Integrated Range Assessment for Woodland Caribou and their Habitat

Churchill Range 2012

Ministry of Natural Resources and Forestry
Species at Risk Branch

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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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Acknowledgements

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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 provides the direction needed to conserve and recover caribou in Ontario through a Range Management Approach. The Range Management Apporach that provides spatial and ecological context for planning and management decisions. This *Integrated Range Assessment* is a fundamental component of the Range Management Approach because it provides the information required to identify the level of risk to caribou within a range, will help to support management decisions, and can 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 overall range condition relative to the ability of the range to sustain caribou.

The Churchill Range is located in northwestern Ontario and is approximately 21,300 km^2 in size. The landscape is largely characterized as boreal forest with an aggressive fire regime and many small-to-large lakes scattered throughout. Historical occupancy shows that caribou occur across much of the range but have been scarce from southern areas around Lac Seul and Sioux Lookout for decades due to persistent or permanent human activity. There are a number of regionally significant calving lakes within the range including DeLesseps, Churchill, Birch, Confederation, Lac Seul, and Lake St. Joseph. Collaring evidence shows that a connection exists in the northern part of the Churchill Range with areas north of the Cat River system in the Kinloch Range. The range has two extremely large 1961 fires that are expected to provide essential caribou habitat in the very near future. The most prominent ongoing human impact on the range is forest harvesting and the southern portion of the range in particular has been subjected to extensive harvest in the past. Other developmental activities include recent mineral exploration in the Springpole Lake area, a transmission line, and a proposal for an associated all-season road.

A two-stage (fixed-wing followed by rotary-wing) aerial winter distribution survey for caribou was conducted during February and March 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 262 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 (15-25 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). Twenty (20) adult female caribou were collared during the 2012 survey. Annual survival of these animals was 87%, suggesting survival is good. However, the short-term population trend is likely declining with a geometric mean of $\lambda = 0.96$. This estimate

suggests a declining trend and is the result of comparatively low calf recruitment and is supported by other long-term trend indicators.

A geospatial analysis estimated that 41.3% of the range can be currently characterized as natural and anthropogenic disturbance. The resulting likelihood of stable or increasing population growth is estimated to be 0.47 and at this level it is uncertain whether the Churchill Range is capable of sustaining the caribou population.

Analysis of the amount and arrangement of caribou habitat indicates alignment with that expected in a natural landscape

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

1.0 Overview

The Ministry of Natural Resources and Forestry (MNRF), then the Ministry of Natural Resources (MNR), adopted a Range Management Approach as directed by *Ontario's Woodland Caribou Conservation Plan* (CCP) (MNR 2009a). An *Integrated Range Assessment Report* is a major component of the Range Management Approach 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 Range Management Approach 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 are directed by the *Range Management Policy in Support of Woodland caribou Conservation and Recovery (Range Management Policy,* MNRF 2014b).

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 Churchill Range is centrally located in northwestern Ontario and is approximately 21,300 km² in size (Figure 1). The range contains St. Raphael Provincial Park, Miniss Enhanced Management Areas (EMAs), and spans seven ecodistricts. The Churchill Range includes a number of regionally significant calving and nursery areas important to caribou including the following lakes: DeLesseps, Churchill, Birch, Confederation, Lac Seul, and Lake St. Joseph (Figure 2). The Churchill Range spans part of ecoregion 3S and the western edge of 3W, which exhibits a relatively short fire return interval.

There are a number of small communities within the range including Lac Seul and Slate Falls; the largest town center in the vicinity is Sioux Lookout approximately 10 km south of the south-central range boundary. Major transportation corridors within the range include a small portion of Highway 599 running north-south near the eastern boundary, as well as Hwy 516 and the Canadian National Railway that runs east-west in the southeast. There is also a dense network of secondary and tertiary roads. Forest Management Units within the range include most of the Lac Seul Forest, more than half of the Trout Lake Forest, and the northwest corner of the Caribou Forest.

The Churchill Range is bounded in the south in part by the southern extent of caribou occupancy on Lac Seul which is a large lake with dense island archipelagos, some of which have calving and nursery functions. The northern boundary of the range is formed in part by the Cat River lake chain, which has many associated lakes including Lake St. Joseph that is used heavily by caribou that winter within the Caribou Forest and Lac Seul Forest. The northern boundary of the Churchill Range also roughly corresponds to the Area of the Undertaking (AOU) boundary and the Kinloch Range. The western range extent abuts the Sydney and Berens Ranges and the eastern boundary is shared with the Brightsand Range.

Caribou occupy areas immediately north in the Kinloch Range. It is believed that a number of northern waterbodies, particularly within the Cat River lake chain and Lake St. Joseph are likely as important to the caribou in the Kinloch Range as they are to caribou in the Churchill Range. The northern range boundary considered the fact that caribou are relatively continuously distributed and that it was necessary to cover all the currently managed forest in delineated ranges. Therefore Cat River and Lake St. Joseph were identified as the northern boundary. The intent of the northern boundary on the Cat River/Lake St. Joseph system was to include one kilometre of the northern shoreline, starting in the west where the Trout Lake Forest and Lac Seul Forests meet then running east to the Brightsand Range (MNRF 2014c). A similar rationale was used when including one kilometre from the south shore of Lac Seul as the southern boundary.

Range delineation, considered many factors specific to this geography including the relatively small home range sizes in this high density lake country where caribou appear to exhibit relatively little seasonal movement between summer and winter areas (i.e. between the Lac Seul Forest and the northwestern and northcentral section of the Caribou Forest). There are quality summer habitats in the Hooker Lake-DeLesseps Lake area with known linkages to winter range areas south and west in the Lac Seul Forest. There is also evidence of movement from the Lac Seul Forest into the southeastern and northeastern part of the Trout Lake Forest (i.e., Marsh Lake to Confederation Lake, or the seasonal migration into the 1961 burn).

In 1961, two very large forest fires occurred in the centre of the range spanning the southeast portion of the Trout Lake Forest and the northern portion of the Lac Seul Forest. These burns have the potential to provide large landscape patches of suitable habitat for future decades and should be suitable in the very near future.

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

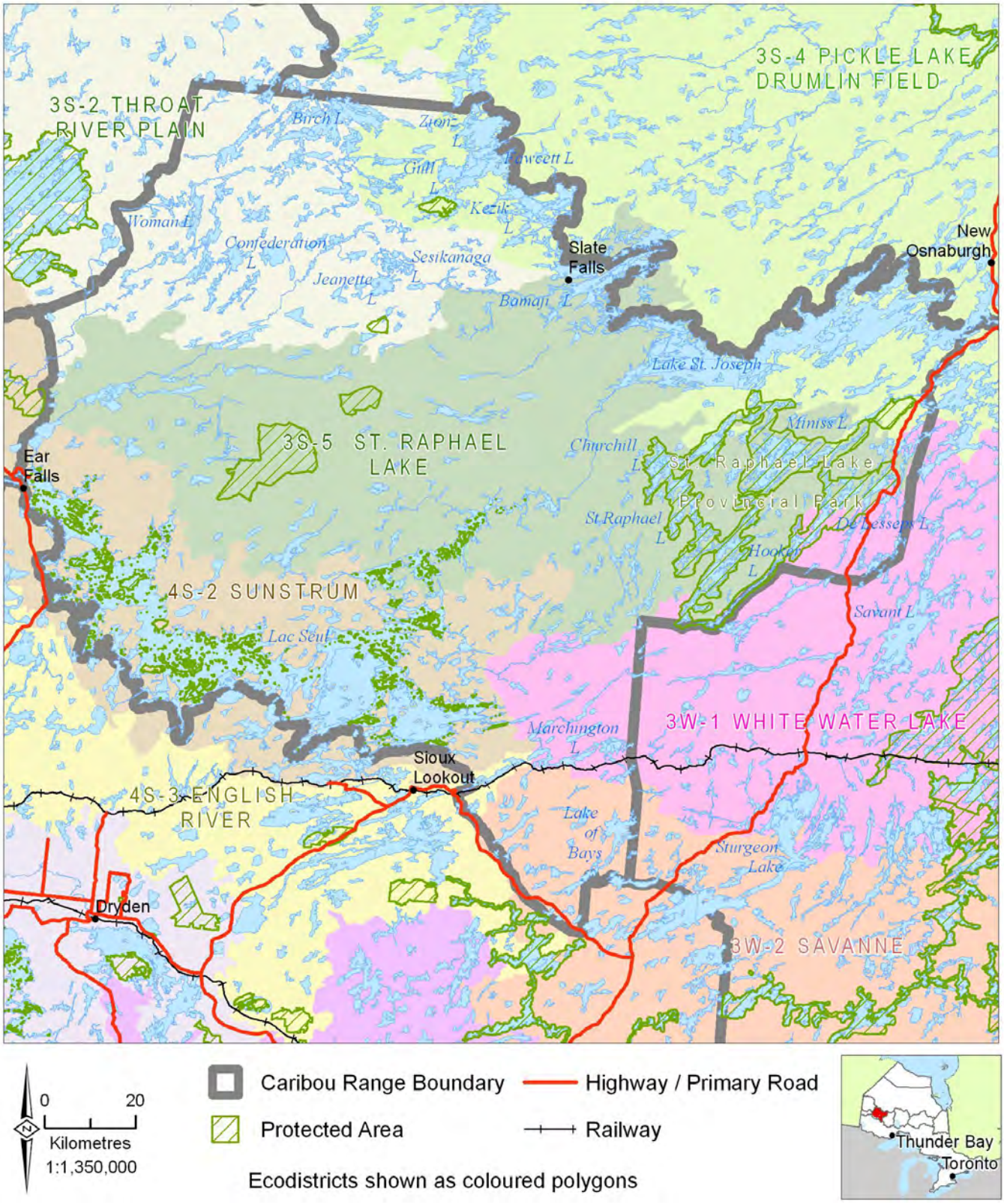


Figure 2. The Churchill Range and associated ecodistricts and protected areas.

3.0 Background Information and Data

3.1 Land management history and management direction

It is likely that caribou numbers and distribution on the Churchill Range have been influenced by a wide variety of natural and anthropogenic factors including large fires, blowdown, and forest harvest (Figure 3, Table 1), as well as infrastructure such as town sites, roads, railways, transmission corridors, hydroelectric facilities, mineral development, protected land, and federal land (Figure 4, Table 1). Past land use planning decisions, infrastructure development, and land management direction on the Churchill Range all have potential implications for the current distribution, abundance, and survival of caribou in the range. Therefore, 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 this 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.

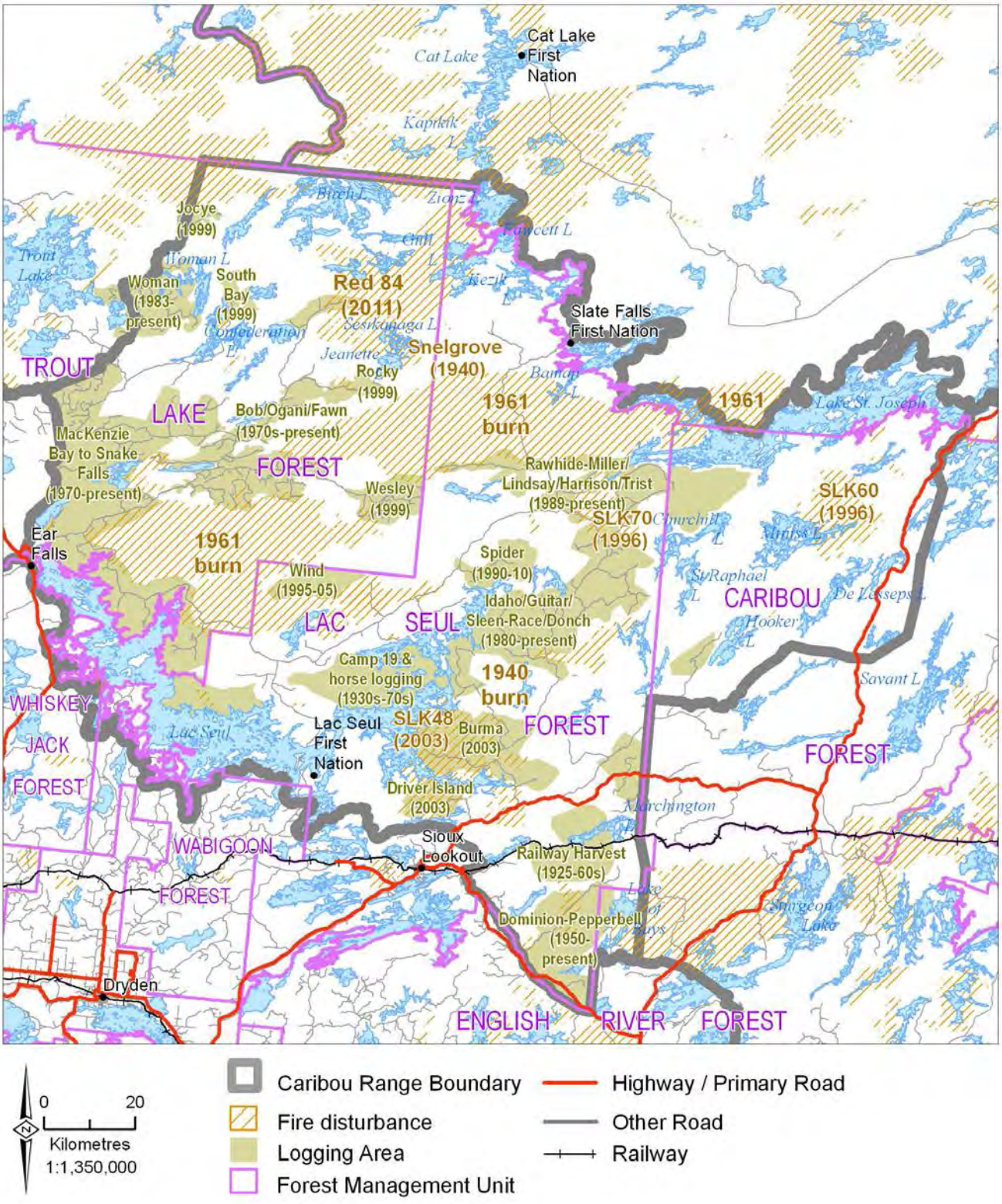


Figure 3. Dates and locations of significant historical natural and anthropogenic disturbances that have occurred within the Churchill Range.

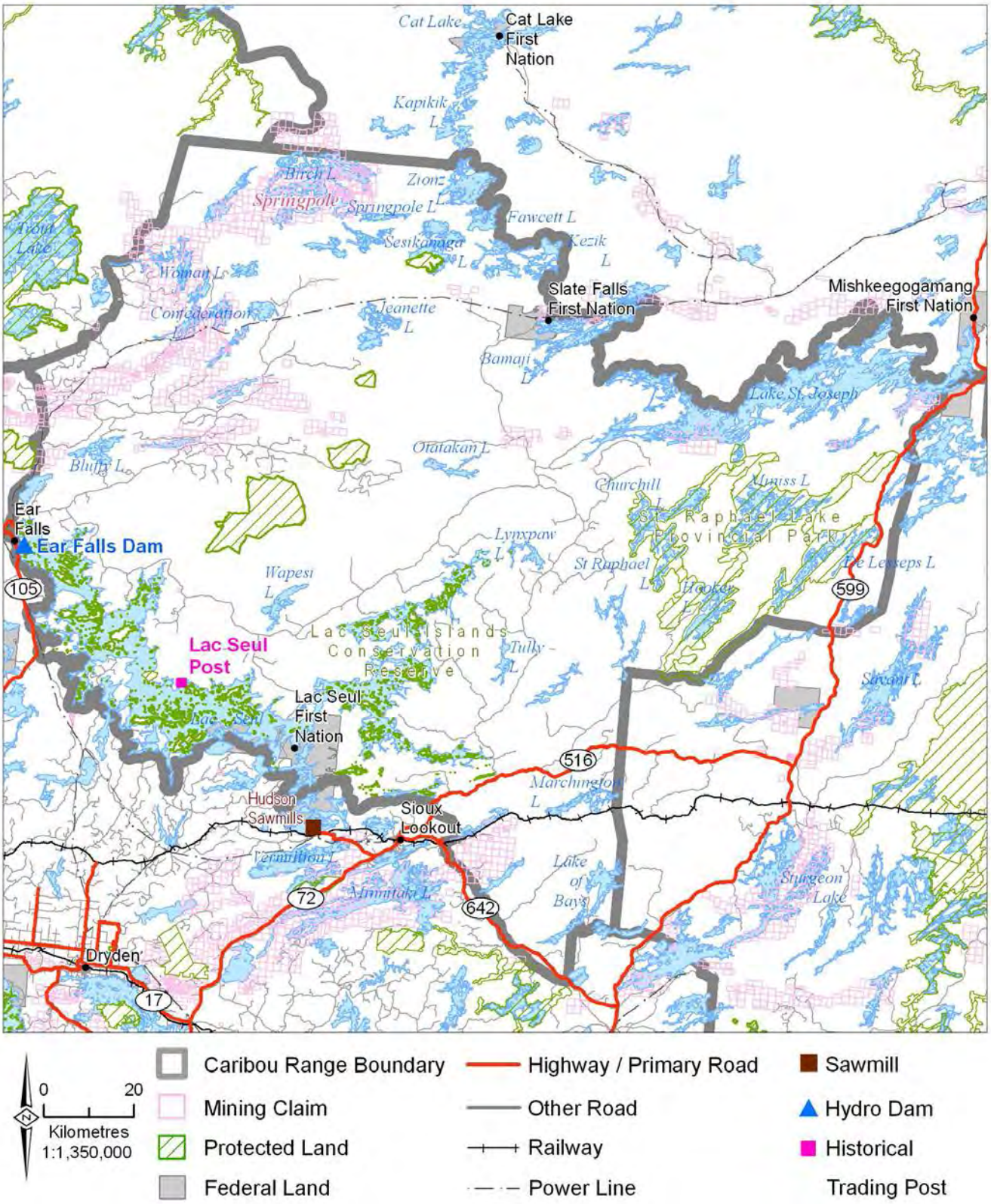


Figure 4. Human infrastructure and historical developments occurring within the Churchill Range

Table 1. Historical timeline of significant events occurring in the Churchill Range.

