (Figure 12). Areas of low occupancy in the south are associated with relatively large natural or forest harvest disturbances. Areas of low probability of occupancy in the north are associated primarily with natural disturbances. The average range-wide probability of caribou occupancy without habitat covariates (0.46; ±0.08) is best used as a quantitative benchmark against which to compare future assessment results. Modelled indices are sensitive to the data employed and care will need to be taken to ensure consistency in the survey design standards, data and analytical methods to ensure appropriate comparisons of change through time.

The degree of immigration and emigration across range boundaries is not known, although there is evidence to suggest caribou traverse the western (Atikaki-Berens in Manitoba), southern (Sydney), eastern (Churchill), and northeast (Kinlock) range boundaries. The extent to which immigration and emigration may contribute to population state may not be estimated at this time.

6.2. Interpretation of habitat state

Almost 30% of the Berens Range is disturbed. Two thirds of the disturbance is a result of natural causes, and is primarily in the northern part of the range. One third of the disturbance is attributed to anthropogenic causes, which are concentrated in the south-central part of the range. The hexagonal disturbance analysis on the Berens Range determined that few hexagonal cells were highly disturbed (81-100%) and that most were determined to have low (0-20%) concentrations of disturbance.

Overall, 28.7% (all waterbodies included) of the Berens Range is considered disturbed. As a result, the likelihood of a stable or increasing population growth is approximately 0.7. The influence of waterbodies in the disturbance analysis should be considered when evaluating the level of disturbance within the range. The water sensitivity analysis (see section 5.2.4) demonstrated that the disturbance estimate for the Berens Range may be as great as 34%. At such a level, the range may still sustain caribou but is increasing uncertainty. However, it is possible that landscapes containing large waterbodies with islands may help compensate for moderate levels of landscape disturbance by providing valuable caribou habitat because the surrounding body of water may provide additional refuge.

Collectively, there are a number of anthropogenic disturbance types not addressed in the above analyses including winter commercial fishing, outfitter activities, access points, camps sites, and shore lunch activities – all of which are suspected to influence caribou, contribute to habitat alteration, as well as sensory disturbance. The extent and intensity of these

disturbances are not quantified but the impacts are expected to be considerable at a local scale.

The amount of winter habitat on the Berens Range is currently just above the median, whereas the refuge amount is above the lower range. Increasing the amount of refuge habitat in the Whitefeather and Red Lake FMUs to within the interquartile range, and increasing the amount of winter habitat in the Red Lake FMU would create conditions that would more commonly have occurred in landscapes to which caribou have adapted.

Currently, both winter and refuge habitats are fragmented as compared to the SRNV at both the 6,000 and 30,000 ha scales. Similar to habitat amount, creating and retaining strategically placed large contiguous patches of mature conifer and winter suitable habitat would create conditions that would have more commonly occurred in landscapes to which caribou have adapted. Retaining the amount of young forest at or below the estimated natural landscape of the SRNV is desirable to improve prospects for caribou conservation and recovery.

At present, the amount of young forest (including permanent disturbances) within the Berens Range is below the lower quartile of the SRNV. Islands on large lakes are considered valuable caribou habitat, but the conventional assignment of winter and refuge habitat value is not always appropriate. In this circumstance, the refuge value of islands is typically high, regardless of the underlying vegetation condition, although conifer forest conditions are generally more desirable than mixed forest conditions.

7.0 Integrated Risk Assessment

7.1. Population size

The minimum number of caribou on the Berens Range is 237 (Figure 34) and likely exceeds 500 based on earlier minimum animal counts. The Berens is part of the Continuous Distribution in Ontario and some immigration and emigration likely occurs. By using the minimum animal count of 237, estimates of probability of persistence are likely precautionary. The probabilities of persistence for 20 and 50 years, under the assumption of stable or increasing population growth, are 0.92-1.0 and 0.75-0.9 respectively (MNRF 2014a; EC 2011).

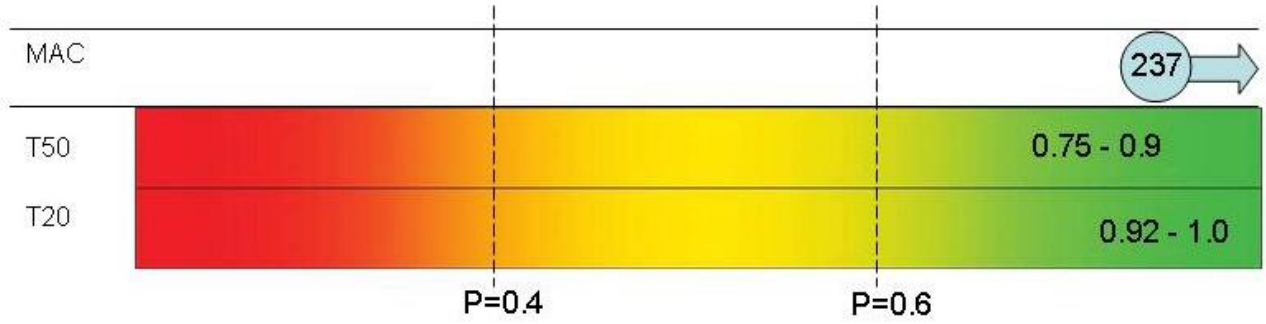


Figure 34. Minimum animal count (MAC) in the Berens Range estimated from the 2012 winter aerial survey as compared to probability of persistence in 20 years (T20) and 50 years (T50).

If the Berens Range and the Atikaki-Berens Range are considered together and caribou are assumed to move freely across the provincial boundary, then the minimum number of caribou would exceed 523 caribou (i.e. 237 (Berens) and 286 (Atikaki-Berens)) resulting in expected probabilities of persistence for 20 and 50 years of 1.0 and 0.95-1.0 respectively.

7.2. Population trend

The current estimate of trend, based on 2011-2012 biological years, suggests a short-term decline (geometric mean λ = 0.93) (Figure 35). Uncertainty exists regarding a long-term trend as survival from the 2012 biological year was good but recruitment rates were low and extremely variable. Future recruitment and survival estimates from collared females will continue to inform and support the population trend information. The longer term trend in the extreme southern portion and currently managed portion of the range appears to be in decline but represents a small area compared to the total range extent.

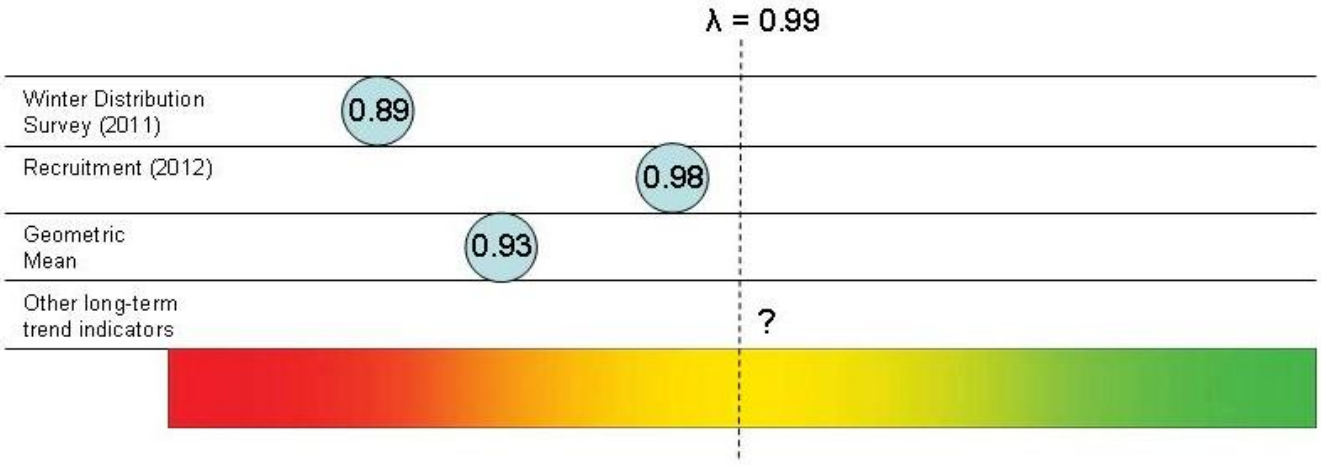


Figure 35. Estimated population trend (λ) for the Berens Range according to the source of the data (i.e. survey) and the corresponding biological year (not the survey year), as well as the short-term trend (geometric mean) and long-term trend as determined from other trend indicators.