Significant event, activity or direction Natural and anthropogenic disturbance (significant fire or blowdown)	Date	Description	Likely influence on caribou or its habitat
1940 burn	1940	23,548 ha fire covering area from southern portion of Tully Lake east to Carling Lake.	Extensive winter use has been documented since the early 90s to present. Animals in this area often referred to as the Legear group. This area is considered to be very important in supporting the southernmost area of intact used winter habitat within the Churchill Range.
Snelgrove fire	1940	12,000 ha fire west of Snelgrove to the border of Trout Lake Forest.	Currently used year-round with calving/nursery areas documented on Snelgrove Lake. Shallow soil bedrock complex with abundant lichen growth.
61 Burn – Trout Lake Forest	1961	89,000 ha fire in southern portion of Trout Lake FMU	Created a large relatively even-aged tract of conifer dominated forest which is future caribou habitat for the southern portion of the Trout Lake FMU. Caribou use has been increasing over last 10 years.
61 Burn – Lac Seul Forest	1961	135,000 ha fire in eastcentral portion of Trout Lake FMU and northern portion of Lac Seul FMU	Created a large relatively even-aged tract of conifer dominated forest which is future caribou habitat for the northern portion of the Lac Seul FMU and the eastern portion of the Trout Lake FMU. Caribou use still limited given thickness of forest and is often associated with residual patches.
SLK60 (Miniss fire)	1996	11,000 ha fire east of Miniss Lake.	Year-round caribou use prior to the fire. Likely to contribute to suitable caribou habitat in the future.

SLK 70	1996	10,000 ha fire in Root River Bridge area. Fire was salvaged shortly after harvesting began. Fire salvage occurred on about one third of southwestern portion of the disturbance.	Prior to the fire and subsequent salvage, year-round caribou use occurred.
SLK 48	2003	23,000 ha fire started on Driver Island and spread to Burma Block. Fire covered large areas of previously harvested forest. Active fire salvage occurred on Driver Island and portions throughout Burma Operating Unit.	Prior to the fire there was documented summer use by caribou on the mainland and the adjacent Lac Seul islands. The habitat prior to the burn was used during the summer months and represented the most southerly extent of currently occupied caribou summer habitat in the Range. Will provide a large area of future habitat in the southern portion of the range.
RED 84	2011	41,000ha fire in northwest corner of range (north of Sesikinaga Lake)	Previously documented as caribou high-use area shown in 2008 habitat survey and collared animals.

Significant event, activity or direction			
Forest Management	**Dates**	**Description**	**Likely influence on caribou or its habitat**
Railway harvest	1925 - 60s	Marchington Lake, Split Lake logging off CN rail line. Horse logged areas resulted in an increase in hardwood and hardwood-mix. Since then, area has undergone repeated spruce budworm infestations.	Deterioration of habitat quality along the rail line has resulted in a gap in distribution of caribou and range fragmentation.
Camp 19 and horse logging	1930s - early 70s	Primarily occurred along stretches of Lac Seul's north shore. Created large patches of mixed forest conditions where conifer forests previously existed.	Reduced the quantity and quality of habitat along the north shore of Lac Seul and potentially reduced the connectivity to, and the value of, potential calving/nursery habitat potential on Lac Seul.

Dominion-Pepperbell Block	1950 - present	Harvest operations began in 50s with bulk of harvesting occurring from 1997-2006. These more recent operations were intended to improve quality of habitat in recovery zone over an extended period of time.	No recent caribou use. This harvesting created a long-standing disturbance in the southern-most portion of the range.
Bob, Ogani and Fawn blocks	1970s - present	Harvest initiated in Ogani Block in 30s but accelerated in 70s advancing into Fawn in 80s and Bob in 90s. Harvest is ongoing.	Created substantial forest disturbance in the central portion of the Trout Lake Forest, which contributed to isolation of the large 1961 burn (future suitable caribou habitat). Likely to become suitable caribou habitat into the future, but not currently in suitable condition. There are very few sightings of caribou documented in this area.
MacKenzie Bay to Snake Falls	1970s - present	Selective cutting occurred in certain areas in 30s and 40s. Clear cutting since 70s is ongoing. At this time, there are all ages and types of forest present with some areas dominated by highly productive silts and clays.	Early and persistent conversion to undesirable forest conditions along the southwestern portion of the range likely contributing to early loss of connectivity between the Churchill Range and the Sydney Range. This area has the potential to be renewed to suitable habitat but not currently on track to do so. Areas adjacent to Lac Seul have the potential to support connectivity to calving and nursery opportunities for caribou on Lac Seul.

Idaho, Guitar, Sleen-Race and Donch Blocks	1980 - present	Collection of large harvest blocks along Vermillion River Road and along east side of Guitar Block completed in 2006, other harvests ongoing.	Large disturbances on the eastern end of Lac Seul (Wapesi Bay area) likely influence the connectivity to Lac Seul from habitats to the north and east. This area was previously well used by numerous caribou in the summer months. Summer use has been documented since the mid-80s with many more recent observations occurring along the shoreline of Lac Seul. These blocks along with Spider, Donch, Track, and Guitar have resulted in the disturbance of access for caribou to the entire northeast arm of Lac Seul now and until the onset of suitability.
Woman Block	1983 - present	Harvest was intended to be completed by 2003 but is still ongoing. Currently exhibits variable age classes.	Sightings and collar data indicate use prior to harvest. Variable age classes and mixedwood composition may limit value to caribou upon maturity. Despite the abundance of mixed wood and rich soils, this area has documented winter and summer use.
Rawhide-Miller, Harrison, Lindsay, and Trist blocks	1989 - ongoing	Harvest blocks to the west and southwest of Lake St. Joseph initiated during early discussion of caribou guidelines. Created road-based access to Lake St. Joseph. Harvest persisted longer than recommended by guidelines.	This harvest has the potential to disrupt connectivity between Lac Seul and Lake St. Joseph and between winter habitats in the south and central portion of the range with calving habitats on Lake St. Joseph. These areas were used by caribou prior to harvest and the prolonged harvest period has the potential to delay return to a suitable habitat state.
Spider Block	1990 - 2010	Clear-cut harvest.	Area previously well used by numerous caribou in the summer months. Recent (2009) use by a cow and calf. This block along with Idaho, Donch, and Guitar may also impede connectivity to the entire northeast arm of Lac Seul.

Wind Block	1995 - 2005	Clear-cut harvest. Adjacent to north side of 1961 burn. Planned under caribou guidelines.	Caribou used this area prior to harvest but not since. Should provide for future caribou habitat adjacent to 1961 burn.
South Bay, Joyce, and Rocky blocks	1999 - present	Progressive harvest creating a mosaic of disturbance in the northwest portion of the range. All planned mosaic blocks by caribou guidelines. Some harvest scheduled to continue until 2019. Road rehabilitation proposed in many areas.	This area is still used by caribou with high levels of winter and summer use associated with significant calving and nursery lakes (i.e. Confederation and Woman lakes). Has the potential to increase risk to caribou in the northern portion of range in the short-term.
Wesley Block	1999 - present	End of Wesley Road (primary). This area was mapped as suitable (100+ yr old conifer) prior to harvest.	Little use was documented when harvest of this block began, but since then collaring info, surveys, and sightings have confirmed that this is good winter and summer habitat. It is important for this area to return to useable habitat in the future.
Driver Island and Burma blocks	2003	Partial clear-cut harvest followed by fire SLK 48.	Documented summer use in forest and on adjacent portions of Lac Seul prior to fire. Represented most southerly extent of occupied caribou summer habitat in the range.

Significant event, activity or direction			
Infrastructure development	**Dates**	**Description**	**Likely influence on caribou or its habitat**
Hudson's Bay Company	1880	Lac Seul trading post on north shore, near current location of Lac Seul community.	Human associated activity has likely influenced caribou distribution and habitat in the area. Caribou were also hunted for food and hide around the Lac Seul basin.
Canadian National Railway line	1907-1909	Primary east-west railroad across Canada.	Initial and sustained human activity corridors bisecting the range possibly contributing to early caribou harvest and collision mortality.
Sioux Lookout (community)	1912	Establishment of town site in support of trans-continental railroad. Became a mining and forestry centre and gateway to the north. Several sawmills have been operational here: Umfreville, McDougall, Farlinger, which were both road and water-based.	Permanent and persistent human recreational and industrial presence contributing to habitat alteration and loss of caribou from the immediate area surrounding this disturbance footprint.
Lac Seul, Kejick Bay, Whitefish Bay (communities)	1900s	First Nation communities established on Lac Seul.	Permanent human infrastructure and associated activity has likely influenced caribou distribution and habitat in the area. Caribou were also hunted for food and hide.
EIC transmission line	1920s	Transmission line from Ear Falls to Pickle Lake.	Permanent linear corridor that bisects north-south connectivity within range.

Ear Falls dam and the flooding of Lac Seul	1937	Construction began in 1928, filling of the reservoir occurred over time. The community of Lac Seul was flooded in 1937.	Filling of the reservoir would have removed caribou habitat from the landbase and may have flooded out calving islands. But will also have increased shoreline length and new islands to a greater extent given it was the English River that traversed this geography prior to reservoir creation.
Highway 599	1950s-60s	Connects Ignace to Pickle Lake	Permanent linear corridor that bisects east-west connectivity between the Churchill and the Brightsand Range. Avoidance of the highway has been demonstrated by collared animals.
Springpole Lake Mineral exploration	1950s-present	60+ years of mineral exploration, trails, drilling, trenching, etc.	Noise and trail development and exploration activity may have disrupted caribou movement patterns and led to avoidance use of potential calving and nursery areas.
Winter roads	1950s - present	50+ years winter road use particularly for mineral exploration and mining in Birch/Springpole area	Winter roads typically follow similar paths from year-to-year and often these roads go through wintering areas for caribou. May contribute to predator movement and hunting efficiency in current high quality winter habitat.
Forestry road development over the last 40+ years	1970 - present	Primary roads system from southwest corner of Trout Lake FMU accessing harvest block to east and northeast of the FMU. Early road development focussed on north shore of Lac Seul. New road corridors planned to avoid mosaic blocks.	Permanent infrastructure directly and indirectly influencing habitat allocation and retention schedules, limiting flexibility in habitat planning, and contributing to documented hunting and collision mortality.
Highway 516	Late	Connected Sioux	Permanent linear corridor that bisects north-south connectivity in

(Marchington Road)	1970s - early 80s	Lookout to Hwy 599	the southeastern corner of the range.
Vermilion River Road	1974- 94	All-weather road from Hwy 599 north and west to Ear Falls provided forest access to the Lac Seul FMU.	Permanent linear corridor that bisects east-west connectivity within the Lac Seul Forest and north-south connectivity in the Trout Forest. Forms a band of disturbance and human activity between the majority of the range and Lac Seul, that has significant potential and some as well as current calving activity.
Northland Road	2006	All-weather road to Slate Falls off of Vermilion River Road	Places a permanent human activity corridor in such a way as to bisect the future habitat associated with the 1961 Lac Seul Burn.

Significant event, activity or direction

Land management direction	**Dates**	**Description**	**Likely influence on caribou or its habitat**
Wolf control	1945-72	Wolf bounty in effect.	Early depressions of the wolf population that may have helped caribou persist through periods of early road-based logging.
Trapline boundaries regulated	1947	Initiation of the Ontario's trapline system.	Formed the basis for early reporting on wildlife occupancy and relative abundance which provided preliminary insight into historical occupancy by caribou.
Wildlife Management Units (WMUs) 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).
Draft of Caribou Guidelines	1992	First draft of forest management guidelines for the conservation of woodland caribou habitat.	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 Habitat Management Direction	1994	Regional mandate to address caribou habitat management on all Forest Management Plans within the Continuous Distribution.	Supported initial efforts at towards caribou habitat conservation in Northwestern Ontario.
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. (Lac Seul Forest in 1992, expanded in 1998; Caribou Forest FMP in 1997; Trout Lake Forest 1994).
Ontario's Living Legacy	1999	Creation of dedicated protected areas and Enhanced Management Areas with specific conservation considerations for woodland caribou.	These protected areas supported conservation and recovery efforts and contributed to caribou winter and summer habitat. These include: St Raphael Signature Site, Lac Seul Islands Conservation Reserve and Whitemud Conservation Reserve.
Forest Management Guidelines for the Provision of Caribou Habitat: A Landscape Approach	1999	Final Forest Management Guidelines for the Provision of Caribou Habitat. Comprehensive and	It aimed to maintain continuous supple of year-round caribou habitat distributed across the landscape and through time to ensure permanent range occupancy (i.e. Lac Seul Forest FMP 2001, 2006, 2011; Caribou Forest FMP 2002, 2007, 2008; Trout Lake Forest 1994, 1999, 2004, 2009).

		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.	
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.
Lac Seul Forest Management Plan "Let Burn" Policy	2011-21 FMP	Degraded forest area along north side of Lac Seul designated a "Let Burn" zone. No fire suppression will occur unless indices are too high and the potential impacts to values are a concern.	Fire can remove current summer refuge habitat, but the long-term intent is to create high quality caribou habitat from fire regenerated forest.

Most of the disturbance history within the Churchill Range involves a long and varied series of forest harvesting events and the associated human infrastructure (Table 1). Early forest harvest off the CN Rail line and later water-based and road-based harvest and associated road networks have, in conjunction with natural fire, established the current forest landscape.

3.2 Caribou occupancy history and assessment

Caribou observations within the Churchill 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). 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 are described (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. Historically, these observations reflect our knowledge of caribou occurrence within the range and the possible response to changes in range condition. Historical observations suggest range recession has occurred or may be occurring, especially in the southern portion of the range south of the CN rail line.

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

Date	Caribou occupancy assessment	Reference
2002/3	Fixed and rotary-wing surveys flown in WMU 16A (2003) and some parts of WMU 1C (2002) – in the northwestern section of the Churchill Range; 23.32% of caribou observed were classified as calves.	Racey, G., M. Klich, and E. McCaul. 2006. Woodland Caribou Winter Distribution in the Northern Boreal Initiative (NBI) Study Area.
2003	Aerial transect survey over St. Raphael Signature Site, March 2003. Based on observation of 13 caribou and tracks, approximately 28-29 animals were thought to be within the Signature Site.	Graham, J. 2003. Sioux Lookout District Winter 2003 Caribou Survey: aerial winter survey of woodland caribou in the St. Raphael Signature Site.
2008	Fixed and rotary-wing surveys flown in Trout Lake FMU. A minimum of 172 caribou in roughly 23 groups were observed. Most caribou were of unknown age and sex, although 10 calves were identified. Most were found in mature black spruce (41-100+ years old) and jack pine stands, lowland spruce, and open areas. High activity was noted in the northeast portion of the FMU and the 1961 burn was being used.	Barnes, L. & R. Bausch. 2008. Woodland Caribou Winter Habitat Survey – Provincial Species at Risk Year End Report FY 2007-2008.

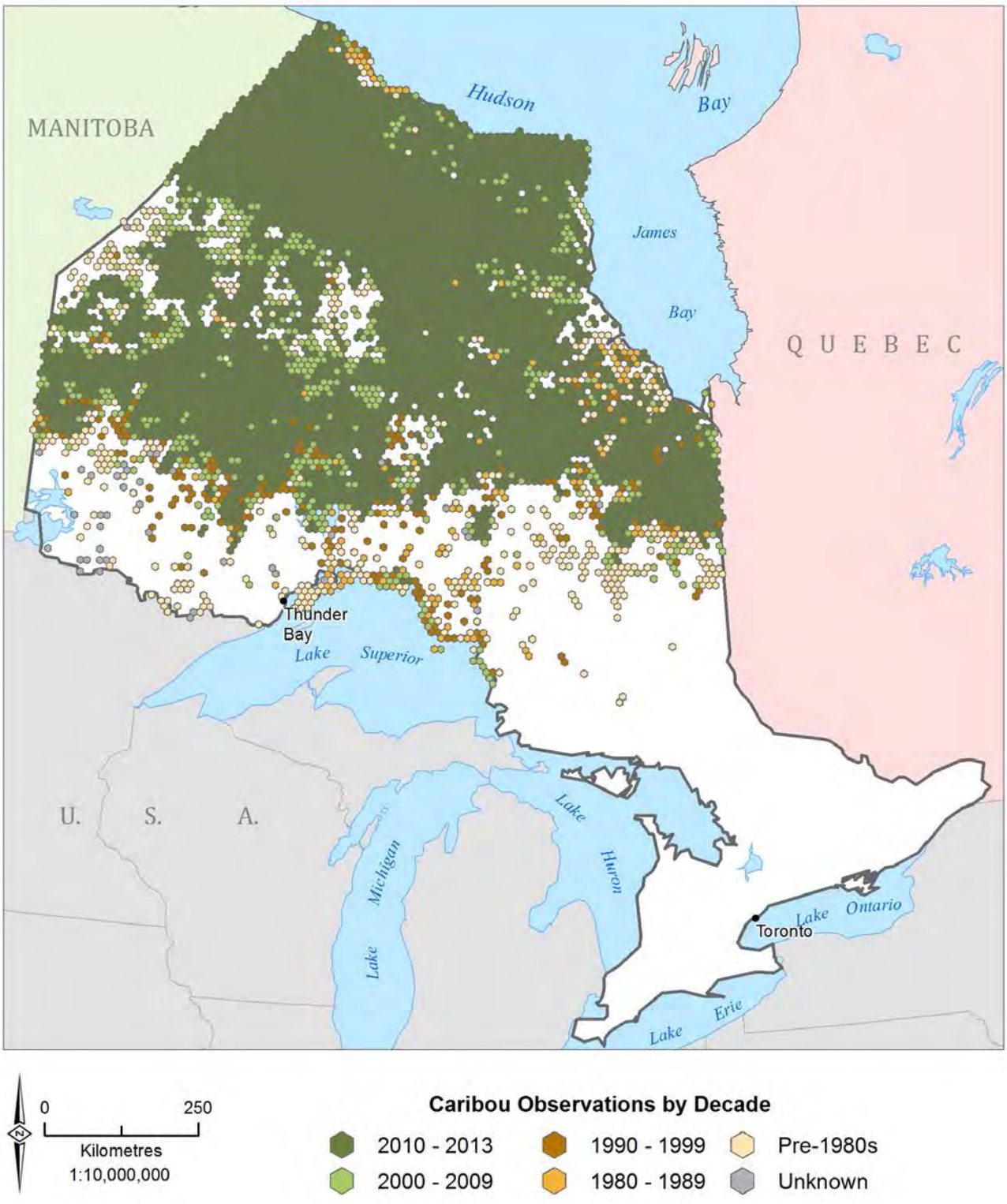


Figure 5. Caribou occurrence across Ontario summarized by date of most recent observation as of June 2013. Absence of observations may reflect low survey effort, lack of reporting, or the absence of caribou.

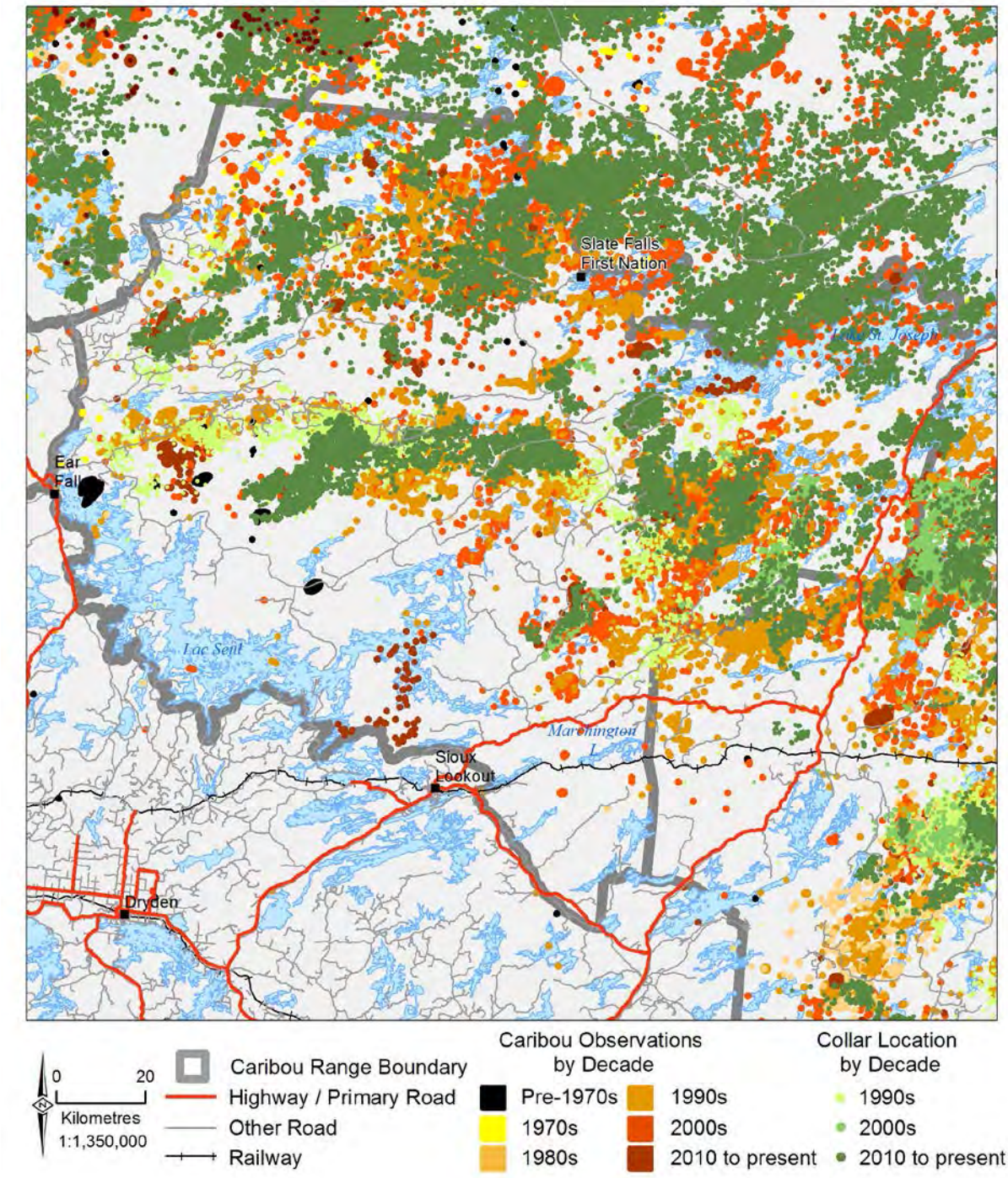


Figure 6. Historical caribou observations[1] within the Churchill Range and surrounding area including observations from aerial surveys, collared caribou locations, research projects, and casual observations.

[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.

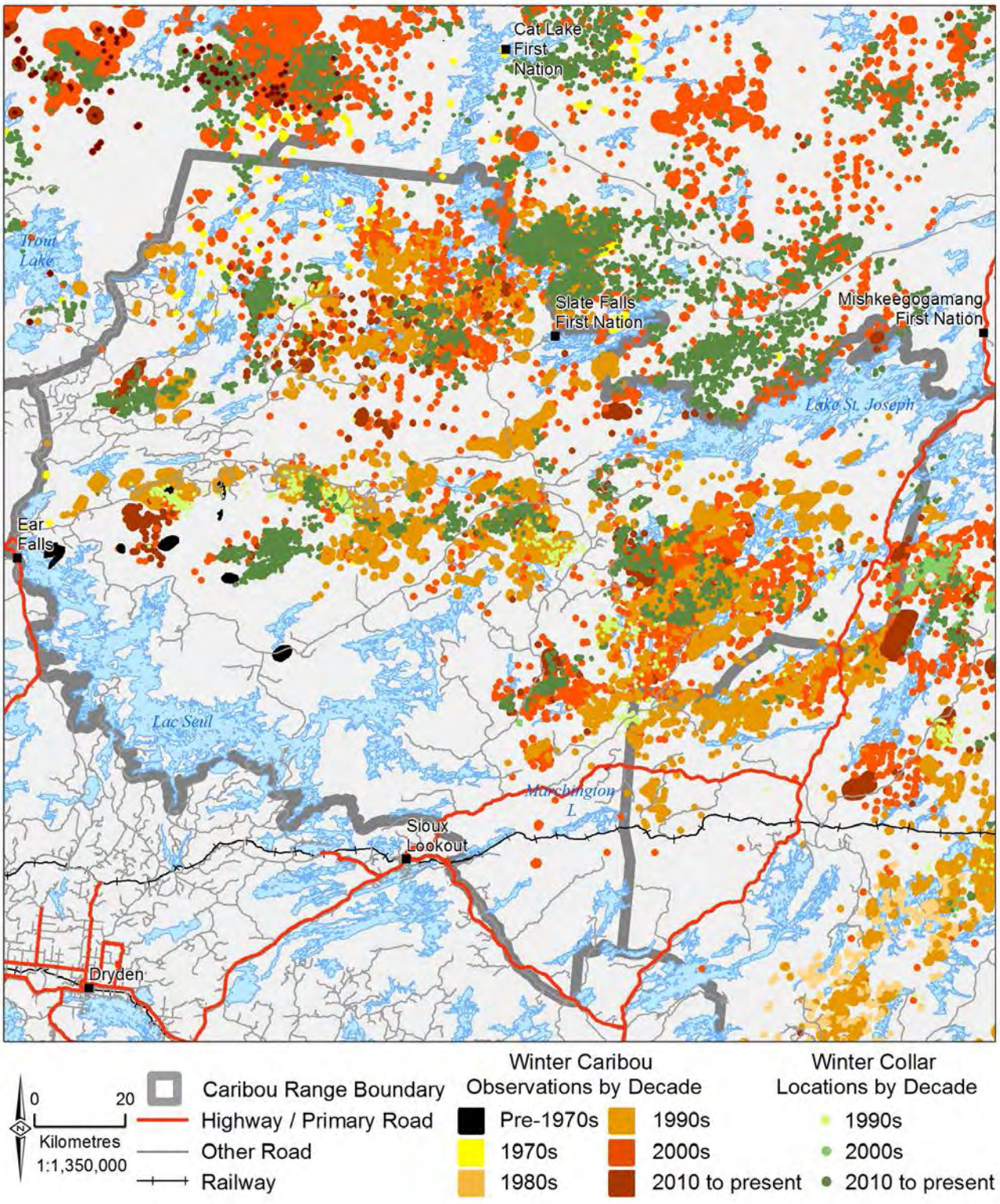


Figure 7. Caribou observations in the Churchill Range during February and March from all observation sources (i.e. aerial surveys, collared caribou locations, and casual observations) as of August 2013.

3.3 Probability of occupancy survey and analysis

Presence of caribou was identified during an aerial fixed-wing transect survey conducted in February and March 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 Churchill Range were estimated using methods described by MacKenzie et al. (2002).

No animals were physically observed south of Idaho Lake, although signs of caribou were present almost as far south Marchington Lake (Figure 8). Caribou were sighted near St. Raphael Lake, the Celt/Springer lakes area, and the Eason Lake area; caribou signs were mainly distributed widely across the northern half of the range.

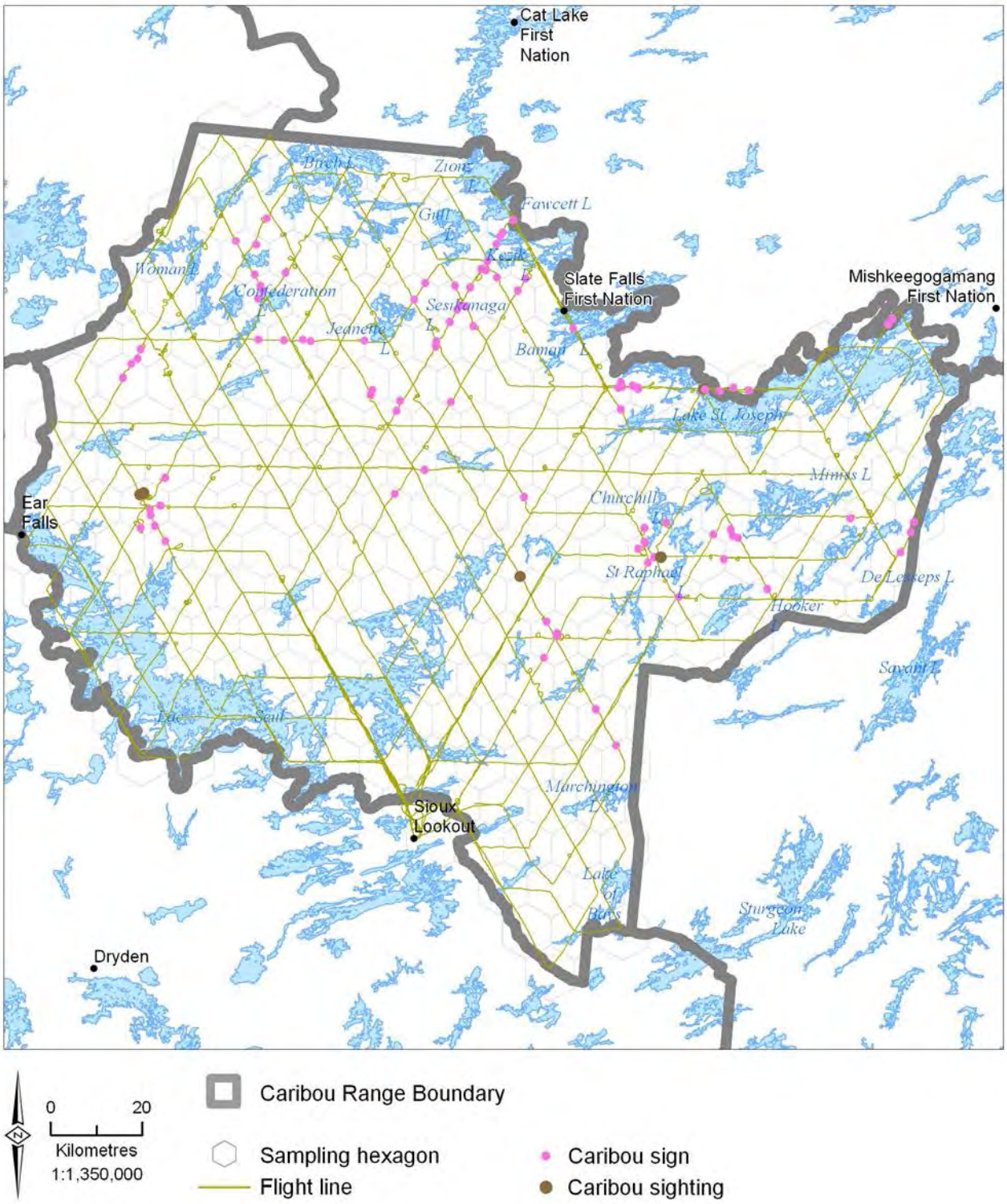


Figure 8. Fixed-wing aerial survey transects on the Churchill Range hexagon sampling grid during the winter of 2012. Observations of caribou and their sign are also shown; any evidence of caribou present within a hexagon contributes to the probability of occupancy calculation.

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 Churchill Range was low and that the estimate had moderate precision (ψ =0.37, SE = 0.07, 95% CI = 0.25-0.51). These standard errors suggest that existing levels of survey effort may only detect moderate to large changes in caribou occupancy with respect to a single estimate for the entire range. As a result, a statistically significant change in this occupancy indicator may not be evident until large changes in caribou distribution occur. Precision may be improved in future surveys through increased visits to each hexagon.

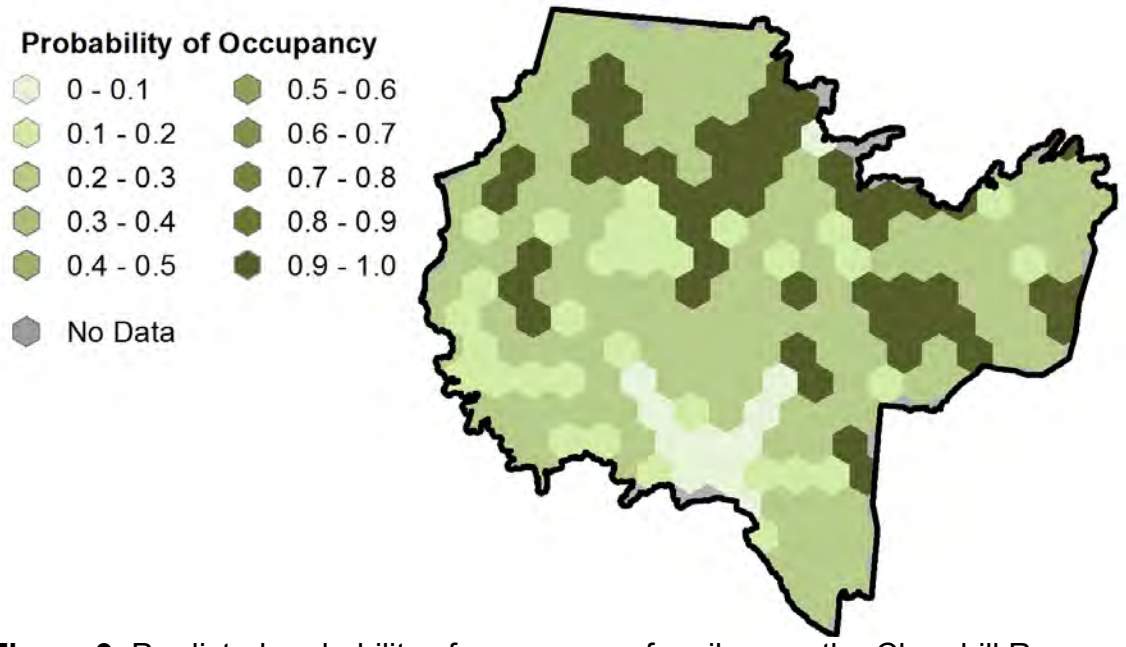


Figure 9. Predicted probability of occupancy of caribou on the Churchill Range based on a model without occupancy covariates and conditional on observation (Probability = 1 for hexagons with detection(s)) from the winter 2012 survey.

The probability of caribou occupancy was significantly correlated with habitat covariates. No single best model containing habitat covariates could be identified and so habitat covariates retained in the four best models supported by the data were used to generate model-averaged

estimates of occupancy (Table 3, Figure 10 and Figure 11). The averaged model used to generate mean estimates of caribou occupancy was:

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

Occupancy					Detection				
Parameter	Estimate[1]	SE	Lower CI	Upper CI	Parameter	Estimate	SE	Lower CI	Upper CI
Ψ	-0.63	0.35	-1.33	0.06	***p***	**-0.77**	**0.27**	**-1.31**	**-0.23**
Conifer	**1.31**	**0.34**	**0.64**	**1.97**	speed	-0.37	0.21	-0.78	0.04
Sparse	0.08	0.21	-0.33	0.50	**time**	**15.68**	**1.78**	**12.18**	**19.17**
Treed bog	0.11	0.25	-0.38	0.59	**time^2**	**-15.61**	**1.79**	**-19.13**	**-12.09**
Disturbance	**-1.07**	**0.30**	**-1.67**	**-0.48**					
Settlement	0.21	0.24	-0.27	0.68					

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

The amount of conifer and disturbance had the greatest effects in predicting caribou occupancy. Although sparse forest, treed bog, and settlement were retained in this model, they had lesser influence in predicting occupancy as indicated by the large standard errors relative to coefficient values. Caribou occupancy on the range was high where conifer forest was more abundant and occupancy was lower in areas of disturbed forests (Figure 12).

The relatively low occupancy rates of caribou interspersed through the central and southern portions of the Churchill Range is consistent with the observed abundance of early succession forest, the intensity of human activity, and other anthropogenic disturbances on this range. There is evidence in other jurisdictions for the negative effects of anthropogenic landscape disturbance on caribou distribution and population persistence (Brown et al. 2007; Wittmer et al. 2007). Also, the positive correlation between caribou occupancy and winter suitable 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).

The predicted occupancy of caribou may be overestimated in isolated portions of the extreme southern end of the Churchill Range (Figure 10), where caribou are thought to be currently absent but where potentially suitable habitat exists; this phenomenon is attributed to the habitat covariates (Figure 11). While the model may overestimate the actual occupancy of caribou on portions of the Churchill Range, this aspect of the model provides a useful tool for mapping potentially important priority areas for future range management decisions intended to restore caribou in those areas.