7.3. Disturbance analysis

The Berens Range is 28.7% disturbed (Figure 36). Calculated values of disturbance range from 28.7-34.0 %, depending on the treatment of water. When considering the accuracy of fine-scale data used in the disturbance analysis, we believe the calculated value of 28.7% provides a realistic depiction of the amount of disturbance in the Berens Range. This level of disturbance would suggest that the likelihood of stable or increasing population growth is greater than 0.7 and is considered likely.

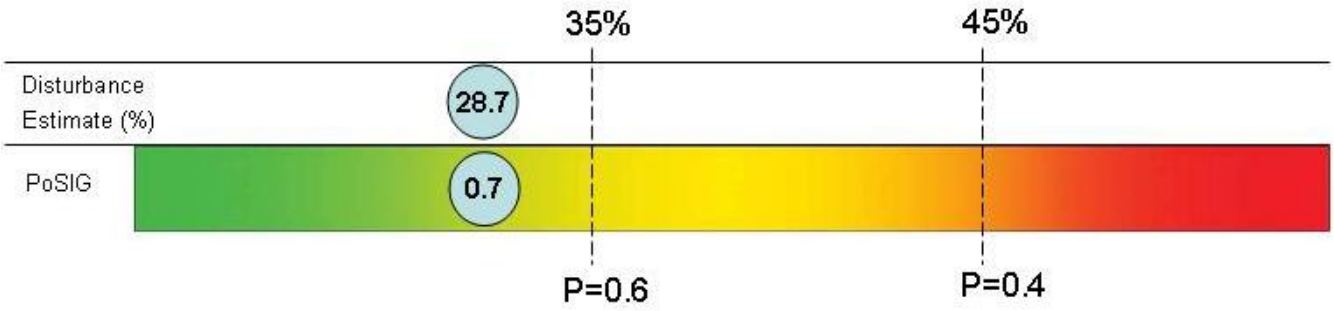


Figure 36. Disturbance estimate as a percentage of area within the Berens Range as it relates to the probability of stable or increasing population growth (PoSIPG).

7.4. Integrated risk assessment process

The six steps of the risk assessment process as identified in the Protocol (Figure 15 in MNRF 2014a) lead to a conclusion of the degree of risk.

Step 1: Lambda is less than 0.99 and the likelihood of a stable or increasing population growth exceeds 0.4; MAC is greater than 80 caribou

Step 2: Lambda is available but is less than 0.99

Step 5: Likelihood of stable-or-increasing population growth based on the level of landscape disturbance is greater than 0.6 *AND* lambda is not considered reliable due to a small number of years of mortality and recruitment data *AND* the population is not maintained by population management actions.

Step 4: Probability of persistence is greater than 0.6

Based on this analysis, risk to caribou in the Berens Range is low.

7.5. Range condition

Risk is estimated to be low in the Berens Range. The amount of winter habitat is within the interquartile range and refuge habitat is just above the lower range relative to the SRNV; the arrangement of habitat is fragmented relative to the SRNV, implying a diminshed range condition compared to that suggested by the integrated risk analysis alone. Therefore, the Assessment Team determined that it is uncertain if range condition is sufficient to sustain caribou.