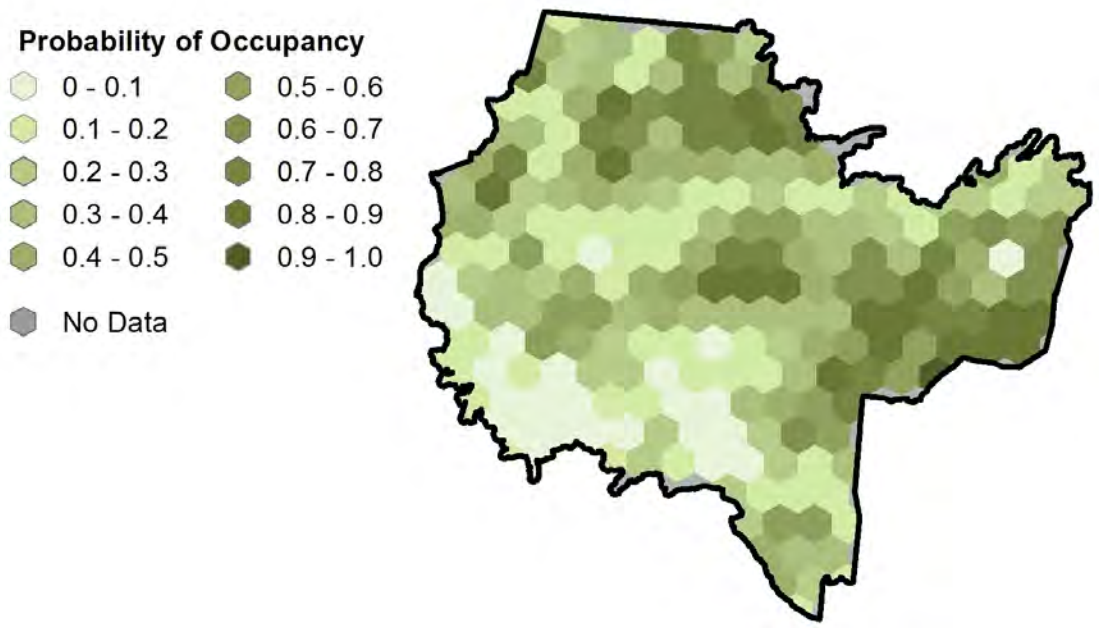


Figure 10. Probability of occupancy determined using habitat covariates across the Churchill Range based on model-averaged estimates using observations for the winter 2012 aerial survey.

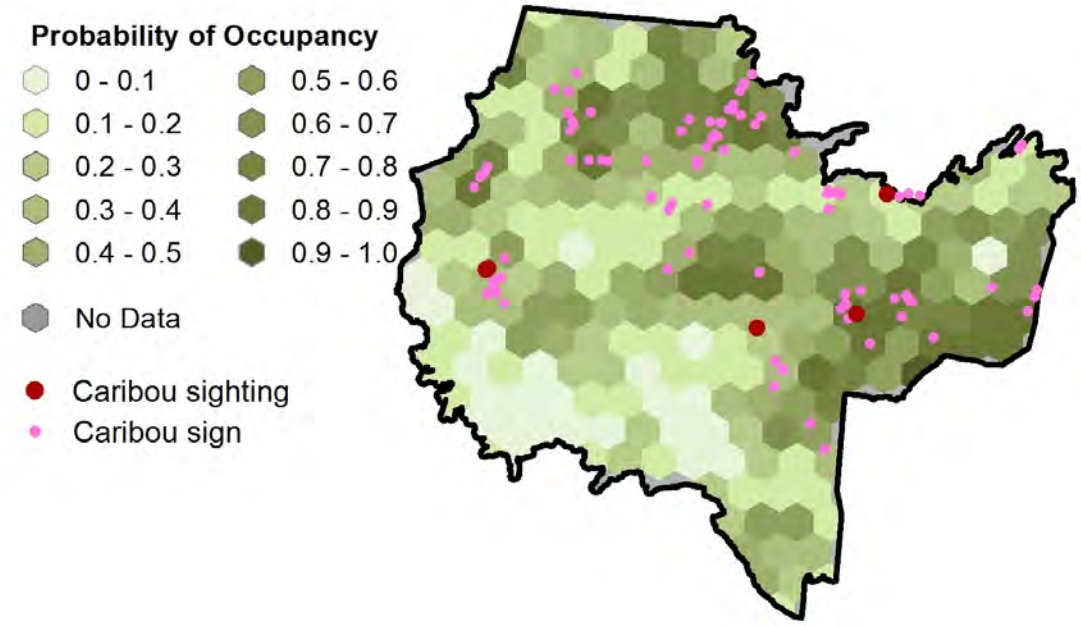


Figure 11. Probability of occupancy determined using habitat covariates in the Churchill Range overlaid with caribou observations and sightings from the winter 2012 aerial survey.

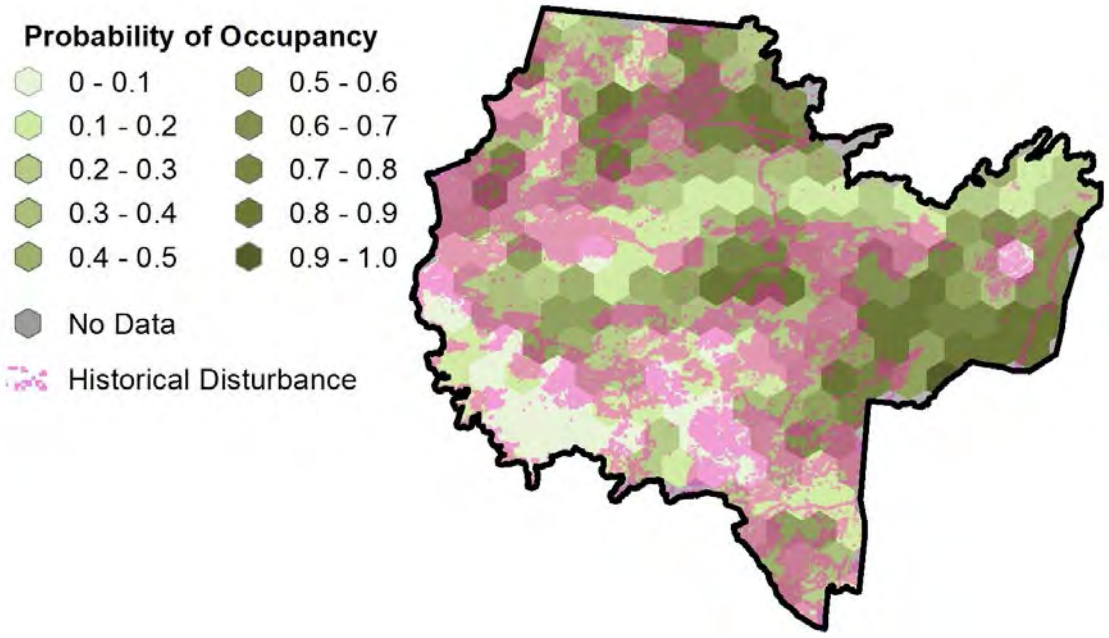


Figure 12. Probability of occupancy determined using habitat covariates across the Churchill Range using observations for the winter 2012 aerial survey overlaid with disturbed areas (i.e. cuts, burns, regenerating depletions).

3.4 Caribou ecology and range narrative

Caribou within the Churchill Range 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, and areas exhibiting low densities of moose and deer, and associated predators. These 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).

Current and historical caribou observations are well dispersed across the Churchill Range but have been largely absent from the southern portions of the range in the vicinity of Lac Seul and the Sioux Lookout area for decades as a result of permanent anthropogenic disturbance. Much of the remainder of the range has documented occupancy in the last 40 years especially in areas exhibiting older conifer dominated forest conditions.

Movement patterns within the Churchill Range are largely explained by landform and mature forest connection between winter habitats and lake systems. There appears to be some connectivity identified by collared caribou movements south and east into the Brightsand Range and north and east into the area east of the Cat River system and north of Lake St. Joseph into the Kinloch Range. There is no known connectivity west to the Sydney Range.

Eskers, sandy outwash, and moraine features with non-calcareous soils such as those north of Lac Seul and south of Lake St. Joseph appear to provide for both forage and efficient travel. Collared caribou movement data and winter occupancy data suggest caribou follow the major esker systems including those that cross the Wenesaga Road and the Northland Road. These eskers are dominated by jack pine with abundant lichen patches.

Significant portions of the Churchill Range have had forest management activities influenced by various versions of caribou guidelines (Racey et al. 1999) and a caribou habitat mosaic since 1992. At the time the mosaic was implemented, the Caribou Forest, the eastern portion of the Trout Lake Forest, and the northern portion of the Lac Seul Forest had little anthropogenic disturbance. Road networks and harvest blocks tended to be clumped, thereby concentrating areas of harvest activity, while leaving large tracts of older conifer forest left relatively intact. It is in these areas of older forest where most caribou habitat use currently occurs. The portions of the range exhibiting lower levels of disturbance such as the northeastern portion of the Trout Lake Forest, the northern portion of the Lac Seul Forest, Lake St. Joseph and the Cat River System, and the north and central portions of the Caribou Forest appear to support the majority of caribou within the range. The more southerly portion of the range exhibits high road densities and levels of disturbance where caribou occupancy is sparse. Harvest practices and renewal planning in the southern portion of the range was designed to renew caribou habitat in its forest habitat renewal strategies.

Three notable areas of caribou habitat which have influenced caribou habitat mosaic development include Lynxpaw Lake, Churchill Lake, and the Tully and Legear lakes area. Lynxpaw Lake is located off the northeast arm of Lac Seul and is in a strategic location linking the Lac Seul and the Trout Lake FMUs. This location was highlighted in the first caribou mosaic developed in 1992. It is used by caribou in the winter and may account for the persistent occupancy by caribou of the islands and shoreline in the northeast arm of Lac Seul. Maintenance of caribou occupancy in this area is essential to the long-term conservation of caribou in the vicinity of Lac Seul. Connectivity between the Lynxpaw Lake area and habitats to the north and east currently exist and will be important to maintain into the future as highly disturbed areas to the south and east are renewed. Churchill Lake and adjacent lands to the

south and east provide both summer and winter habitat and represents the westerly extent of an east-west complex of occupied habitat components linking to the De Lesseps Lake area. Churchill Lake also has demonstrated linkages to Lake St. Joseph to the north and northeast. Furthermore, the Tully and Legear lakes area is at the southernmost extent of historical and currently occupied winter habitat in the Churchill Range making these areas of strategic as conservation value.

The Churchill Range has an aggressive fire regime, mostly on the Trout Lake and Lac Seul FMUs. Overall, it appears as if the cumulative amount of disturbance attributed to forest harvest and wildfire exceeds the amount of disturbance that might naturally have occurred within the range but are nevertheless an agent for caribou habitat renewal. Recently, documented caribou use has occurred in recent burns such as RED 84 in 2011 (Table 1). Large fires in 1961 (Trout Lake and Lac Seul FMUs) and 2003 (Burma Block on Lac Seul Forest) have produced extremely large tracts of younger forest with the potential to provide future habitat. Two 1940 burns, Tully and Snelgrove, have demonstrated high value to caribou as evidenced by current occupancy patterns.

The Tully and Legear lakes area is known to have a long history of winter use and is considered important to caribou in the Churchill Range as it provides an anchor for the central-east portion of the range. Three collared bulls have provided evidence of habitat use and their movements have suggested the importance of this area to maintaining caribou at the southern extent of this range. There is also a demonstrated historical connection between this area and De Lesseps and Hooker lakes area.

Forest age class is an important consideration in evaluating habitat quality. It is assumed that caribou refuge and winter habitat begins to become suitable at approximately 40 years of age, depending on soil type and species composition. However, forest appears to mature slower into caribou habitat as latitude increases. In northern parts of the Churchill Range it appears that it takes 50+ years for caribou to frequent previously disturbed areas. For example, a 1961 fire in the Lac Seul Forest has been regenerating to extensive tracts of mature conifer forest and at 50 years of age, caribou use is low. However, the burn is undergoing a self-thinning process, particularly among jack pine, and refuge and winter habitat functions may be improving. Much of the recent observed use is associated with older residual patches, rocky, lichen-covered bedrock knobs next to creeks and around the periphery. There is persistent winter use within the other 1961 burn in the Trout Lake Forest in the west-central part of the range (Figure 3) as evidence by collared caribou and observations noted from several winter habitat surveys. Areas of jack pine in this burn are also self-thinning that might support the ease of movement or increase visibility or forage abundance typical of quality caribou habitat. Occupancy of both these 1961 burns is still lower than expected for the age of forest (40+ years). Eventually, these burns will create two very large tracts of suitable habitat in the central portion of the Churchill Range.

There is significant east-west caribou movement immediately above and below the 1961 fires where the forest is older. This occupancy next to the burns increases the chance for re-occupancy as habitat quality within the burns improves with age. Currently, moose densities in

these burns are low, supporting the notion that the burns may be contributing substantially to the refuge value of the landscape even though current caribou occupancy is low and scattered.

Large areas of older jack pine and black spruce dominated forest exist in the central portion of the Caribou Forest and north and east of Hooker Lake, which exhibit caribou use year round. The forests in this area grow on deeper till soils with a high potential for conversion to mixedwoods in response to forest harvest or other non-fire disturbance. Some of these areas have been deferred from harvest as part of the Caribou Forest FMP. The Plan acknowledges the potential of successional transition to a more mixed forest condition and lowering the quality of caribou habitat. However, apparent successional pathways suggest that these forests largely succeed into multi-aged black and white spruce dominated forest conditions with some increase in white birch and aspen. It appears as if some of these older areas, in the absence of significant blowdown or breakage, may maintain caribou habitat value well past 140 years.

Many of the natural forest vegetation communities within ecoregion 3S exhibit high levels of conifer purity and low incidences of hardwood shrubs and herbs. These vegetation conditions extend northwest into the Berens Range and the area north and east of the Cat River system. This conifer purity is likely an important factor influencing the refuge value of the landscape. Apparent shifts after forest management to a more mixed forest condition with higher shrub densities is a concern, particularly on the fine textured soils associated with the Lac Seul basin. These fine textured soils do not support lichen development. The Trout Lake Forest has large areas of old coniferous forest with perhaps the highest density of caribou within the range.

The Churchill Range has a very high water density and contains many lakes with abundant islands and complex shorelines. This water contributes to the refuge value of the landscape and supports calving and nursery functions. There seems to be short but distinct migrations to major areas of calving or nursery activity such as Lake St. Joseph, the northeast arm of Lac Seul, Churchill Lake, Birch Lake, Confederation Lake, Jeanette Lake, De Lesseps Lake, and the series of lakes along the Cat River system. All of these lakes could be considered locally if not regionally significant to caribou persistence on the Churchill Range. Future recruitment potential on the Churchill Range is likely as much linked to the future condition and connectivity to these lakes as it is to the landscape pattern and amount of disturbance on the range. Recent mineral exploration activity and access to Confederation Lake and Springpole Lake raise many concerns about habitat alteration, and sensory disturbance to caribou using these lakes as calving or nursery habitat.

This Confederation Lake area contains significant caribou calving and nursery habitat and is in close proximity to winter refuge habitat. Large groups of animals have also been observed during winter on the north end of Confederation Lake. Their presence here is most likely associated with adjacent areas of suitable winter habitat. Surveys in 2003 on Woman Lake also documented calving and nursery areas on the islands and peninsulas in the central and northern part of the lake as well as in some parts of Washagomis Lake.

Lake St. Joseph is recognized as a regionally significant calving / nursery area (Racey et al.1999) and it appears that caribou using Lake St. Joseph have connections to winter habitats to the north, south, and west. Caribou used the Trist Block in the early 1990s when harvest activities were authorized and initiated. It was thought that the Trist Block provided both winter and summer habitat at the time and that caribou using this forest used both Churchill Lake and Lake St. Joseph for calving and nursery functions. Since harvest, caribou use in the Trist Block has diminished and is now low. Some islands on Lake St. Joseph are experiencing intensive mineral exploration which creates physical alteration of habitat and sensory disturbance potentially compromising calving and nursery functions on this regionally significant calving lake.

Devil's elbow on the southeastern part of Lac Seul represents the most southerly known calving area within the Churchill Range. The high potential for additional calving activity on Lac Seul, and the occurrence of calving activity in the vicinity of Devil's elbow and the northeast arm, suggests a strategic importance to maintaining or enhancing the connectivity to and habitat quality of the shorelines of Lac Seul.

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

3.5 Influence of current management direction

Recent and current management direction, up to the time of this Integrated Range Assessment, has had many positive influences on the current state of caribou within the Churchill Range. Direction from the Crown Forest Sustainability Act (CFSA) (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.

The importance of the current Churchill Range to maintaining caribou was recognized in the late 1980s and spurred explicit management efforts to sustain caribou and their habitat starting in 1991 (Racey 1991). 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. Implementation of caribou habitat tract mapping, mosaic planning, and priority retention of larger areas of high value habitat components contributed to continued range occupancy and ecologically sustainable forest management. This, along with a commitment to manage the landscape with the intent of preventing further range recession over the last 20 years has established an existing landscape condition and a management approach that will allow for an easier transition to a comprehensive RMA.

Ontario's CCP identified several key pieces of management direction leading to improved conditions for caribou. The Range Management Approach confirms the previous landscape

approach to conserving caribou habitat, especially the recognition of the importance of caribou habitat renewal, and population viability, especially the role that effective silviculture and road decommissioning and rehabilitation have in returning disturbed areas to suitable caribou habitat. This direction has also been reflected in regional direction for forestry within caribou range. Resulting deferrals have been important to sustaining caribou occupancy patterns. It is too early to tell if silvicultural practices have been successful in creating the early forest conditions necessary to ensure reliable renewal of caribou habitat.

Investing in caribou collaring has been invaluable in increasing awareness, as well as identifying important habitat features such as winter habitats, calving areas, and general travel routes or linkages across the landscape. Collaring data has been useful in supporting landscape planning and providing rationale for long-term deferrals.

The Cat Lake-Slate Falls Land Use Plan has recognized and identified the need for protection along the chain of lakes associated with the Cat River system. This protection is essential to maintaining the integrity and viability of caribou calving and nursery functions as forest management activities are planned and implemented in the new land use are.

The Sioux Lookout and Red Lake districts have developed strategies to allow prescribed natural fire rationalized, in part, to help restore caribou habitat value. The direction benefits caribou in areas where older or degraded forest exists and renewal initiated by fire would improve the likelihood of producing future caribou habitat. Such a strategy can only be successful if areas of suitable habitat are maintained adjacent to these fires. Prescribed burns have been utilized recently within the range; two prescribed burns were carried out in the summer of 2012 in areas of blowdown near Okanse and Horse lakes.

Direction associated with the CFSA, particularly the forest renewal, provides an opportunity to identify and implement renewal and maintenance activities to benefit caribou habitat renewal. Adequate funding is essential to apply the silvicultural practices necessary to maintain the high conifer composition, slash management, and road decommissioning to ensure quality future caribou habitat. This also includes the continued and adequate support for the use of herbicides, which are an essential tool in silvicultural strategies to maintain conifer dominated forest composition.

There have been challenges in applying current management direction related to caribou conservation. The caribou guidelines were predicated on the assumption that allocated harvest blocks would be harvested and renewed in such a manner as to produce large tracts of relatively even-aged conifer forest. In some cases, there has been prolonged operating periods within harvest blocks that resulted in a more uneven age distribution than is intended, greater maintained edge effects, greater amount of residual and mixed forest conditions, and longer use of operational roads. Ultimately, this practice likely delays habitat renewal at the landscape level and reduces the likelihood and timeliness of caribou re-occupancy.

The regional fire strategy and its focus on fire suppression within the area where forest management is permitted has largely prevented the renewal of very old and degraded forest

conditions. However, there has been more recognition of the importance of natural fire or prescribed burns to the renewal of caribou habitat.

There have also been challenges in applying current management direction to fulfil its intended purpose related to caribou conservation. Provincial Forest Access Road Funding Program initiated in 2005 promoted the construction and maintenance of primary and secondary access roads which encouraged access into previously unroaded areas. Additional roads potentially increase vulnerability of caribou in these areas before previously harvested areas elsewhere mature and provide for caribou habitat.

Renewal has been deemed successful in the Caribou Forest (Arbex Forest Consultants Ltd. 2009) despite silvicultural success estimated between 10-20%. Renewal was considered effective with few exceptions in the Lac Seul Forest and silvicultural success was estimated between 37-60%, however, some water crossings were not decommissioned sufficiently (Timberline 2011). Management of the Trout Lake Forest was deemed to be in need of improvements but that forest sustainability overall was not compromised (KBM Forestry Consultants Inc. 2009).

3.6 Major data and analysis uncertainties

There are several major data uncertainties associated with the estimation of risk and the determination of range condition within the Churchill Range.

Recruitment rates for the Churchill Range were low in late winter 2012. However, recruitment rates were very low in the Sydney, Berens, 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.

As previously mentioned, forest appears to mature slower in northern parts of the Churchill Range where it seems to take 50+ years for caribou to frequent previously disturbed areas (i.e. 1961 burns). However, the disturbance and the habitat analysis assumes that all forest stands over 36 years of age are actively transitioning into suitable caribou habitat.

In areas without FRI coverage, the Provincial Land Cover 2000 (PLC 2000) and Provincial Land Cover 2010 (PLC 2010) were used to quantify caribou habitat. These two products differ in the methodology used to produce them, and therefore accuracy. This is most noticeable when comparing the open fen, treed fen, open bog, and treed bog land cover classes. In general terms, the PLC 2000 over-represents the amount of tree cover, often classing an open area or sparsely treed area as treed fen or treed bog (Stratton 2012). In comparison, the PLC 2010 under-represents the amount of treed cover, often classing a sparsely treed or treed area as open fen or open bog (Stratton 2012). When considering that the habitat model for determining winter and refuge habitat (conventional boreal model) classifies treed fen and bog as habitat, but not open fen or bog, it may be important to consider these variations when interpreting the habitat values.

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), which was updated by Environment Canada in 2011 (EC 2011). 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 2011 Environment Canada 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 on the Churchill Range using Ontario data is estimated to be approximately 9.9% greater than that generated using the Environment Canada data. Some of the difference in habitat disturbance values on this range can be attributed to the significant forest fire events of 2011, which were accounted for in Ontario's 2012 disturbance assessment, but not Environment Canada's 2011 assessment. 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 a stable to increasing population growth and evaluation of range status. In the Churchill Range, waterbodies account for a substantial portion (20.1%) 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.

3.7 Special considerations within the range

Special circumstances exist within the Churchill 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 in population and habitat modeling. Such factors should give context to results of the Integrated Range Assessment Framework.

Aboriginal subsistence harvest occurs in low numbers within the range (D. Berube pers. comm. 2013). For example, there is aboriginal subsistence harvest in the vicinity of Lake St. Joseph and on the Vermillion River Road.

Mineral exploration is occurring on mining claims in the vicinity of Birch Lake, Springpole Lake, Confederation Lake, and Lake St. Joseph. This human activity may influence the distribution of caribou and possibly the recruitment of young into the population, as all four of these lakes are known caribou calving and nursery areas. The sensory disturbance components are not addressed by the disturbance analysis.

3.8 Other wildlife

The boundaries of the Churchill Range include Wildlife Management Units (WMU) 3, 4, 16A and 16B (Figure 13), within cervid ecological zones A and B (MNR 2009b). The portion of WMU 3 within the range is very small.

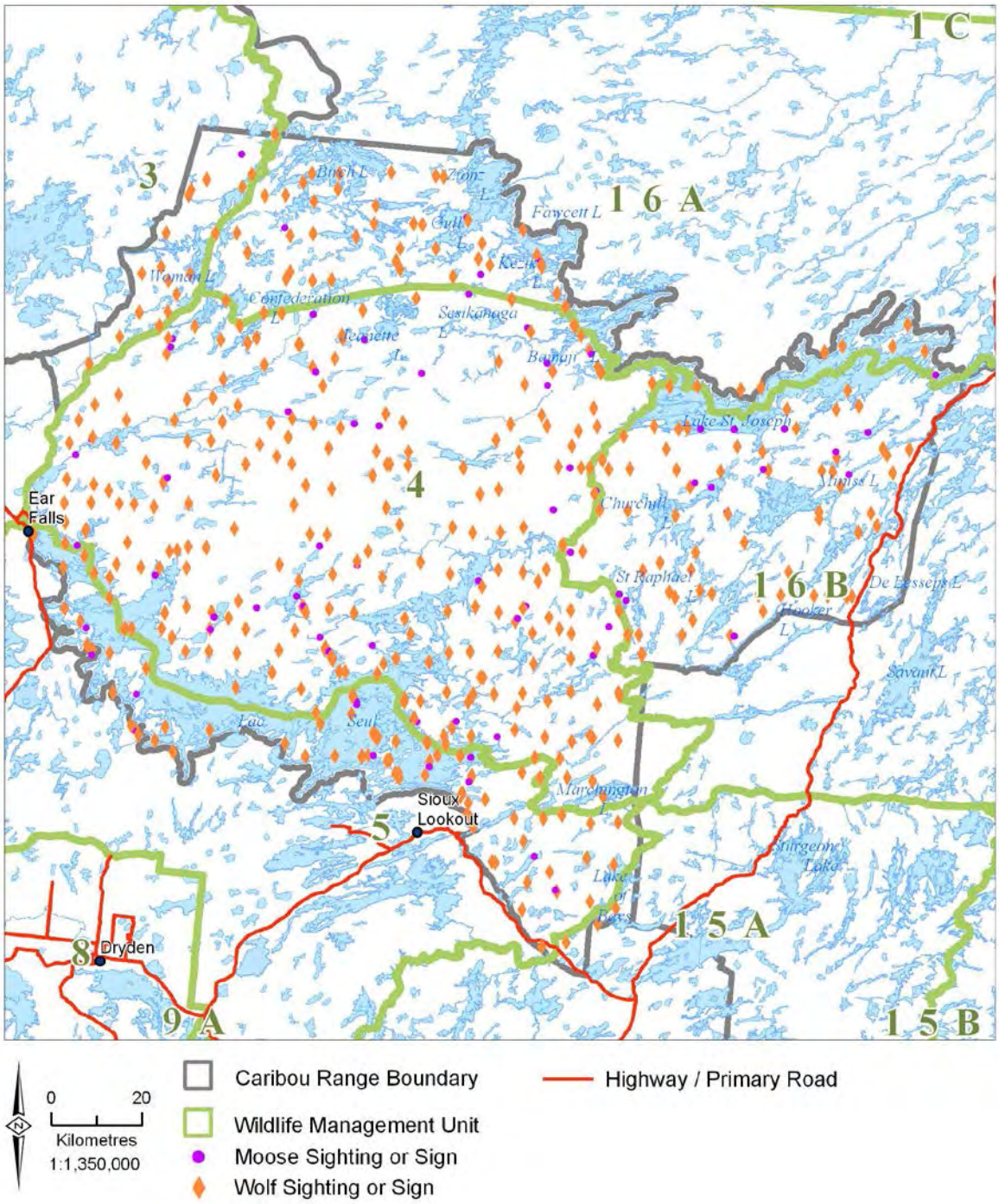


Figure 13. Wildlife Management Units overlapping the Churchill Range with moose and wolf signs or sightings observed during the winter 2012 aerial surveys.

Moose densities have historically been stable to decreasing across much of the Churchill Range and are between 6.0-22.6 moose per 100 km^2 (Table 4). However, moose populations within WMU 16B may be increasing in recent years.

Table 4. Recent moose population estimates for Wildlife Management Units (WMU) within the Churchill 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)
16B	A	10,625	650 (2006)	6.0
4	B	10,991	2130 (2011)	22.6
16A	A	16,900	1300 (2010)	8.0

[1]Area is for the WMU

White-tailed deer in WMUs 4, 16 A and 16 B are believed to be at very low densities but are possibly increasing. Deer are moving northward into areas that have had historically low deer populations, likely responding to less severe winters and lower snow depths over the last 20 years. 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 are relatively abundant in the WMUs within the Churchill Range (17-21 bears/100 km^2) (Table 5) (M. Obbard, MNR unpublished data). Estimated bear densities were similar to average values for WMUs across Ontario's northwest region and black bear ecological zone D.

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

WMU	BBEZ[1]	Year	Density (# bear/100km^2) ± SE	Density relative to BBEZ mean	Density relative to regional mean
16B	D	2009	17.5 ± 6.4	Similar	Similar
4	D	2005	20.9 ± 9.3	Similar	Similar
16A	D		Unknown		

[1]Black bear ecological zone

Traditionally, there is little information about wolf densities. However, during winter 2007 an aerial survey was flown in a study area overlapping much of the Churchill Range. Wolf densities were relatively high and estimated at 0.92 wolves/100 km^2 (B. Patterson, (MNR, unpublished data). At this level, the density is predicted to negatively affect caribou populations (Bergerud and Elliot 1986; Bergerud 1988). Anecdotal evidence indicates that wolf populations

in WMUs 4, 16A, and 16 B are likely displaying a general increase and this is supported by the results of the Moose Hunter Post Card Survey (PCS) wolf sighting index (Figure 14). Furthermore, there were frequent observations of wolves during the winter 2012 caribou 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 4, 16A, and 16B (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 Churchill Range. Range level summaries of data and models pertaining to the Churchill 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 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 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.

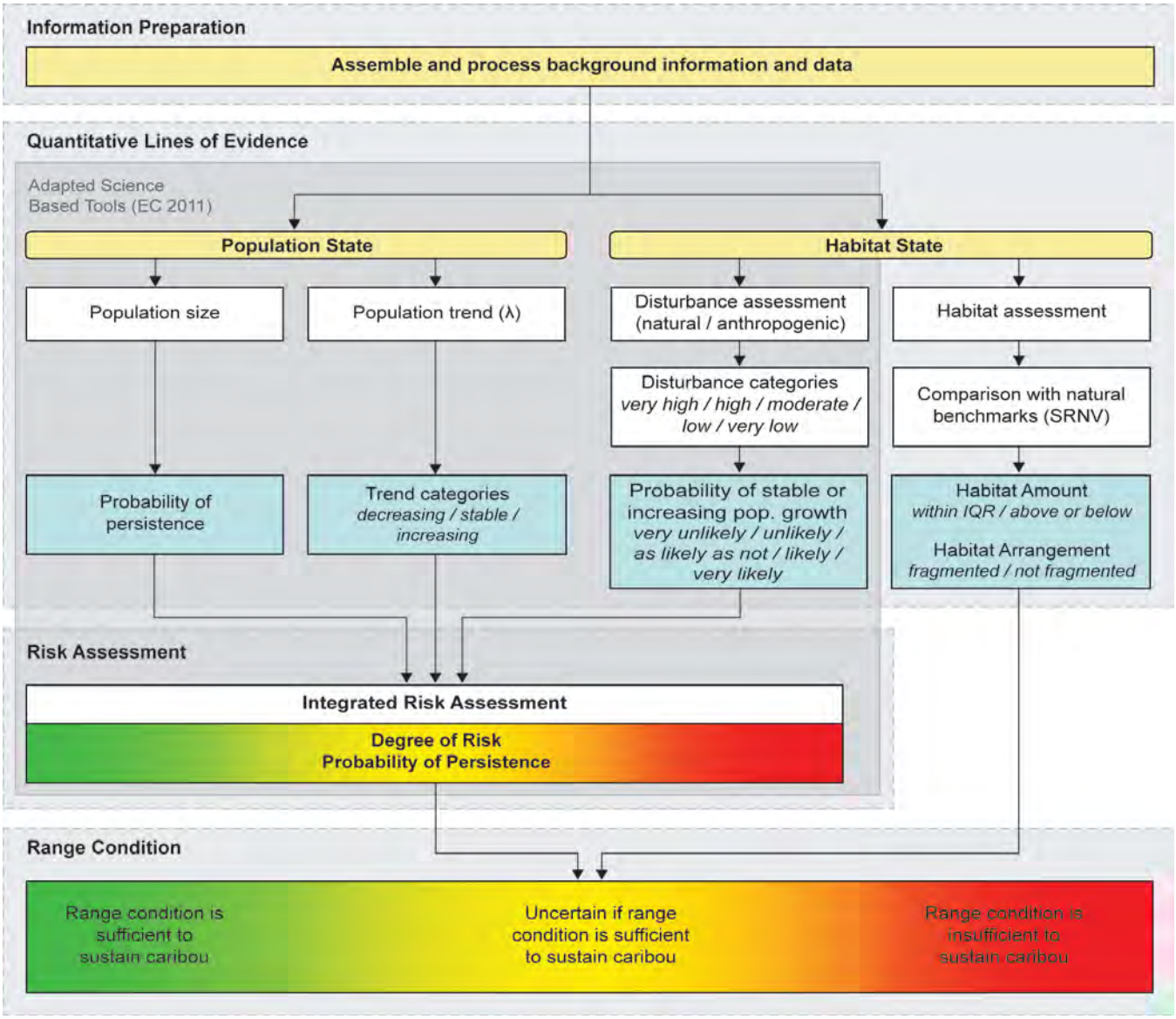


Figure 15. The integrated assessment framework with four quantitative lines of evidence. Three lines of evidence related to population size, trend and habitat disturbance assessment contribute to an integrated risk assessment. The results of the integrated risk assessment are combined with habitat assessment (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 (MNRF 2014a) 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, 13 collars have been placed on caribou between 1995 and 2012. In February and March 2012, 20 GPS collars were deployed on adult female caribou in the Churchill Range. Data generated from collared caribou will be used in this and in future reports to determine annual survival, recruitment and refine trend estimates.

5.1.1.2 Winter aerial surveys

Between February 13th and March 11th, 2012, a fixed-wing hexagon-based aerial survey was conducted for the Churchill Range (Figure 8). All caribou and signs of their presence were recorded. Where possible, observed caribou were counted and classified as adults or calves. Also recorded was evidence of wolves, moose and wolverine. 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 between February 13th and March 11th, 2012. This is 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 were counted and classified caribou as: unknown adults, adult males, adult females, calves, or unknown age and sex. Sex of adults was determined through observation of the presence or absence of a vulva patch, animal behaviour, and/or body morphology.

5.1.1.3 Recruitment

Recruitment estimates follow the Protocol (MNRF 2014a). 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 12-15% 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 average adult survival rates of 85% (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 (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 (MNRF 2014a).

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

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

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

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

5.1.1.5 Size

The aerial survey methods used to conduct a probability-based occupancy survey (Section 3.3) supplemented with a follow-up helicopter survey 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 and

March 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 forty (340) caribou observations were recorded during the 2012 aerial surveys; 48 resulting from the fixed-wing survey and 292 from the rotary-wing survey. After removing recounts, six caribou were observed during the fixed-wing portion and 256 caribou were observed during the rotary-wing portion. Therefore, the total minimum animal count (MAC) was 262, including 18 calves (6.9%), in the Churchill Range during February and March 2012 (Table 6 and Table 7).

During the fixed-wing portion of the survey, no caribou were observed in the southern or northern portions of the range and signs of caribou activity were scarce in the south. Although no caribou were observed in the northern portion of the range, signs of caribou activity were much more abundant. Caribou were only physically sighted in a few locations, all in the central portion of the range (Figure 8).

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 Churchill Range.

Table 6. Minimum animal count observed during a fixed-wing and rotary-wing aerial survey conducted in the Churchill Range, February 13-March 11, 2012.

	Caribou age and sex identification[1]						
Survey method	**UA**	**AM**	**AF**	**Calves**	**UN**	**Total adults**	**Total caribou**
Fixed-wing (FW)	0	3	3	0	0	6	6
Rotary-wing (RW)	42	101	95	18	0	238	256
Total	**42**	**104**	**98**	**18**	**0**	**244**	**262**

[1]UA=Adult of unknown sex, AM= Adult male, AF=Adult female, UN=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). During the 2012 aerial survey, the sex ratio of known adult females to known adult males observed during the rotary-wing survey was 0.448. Using this sex ratio to determine the number of AF_{adj} resulted in a total recruitment estimate of 15.4 calves per 100 AF_{adj} (Table 7; Figure 16).

The 2013 recruitment survey targeted collared adult female caribou and observed 115 caribou, 15 of which were calves. The sex ratio was 0.703, resulting in a recruitment estimate of 24.7 calves per 100 $AF_{adj.}$ These levels of recruitment are low and comparable to 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 fixed-wing and rotary-wing aerial surveys conducted in the Churchill Range during the winters of 2012 and 2013.