8.0 Involvement of First Nation Communities

Red Lake staff discussed the Integrated Range Assessment with the communities of Pikangikum, Deer Lake, Poplar Hill, Grassy Narrows, Wabaseemoong, and Manitoba First Nation communities Pauingassi and Little Grand Rapids. Community members involved in the

2012 winter aerial survey work includes George Land (Wabaseemoong), Darrell Keeper (Pikangikum), Freddie Meeseewapetung and Isiah Pahpasay (Grassy Narrows), and Seymour Owen (Poplar Hill). In September 2011, notification letters were sent to each of the above communities describing the planned Integrated Range Assessment work. Follow up was undertaken through phone calls and visits to the communities in the ensuing weeks. The following is a summary of face-to-face meetings held with communities.

- While in the community during the winter of 2011, MNRF representatives met with Deer Lake First Nation Chief and Council to describe the survey in greater detail.
- While meeting with representatives of Pauingassi and Little Grand Rapids First Nation in Manitoba, during the winter of 2011, further details regarding the Integrated Range Assessment work were shared and discussed.
- Correspondence between Pikangikum First Nation, the Whitefeather Forest Management Corporation (WFMC) and MNRF led to a number of informal meetings and discussions throughout the winter of 2011/2012 with the WFMC Elders Steering Group. MNRF shared details of the Integrated Range Assessment work and discussed and addressed comments and concerns from the WFMC Elders Steering Group. MNRF and the WFMC Elders Steering Group also discussed community participation on survey crews.
- Poplar Hill First Nation invited MNRF representatives to the community during the winter of 2011 for a half-day session to share further details on the Integrated Range Assessment work and discuss community participation on survey crews.
- Two visits to Grassy Narrows First Nation were organized; one in the winter of 2011 and one in the winter of 2012. During the first meeting, the Integrated Range Assessment work was discussed in greater detail and questions and concerns regarding the survey work were discussed. Follow-up from the head of the Grassy Narrows Trapper's Council after the first meeting indicated a willingness by community members to participate in the survey work. During the second meeting, a trip to a seventh grade class was organized by the head of the Grassy Narrows Trapper's Council so that youth could learn more about the work. During the second visit community participation in the work was further discussed.
- One visit to Wabaseemoong was organized in the winter of 2011.

While understanding of and support for the Integrated Range Assessment work was generally favourable amongst the majority of the communities, there were some key concerns raised by some community members that became the subject of further discussion including:

- Concerns regarding the extent to which aircraft would disturb or cause the animals to run, leading to stress on the animals that could affect their health.
- Concerns regarding the affixing of collars to animals; the amount of wear on an animal's neck, the stress caused the animal during collaring and increased vulnerability of animals that have been collared.
- Concerns regarding how the information would be used and how the conduct of the survey may either interfere with hunting or information used to make decisions that could affect the harvesting/livelihood activities of community members.

9.0 Comparison with the Federal Generalized Approach

Environment Canada (EC) published a *Scientific Assessment to Inform the Identification of Critical Habitat for Woodland Caribou (Rangifer tarandus caribou), Boreal Population, in Canada* in 2011. Based on available information and specific methodologies used by EC (2011), it was determined that caribou occupying the Berens Range are as likely as not to be self-sustaining. EC concluded that the Berens Range was 39% disturbed; there was no population estimate or probability of persistence determined because of insufficient data at that time. These results were based on best available data at the time provided to EC from the MNRF. Data presented in this IRAR will be used by Environment Canada to update their analysis in the future.

Differences between the Integrated Range Assessment documented in this report and the results of the EC assessment can be attributed to the following:

1. Ontario estimated a minimum animal count of 237, and suggests the population may be larger than 500 caribou.
2. The amount of disturbance identified on the range includes additional disturbance associated with mining claims, linear features, and blowdown events which were not addressed by EC. MNRF used a finer grained depiction of fire disturbance than the broad polygonal fire disturbance used by EC. MNRF determined varied estimates of disturbance associated with stated assumptions relating to the treatment of water in the disturbance calculations.
3. Recruitment and adult survival estimates derived from winter 2012 distribution survey and collared caribou resulted in lambda estimates that suggest a declining short-term trend.
4. MNRF considered amount and arrangement of caribou habitat in the determination of range condition which was not considered by EC.

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