		Caribou age and sex identification[1]										
Year	**Survey**	**UA**	**AM**	**AF**	**Calf**	**UN**	**Total adults**	**Total caribou**	**Sex ratio**	AF_{adj}	**Calf: 100 AF_{adj}[2]**	**% Calves[3]**
2012	Winter distribution (FW/RW)	42	104	98	18	0	244	262	0.448	116.8	15.4	6.9
2013	Recruitment survey	9	34	56	15	1	99	115	0.703	62.3	24.7	n/a[4]

[1]UA=Adult of unknown sex, AM= Adult male, AF=Adult female, UN=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 not applicable from recruitment survey data

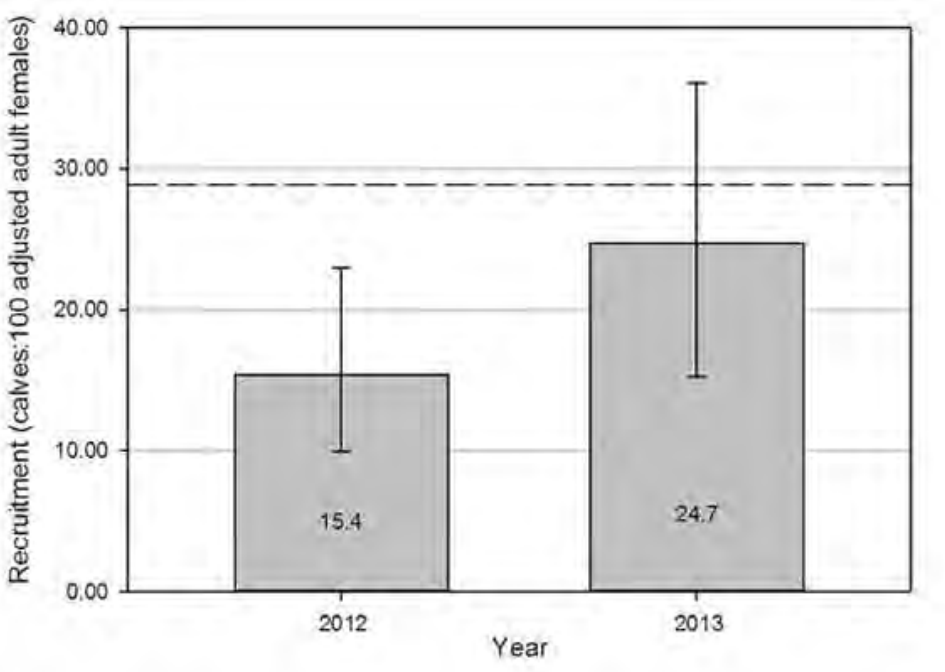


Figure 16. Recruitment estimates (calves/100 AF_{adj}) with associated 95% confidence intervals from 2012-2013 in the Churchill Range. Dashed line indicates recruitment levels expected for a stable to increasing population (EC 2008).

Annual survival was estimated for all collared adult females which spent the majority of their time within the Churchill Range during the biological year (April 1st, 2012, to March 31st, 2013). The annual survival rate was 0.87 (95% CI = 0.75- 1.00) (Table 8; Figure 17) and resulted in an estimated mean population trend (λ) of 0.96 (ranging between 0.94-0.98) suggesting that the short-term population trend is likely declining.

Table 8. Annual survival rates (*S*) and population trend (λ) of collared female caribou (*n*) and number of mortalities (*d*) during 2011-2012 biological years (April 1st-March 31st) in the Churchill Range.

Biological year	*n*	*d*	Exposure days	Daily survival rate	Survival (S)[1]	Upper 95% CI	Lower 95% CI	Lambda (λ)[2]
2011					0.87			0.94
2012	24	3	8188	0.9996	0.87	1.00	0.75	0.98
						Geometric λ Mean		**0.96**

1 The geometric mean survival rate from 2012 was used to estimate population trend (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).

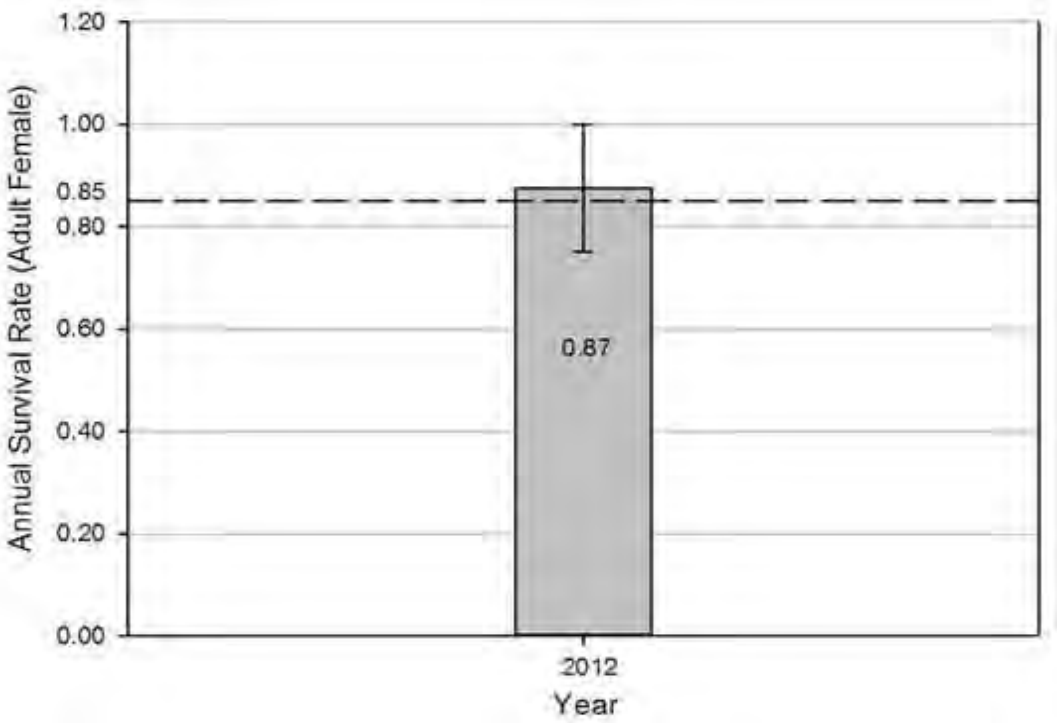


Figure 17. Annual survival rate and 95% confidence intervals of collared adult female caribou which spent the majority of the biological year (April 1st-March 31st) within the Churchill Range. Dashed line represents the 0.85 survival rate (EC 2008).

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 (e.g. Provincial Parks, areas above 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.

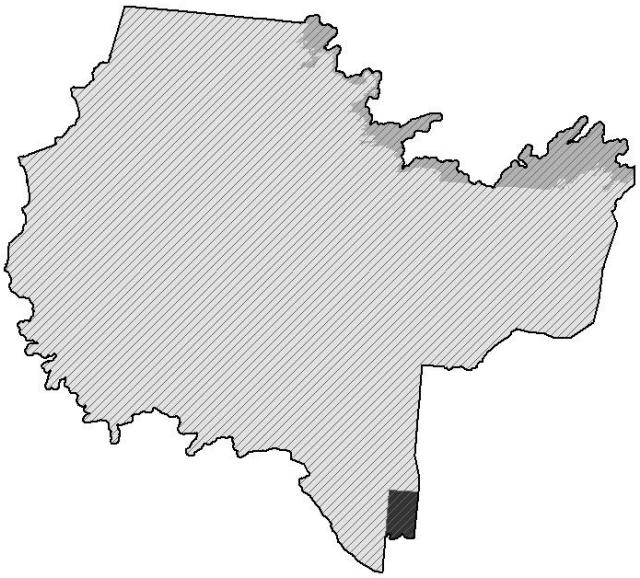


Figure 18. The Churchill Range including the extent of the FRI data ( ), the extent of 2012 Provincial Satellite Derived Disturbance Mapping data ( ), the extent of PLC 2000 data ( ), and the extent of relevant data from LIO ( ).

5.2.2 Disturbance analysis results

The physical disturbance from various sources within the Churchill 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

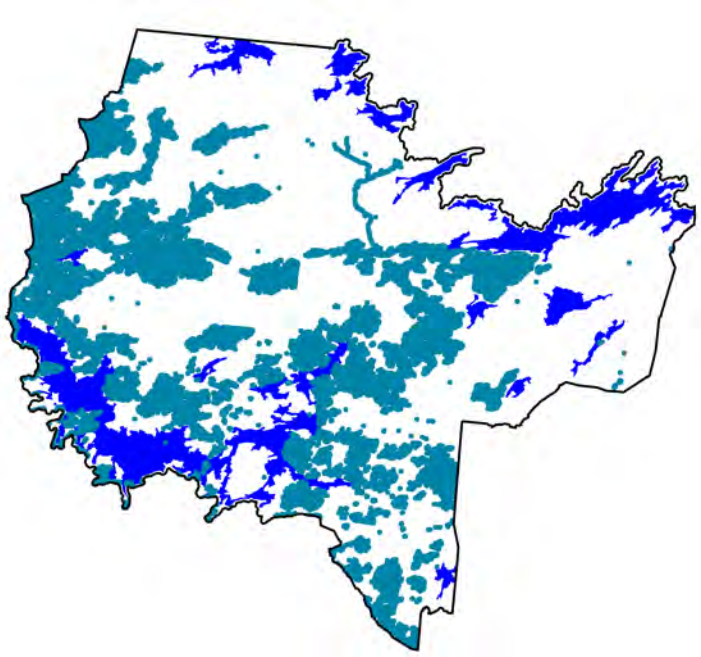


Figure 19. Forest harvest disturbances ( ) including 500 metre buffers in the Churchill Range.

Table 9. Forest harvest statistics in the Churchill Range.

Harvest features	Count (n)	Area (ha)	Buffer area (ha)
Harvest stands (FRI)	51,530	200,089	499,298
Harvest areas (2012 Provincial Satellite Derived Disturbance Mapping)	n/a[1]	172	4,344
Harvest areas (PLC 2000)	n/a[1]	1,658	33,355

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

5.2.2.2 Other industry disturbance

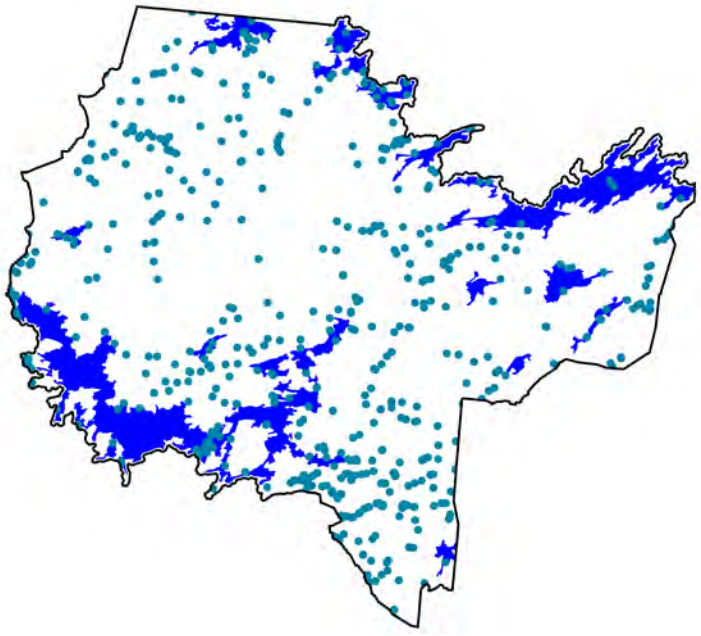


Figure 20. Other industry features ( ) including 500 metre buffers in the Churchill Range.

Table 10. Other industry disturbance statistics in the Churchill Range

Other industry features	Count (n)	Area (ha)	Buffer area (ha)
Agriculture	3	16	230
Airports	8	13	679
Buildings	1,044	n/a[1]	27,835
Dams	1	n/a[1]	13
Forest processing facilities	1	n/a[1]	15
Infrastructure	1	140	441
Towers	6	n/a[1]	548
Trap cabin	109	n/a[1]	8,596
Utility Sites	0	0	0
Waste disposal sites	9	1	767
Water power generating stations	1	n/a[1]	24
Work camps	105	n/a[1]	7,012

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

5.2.2.3 Linear features disturbance

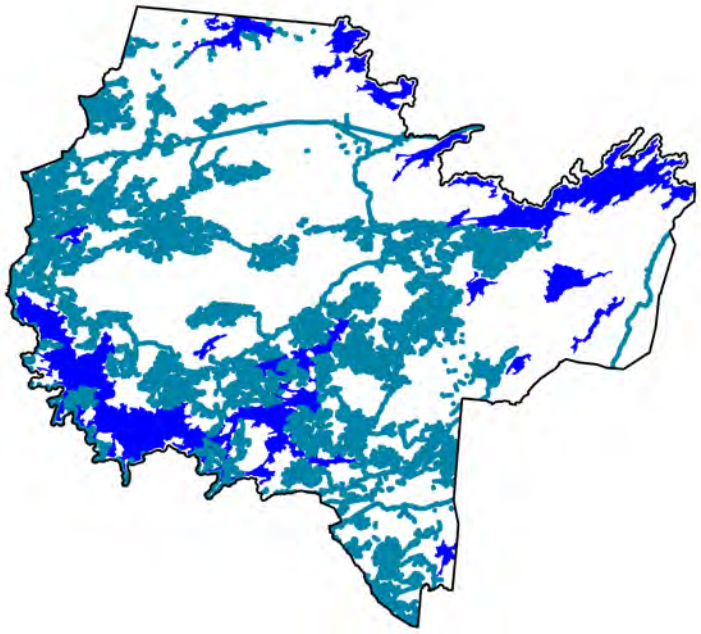


Figure 21. Linear features ( ) including 500 metre buffers in the Churchill Range.

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

Linear feature	Count (n)	Area (ha)	Buffer area (ha)
Roads	n/a[1]	n/a[2]	545,711
Trails	n/a[1]	n/a[2]	21,860
Railways	0	0	4,194
Utility lines	n/a[1]	n/a[2]	20,105

[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

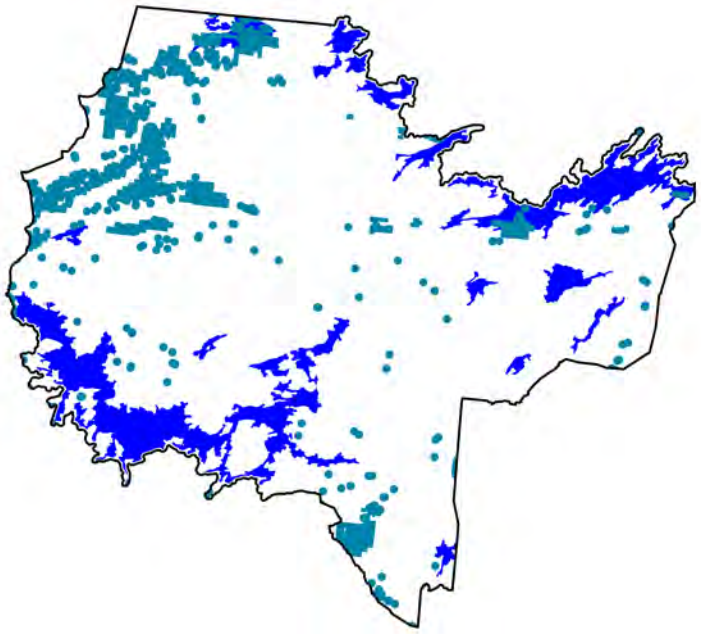


Figure 22. Mining and mineral exploration features ( ) including 500 metre buffers in the Churchill Range.

Table 12. Mining feature disturbance statistics in the Churchill Range.

Mining feature	Count (n)	Area (ha)	Buffer area (ha)
Active mining claims	949	103,843	n/a[2]
Aggregate sites – authorized	0	0	0
Aggregate sites – un-rehabilitated	21	n/a[1]	1,659
Drill holes	1,047	n/a[1]	19,886
Mining locations	0	0	0
Mine (shafts, open pits)	7	411	1,001
Pits and quarries	142	102	10,242

[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

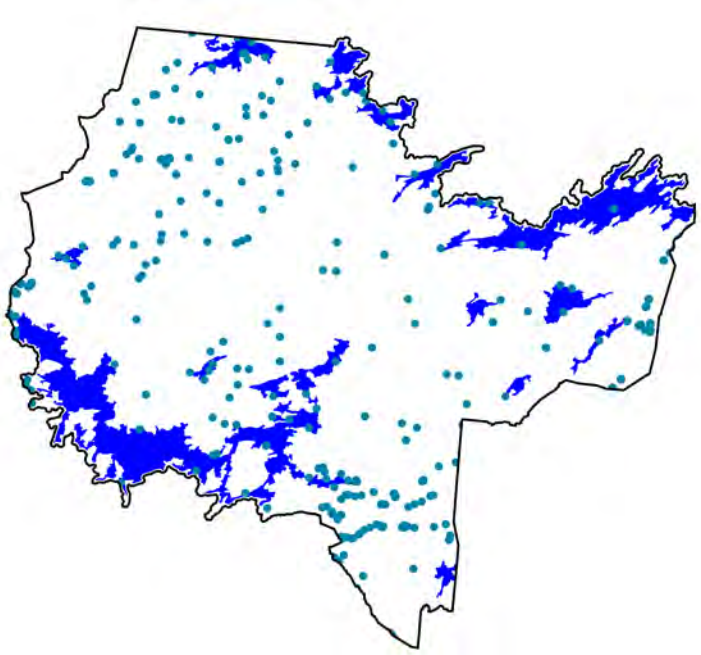


Figure 23. Tourism infrastructure features ( ) including 500 metre buffers in the Churchill Range.

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

Tourism feature	Count (n)	Area (ha)	Buffer area (ha)
Cottage areas	4	59	754
Cottage and residential sites	217	41	10,626
Commercial campgrounds/parking lots/outpost camps/main base lodges	141	66	11,575

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.

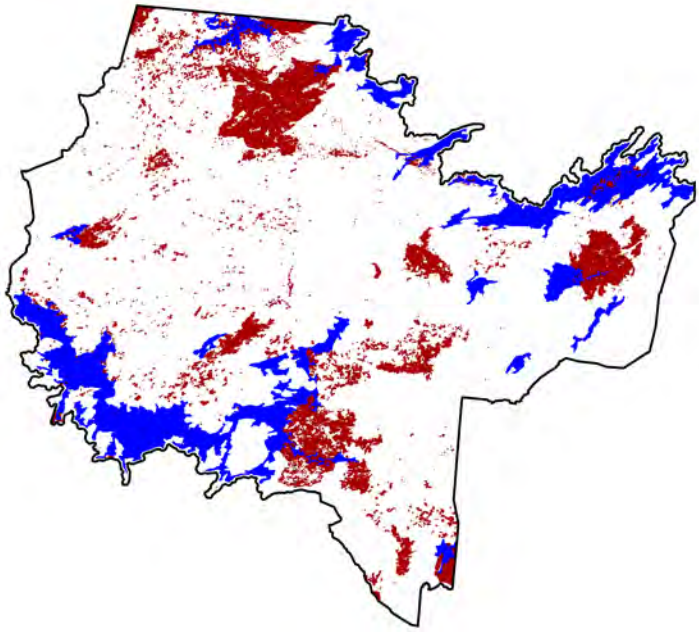


Figure 24. Natural disturbances from fire, blow-down, snow, and insect damage (■) in the Churchill Range.

Table 14. Natural disturbance statistics

Natural feature	Count (n)	Area (ha)	Buffer area (ha)
Fire (FRI)	n/a	102,582	n/a[2]
Fire (2012 Provincial Satellite Derived Disturbance Mapping)	n/a[1]	738	n/a[2]
Weather (2012 Provincial Satellite Derived Disturbance Mapping)	n/a[1]	2,896	n/a[2]
Unknown causes (2012 Provincial Satellite Derived Disturbance Mapping)	n/a[1]	115	n/a[2]
Fire (PLC 2000)	n/a[1]	226	n/a[2]
Fire (LIO)	n/a	56,754	n/a[2]

[1]Derived from raster imagery; number of features not available
[2] No zone of influence (buffer) associated with natural disturbance

5.2.3 Disturbance analysis summary

Water accounts for 20.1% of the landscape within the Churchill Range. Approximately 5.4% of the land are of the range is represented by data sources other than FRI. Table 15 includes range statistics which assist with the interpretation of the disturbance map (Figure 25).

The amount of area, inferred as functional habitat loss identified from the disturbance analysis amounts to 878,285 ha, or 41.3% of the Churchill Range. Natural disturbance accounts for 5.4% and anthropogenic disturbance accounts for 35.9% of the range. The overlap of natural and anthropogenic disturbances accounts for 1.9% of the range area and 4.6% of the total disturbance, this value is counted as anthropogenic disturbance.

Table 15. Churchill Range landscape statistics.

Range component	Area (ha)	%
Total range area	2,126,476	100.0
Water	426,468	20.1
Non-water	1,700,008	79.9
FRI extent[1]	2,010,895	94.6
Non-FRI extent[1]	115,581	5.4
Total disturbance within range	878,285	41.3
Natural[2]	114,825	5.4
Anthropogenic[2]	763,460	35.9
- Overlap of natural and anthropogenic disturbance[3]	40,346	1.9
Not disturbed within range	1,246,191	58.6

[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

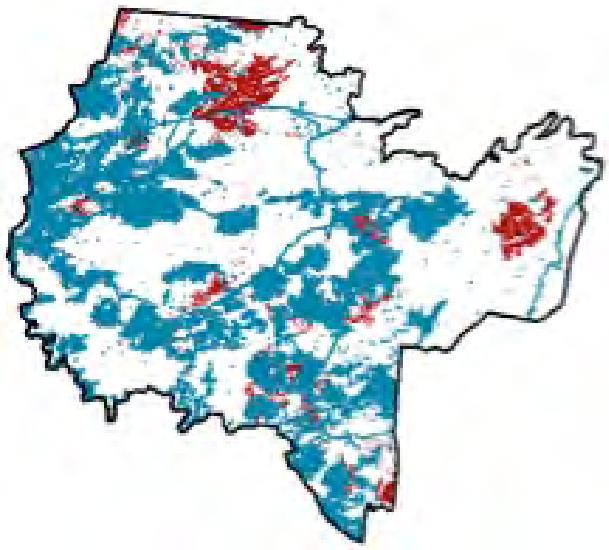


Figure 25. Anthropogenic[1] ( ) and natural ( ) disturbances (i.e. forest <36 years) in the Churchill Range.
[1]Anthropogenic disturbances include a 500 m buffer. When anthropogenic disturbances overlap with natural disturbances it is counted as anthropogenic.

The pattern of disturbance across the Churchill Range reflected in 100 km2 hexagons (Figure 26). Disturbance is interspersed in the southern and western portion of the range as a result of both natural and anthropogenic causes. The eastern and central portion of the range is less disturbed.

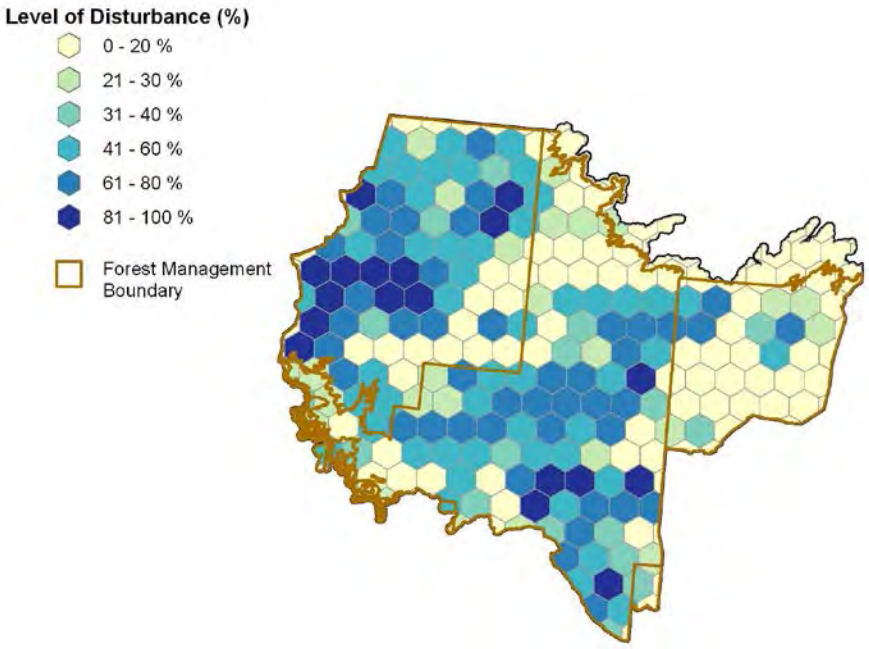


Figure 26. The concentration of natural and anthropogenic disturbances in the Churchill Range within 100 km^2 hexagon grid cells (used for the probability of occupancy survey, Section 3.3).

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

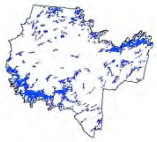
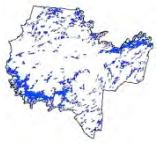
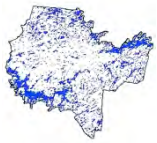
Water accounts for a substantial portion of the Churchill Range (20.1%) and contributes to the ability of caribou to isolate themselves from predators and the provision of calving habitat. However, the footprint of natural and anthropogenic disturbances (such as wildfires and harvest blocks) does not 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 4,264 km^2 of the range, and disturbance ranges from 41.3%-51.7%, depending on the inclusion of water.

Table 16. Disturbance sensitivity analysis. The percent disturbance is estimated by removing waterbodies of differing 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).

Churchill Range	Waterbody	Water ha (%)	Disturbance (%)		
			Natural	Anthropogenic	All
	Range extent	0 (0.0)	5.4	35.9	41.3
	> 10,000 ha removed	168,437 (7.9)	5.9	39.0	44.9
	> 5,000 ha removed	180,203 (10.6)	5.9	39.2	45.1

	> 1,000 ha removed	270,5729 (12.7)	6.2	41.1	47.3
	> 500 ha removed	300,819 (14.1)	6.3	41.8	48.1
	> 250 ha removed	329,268 (15.5)	6.4	42.5	48.9
	All water removed	426,468 (20.1)	6.8	44.9	51.7

5.2.5 Habitat state: habitat assessment

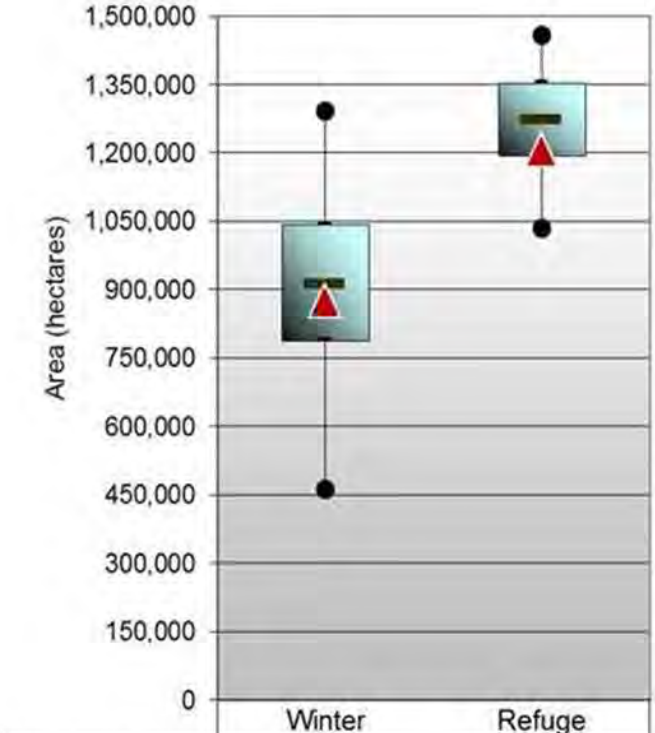
Habitat assessment compares the current amount and arrangement of habitat against that projected by the Simulated Range of Natural Variation or SRNV (MNRF 2014a). For the Churchill Range both the amount and arrangement SRNV are compared against 2012 amounts and 2010 arrangement as inferred from the FRI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

Figure 27. The Churchill 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 and refuge habitat are below the median but within the interquartile range of what is expected in a natural system projected by the SRNV (Figure 28). The value shown for each FMU include all land regardless of ownership. Consequently, the Integrated Range Assessment are significantly higher than those used in forest management planning which would include managed crown land only.



	Winter	Refuge
Lower Quartile	789,520	1,196,592
Lower Range	461,357	1,035,807
Median	911,008	1,271,623
Upper Range	1,292,364	1,459,006
Upper Quartile	1,044,972	1,355,828
2012	876,983	1,205,640

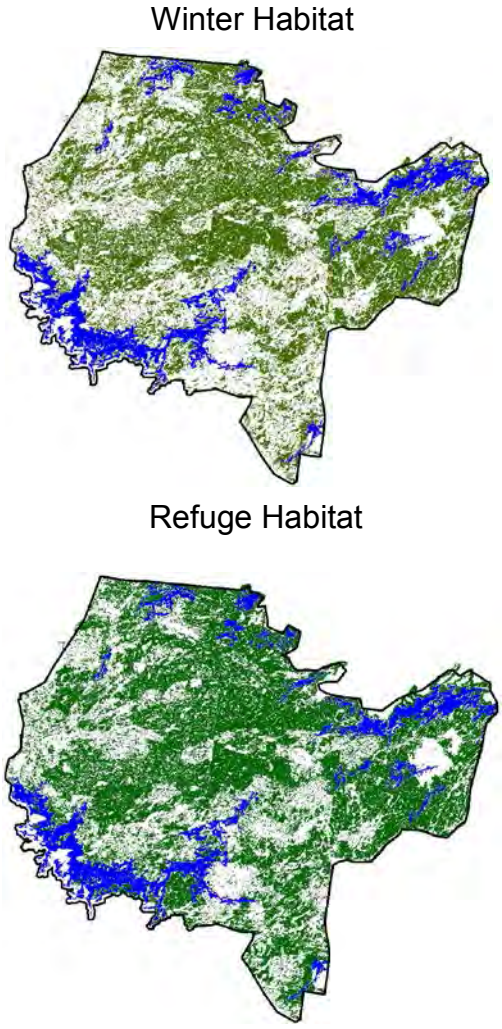
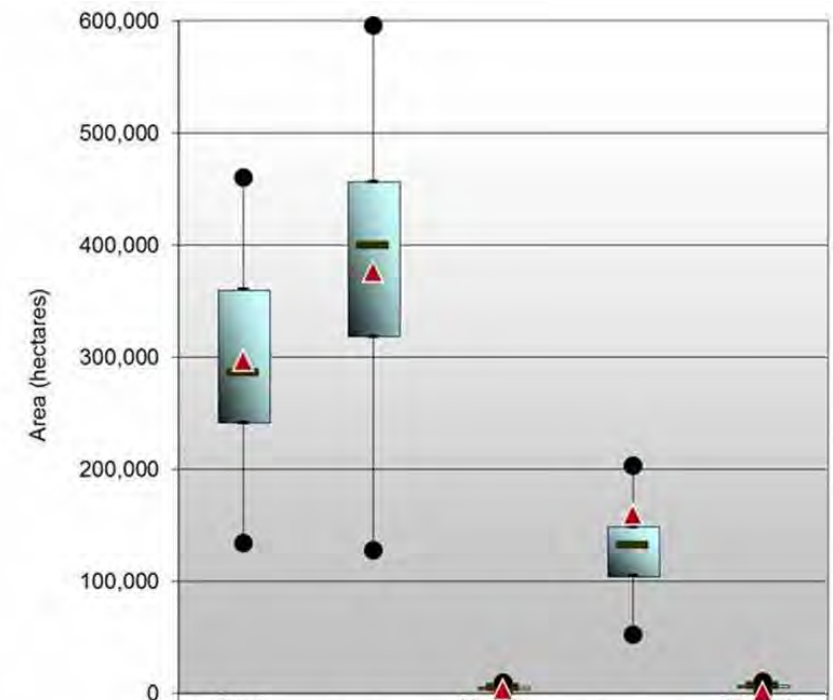


Figure 28. Box and whisker plot of caribou winter and refuge habitat amounts in the Churchill Range as compared to the SRNV.

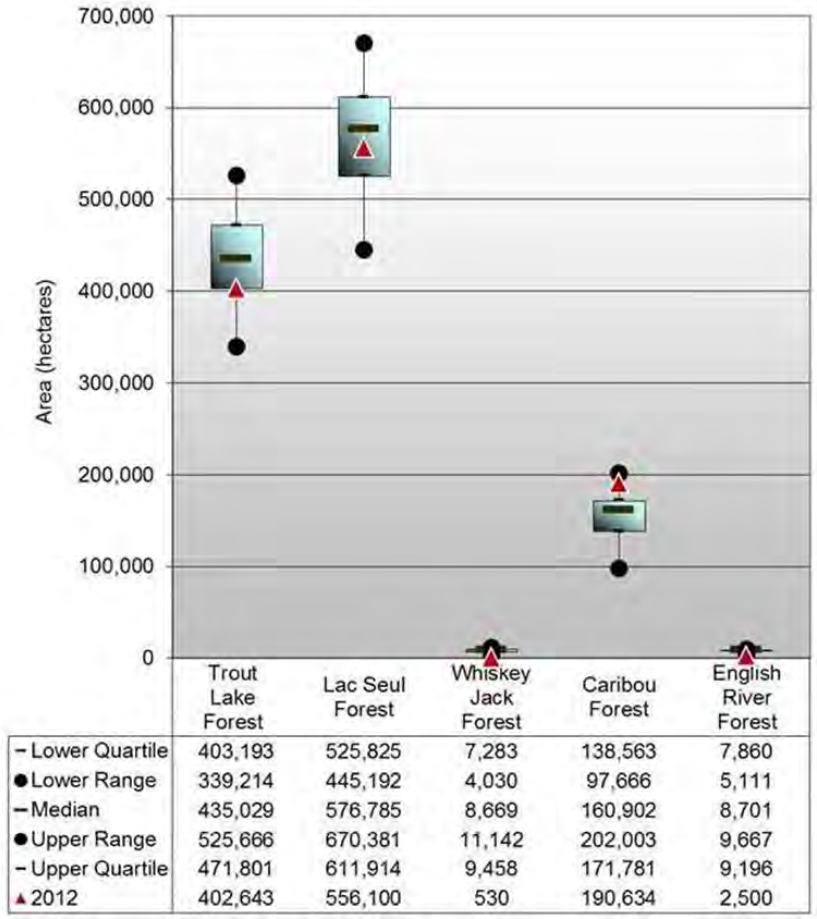
Current winter habitat amounts across the Churchill Range were examined according to Forest Management Unit (FMU) (Figure 29). Current amounts with the Trout Lake and Caribou FMUs are above the median. Winter habitat in the Lac Seul Forest is below the median but above the lower quartile. Amount in the Whiskey Jack and English River FMUs (which are very small portions of the range) are below the lower quartile.

Current refuge habitat amounts across the Churchill Range were also examined according to FMU (Figure 30). Refuge habitat in the Caribou Forest is currently above the upper quartile of the SRNV. Amount in the Trout and Lac Seul FMUs is within the interquartile range. Refuge habitat amount in the Whiskey Jack and English River FMUs is below the lower range of the SRNV.



	Trout Lake Forest	Lac Seul Forest	Whiskey Jack Forest	Caribou Forest	English River Forest
– Lower Quartile	241,614	318,426	3,714	104,793	5,286
● Lower Range	134,506	127,874	1,176	52,203	2,065
– Median	285,769	399,076	5,071	131,858	6,640
● Upper Range	460,170	595,896	9,814	202,781	10,322
– Upper Quartile	360,038	456,328	6,414	148,676	7,769
▲ 2012	297,108	376,110	3,000	159,434	1,250

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



	Trout Lake Forest	Lac Seul Forest	Whiskey Jack Forest	Caribou Forest	English River Forest
– Lower Quartile	403,193	525,825	7,283	138,563	7,860
● Lower Range	339,214	445,192	4,030	97,666	5,111
– Median	435,029	576,785	8,669	160,902	8,701
● Upper Range	525,666	670,381	11,142	202,003	9,667
– Upper Quartile	471,801	611,914	9,458	171,781	9,196
▲ 2012	402,643	556,100	530	190,634	2,500

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

5.2.6.2 Winter habitat arrangement

At the 6,000 hectare level, 50.9 % (0.295 + 0.214 = 0.509) of the hexagons have 61% or more winter caribou habitat (Figure 31). The mean from the SRNV is lower with 44.9% (0.301 + 0.148= 0.449) of the hexagons having 61% or more winter caribou habitat. Most of this difference occurs in the 81-100% proportion class. This represents a present arrangement value 6.0% above the SRNV.

At the 30,000 hectare level, 48.5% (0.332 + 0.153 = 0.485) of the hexagons have 61% or more winter caribou habitat. The mean from the SRNV is lower with 40.6% (0.348 + 0.058 = 0.406) of the hexagons having 61% or more winter caribou habitat. This represents a present arrangement value 7.9% above the SRNV.

Currently caribou winter habitat measured at the 6,000 and 30,000 ha levels is not fragmented relative to our estimates of the natural landscape.

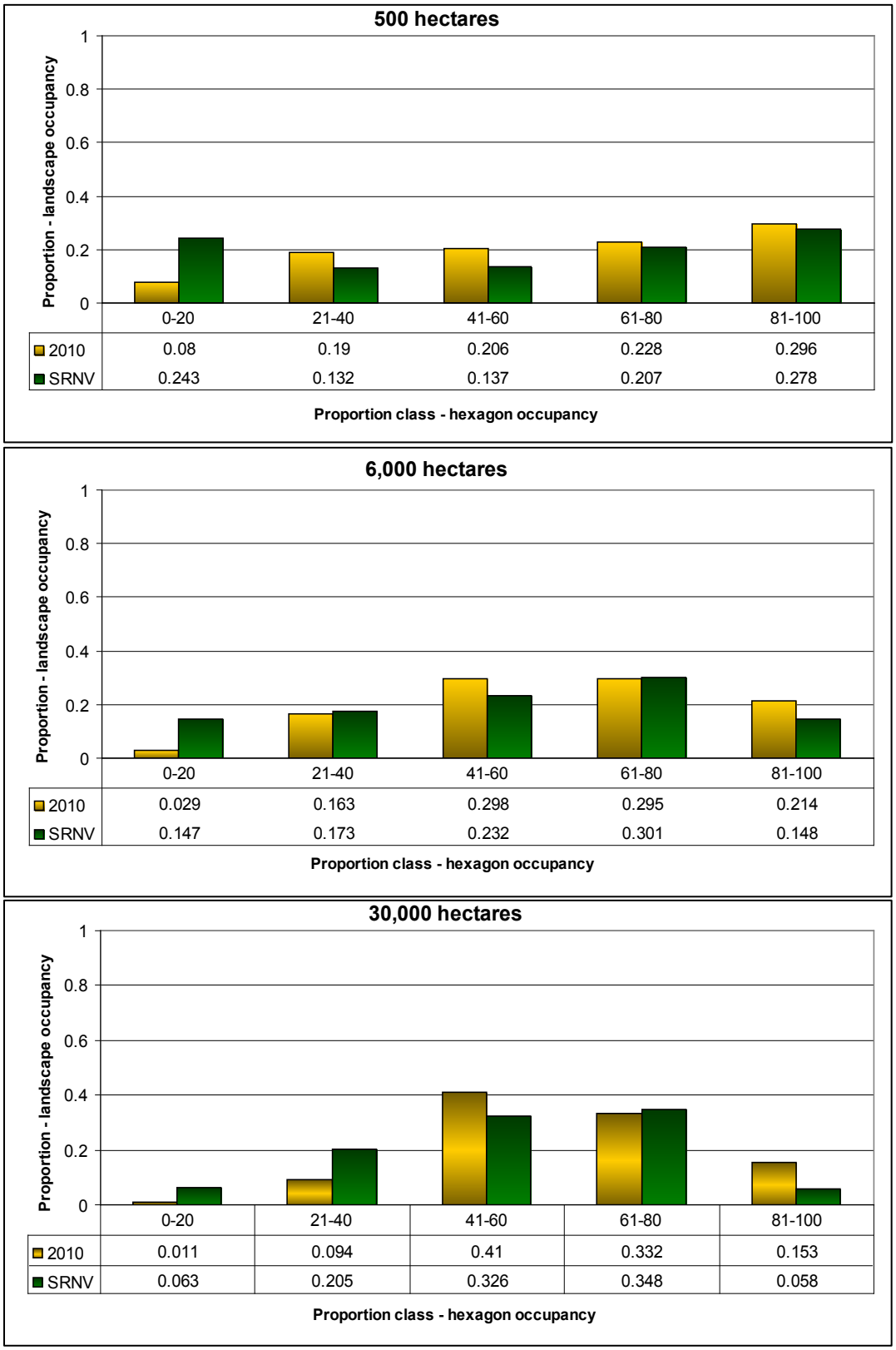


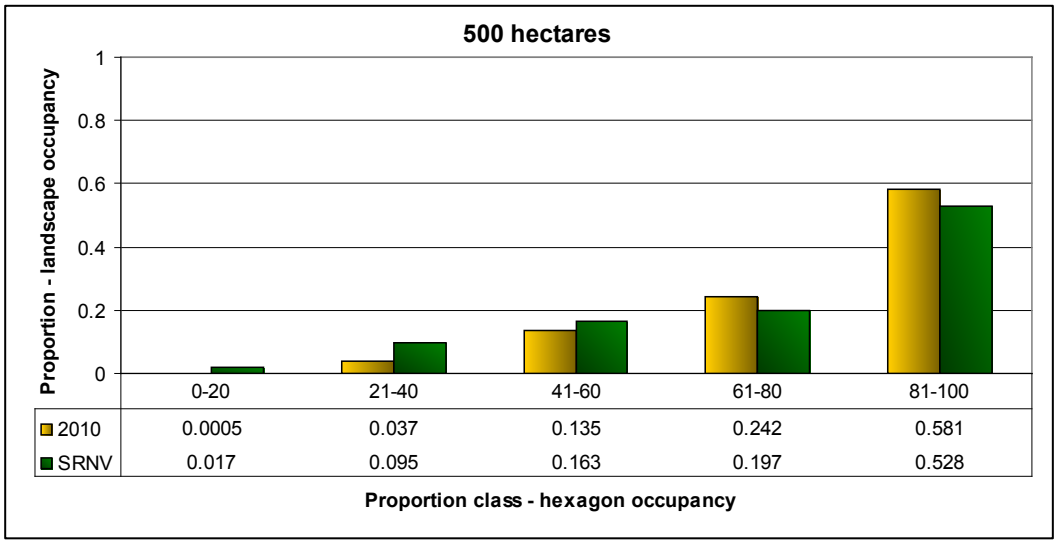
Figure 31. Caribou winter habitat texture histogram compared to means from the SRNV at the 500, 6,000, and 30,000 hectare levels for the Churchill Range.

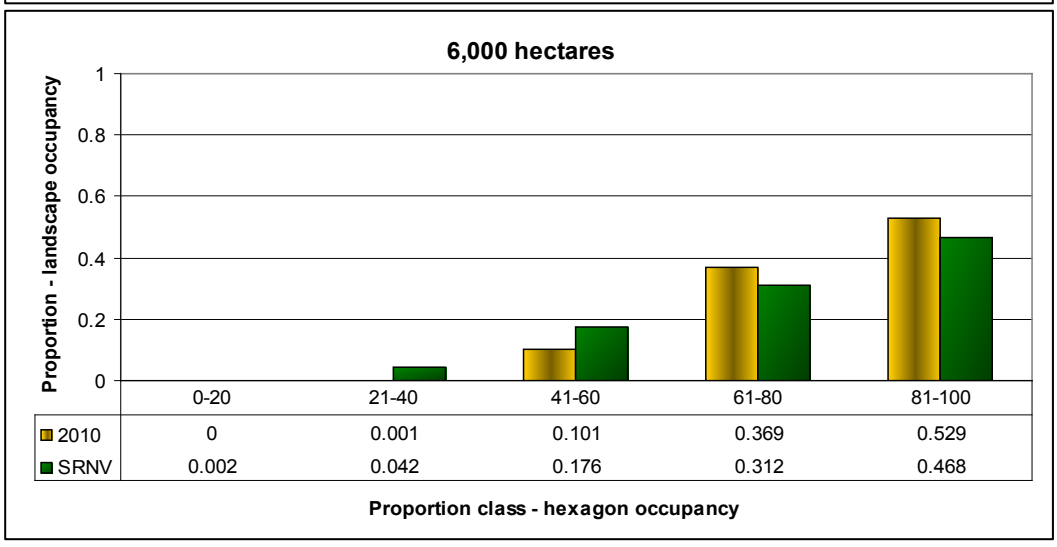
5.2.6.3 Refuge habitat arrangement

At the 6,000 hectare level, 89.8% (0.369 + 0.529 = 0.898) of the hexagons have 61% or more refuge habitat (Figure 32). The mean from the SRNV is less with 78% (0.312 + 0.468 = 0.780) of the hexagons having 61% or more refuge habitat. Most of this difference occurs in the 81-100% proportion class. This represents a present arrangement value 11.8% above the SRNV.

At the 30,000 hectare level, 97% (0.508 + 0.462 = 0.97) of the hexagons have 61% or more refuge habitat. The mean from the SRNV had 84.7% (0.443 + 0.404 = 0.847) of the hexagons having 61% refugee habitat. This suggests that the landscape is not fragmented, with an arrangement value 12.3 % above the SRNV.

Caribou refuge habitat measured at the 6,000 and 30,000 ha levels is not fragmented relative to the SRNV.





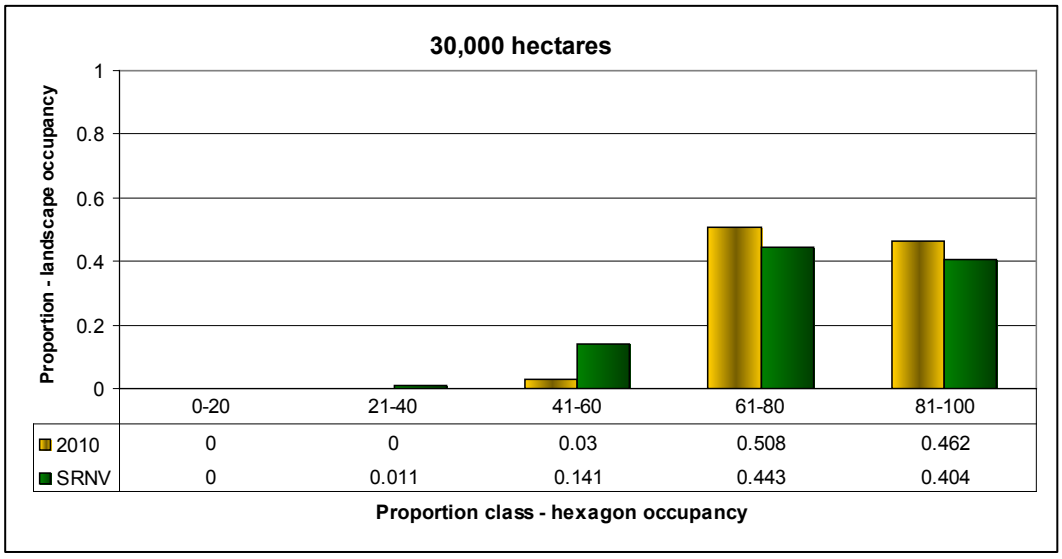


Figure 32. Caribou refuge habitat texture histogram compared to means from the SRNV at the 500, 6,000, and 30,000 hectare levels for the Churchill Range.

5.2.6.4 Young forest SRNV area results

The current amount of young forest is below the median but above the lower quartile range estimated by the SRNV (Figure 33). This indicates that the current amount is less than what would be expected in a natural system. Young forest includes all young forests regardless of origin and includes forest areas created by fire, logging, or blowdown.

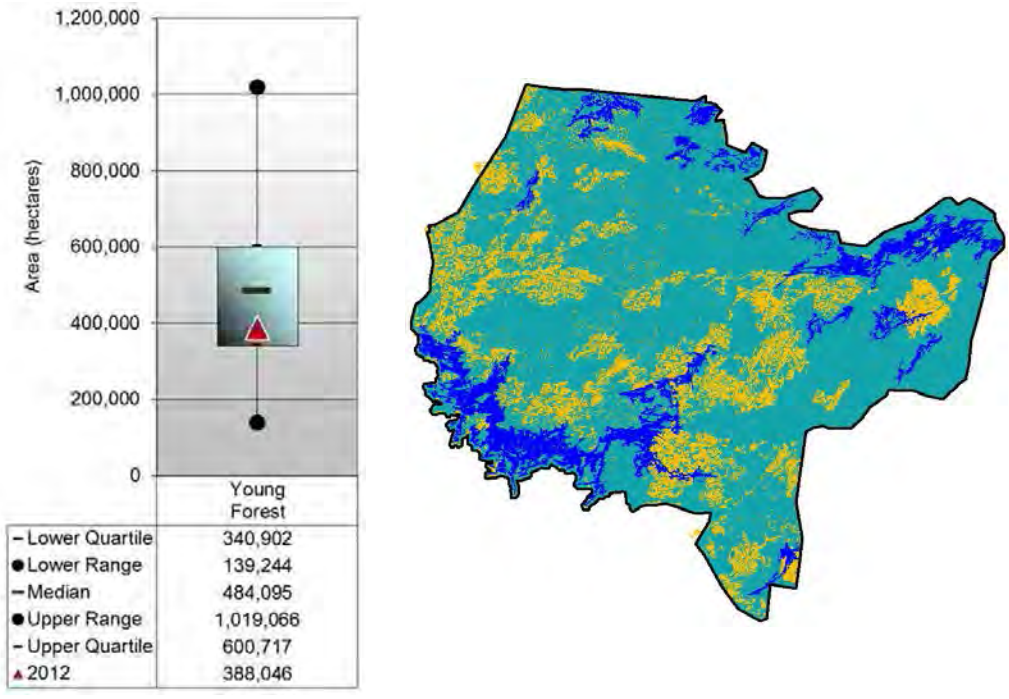


Figure 33. Box and whisker plots of young forest (i.e. <36 years) and permanent disturbance in the Churchill Range as compared to the SRNV.

6.0 Interpretation of Lines of Evidence

6.1 Interpretation of the population state

The minimum animal count for caribou (MAC) occupying the Churchill Range was 262. Generally, MNRF staff are confident that they observed the majority of the caribou within the range by targeting many known areas of caribou activity during the rotary-wing portion of the winter distribution survey in 2012 (Robinson pers. comm. 2012). Despite this, it is known that surveys of this nature typically only detect a portion of the caribou present; we concluded that this range is occupied by at least 300 caribou and possibly substantially more.

Recruitment rates in 2012 and 2013 (15.4 and 24.7 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). Although adult female survival was 87%, the resulting population growth rate (λ) was in decline (0.96). The low recruitment rates indicate a low recovery potential for caribou in the Churchill Range. Warm winter weather during the survey in 2012 may have contributed to the very low calf sightings and resulting recruitment estimate. Low recruitment in 2012 was also observed in the Berens and Sydney ranges as well as Manitoba. 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).

The probability of occupancy estimates were low in the south and were generally higher in the north-central portion of the range, just east of Seseganaga Lake and north of the 1961 burn, and around the St. Raphael Signature Site in the east-central portion of the range. There is an apparent inverse relationship between occupancy estimates (Figure 10) and the amount of disturbance (Figure 13). Areas of low occupancy in the north are associated with relatively large natural or forest harvest disturbances. The average range-wide probability of caribou occupancy without habitat covariates (0.37; ±0.14) 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 the Churchill Range boundaries is unknown – although there is some collared caribou movement evidence to show caribou cross the eastern boundary with the Brightsand Range near St. Raphael Signature Site and the Savant Lake area, north into the Kinloch Range along the Cat River system, and the northwest to the Berens Range (Birch Lake area and the area south of Upper Goose Lake). It is likely that movement between the Churchill and Sydney ranges is very limited as there is a significant amount of anthropogenic disturbance in both ranges along the boundary. 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

More than 40% of the Churchill Range is disturbed, most as a result of human-caused activities. These disturbance activities are concentrated in the southern, central and western portions of the range.

The level of disturbance on the Churchill Range is 41.3% (all waterbodies included). As a result, the probability of a stable-or-increasing population growth is considered uncertain with an estimated probability of 0.47. The influence of waterbodies in the disturbance analysis should be considered when evaluating the level of disturbance within the range. The water sensitivity analysis (Section 5.2.4) demonstrated that the disturbance estimate for the Churchill Range may be as great as 51.7% (all waterbodies excluded). At such a level it is unlikely that the range could sustain caribou. 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.

Current winter and refuge habitat amounts on the Churchill Range are below the median but within the interquartile range of the SRNV. Increasing or maintaining the amount of winter and refuge habitats throughout the range, as well as increasing winter or refuge habitat within the Trout Lake and Lac Seul FMUs would create conditions that would more commonly have occurred in landscapes to which caribou have adapted.

Winter and refuge habitats within the range occur in large contiguous patches (6,000 and 30,000 ha scales) and are consistent with the SRNV. Improvements could occur through the creation and retention of strategically placed large contiguous patches of winter and refuge 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 SRNV is desirable to improve prospects for caribou conservation and recovery. At present, the amount of young forest (including permanent disturbances) within the range is below the median value 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 Churchill Range, based on the MAC from the winter 2012 survey is 262 and likely exceeds 300 caribou. The Churchill Range is part of the Continuous Distribution in Ontario, some immigration and emigration likely occurs. By using the minimum animal count of 262, estimates of probability of persistence are likely precautionary. The probabilities of persistence for 20 and 50 years, under the assumption of a stable or increasing population (see population trend) would be approximately 0.95-0.99 and 0.75-0.90 respectively (MNRF 2014a; EC 2011) (Figure 34).

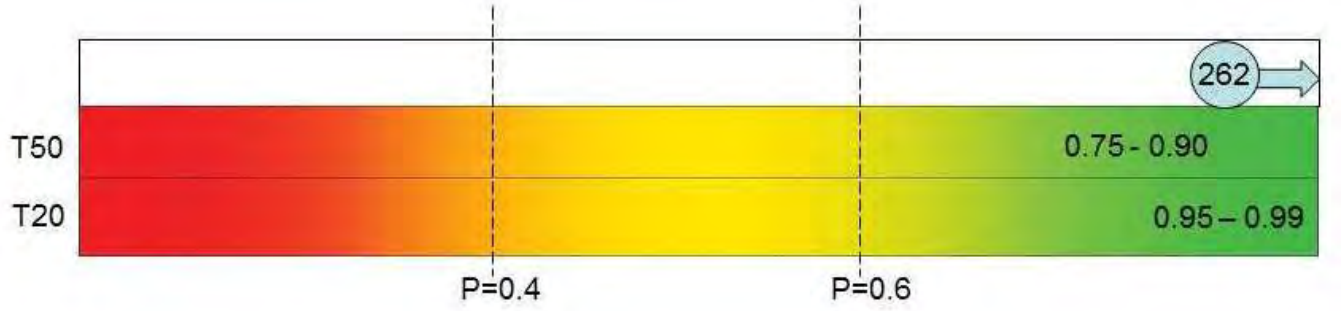


Figure 34. Minimum animal count (MAC) in the Churchill Range estimated from the 2012 winter aerial survey as compared to probability of persistence in 20 years (T20) and 50 years (T50).

7.2 Population trend

The current estimate of trend, based on the 2011 and 2012 biological years, suggests the short-term population trend is likely stable to declining ($\lambda = 0.96$) (Figure 35). Uncertainty exists regarding a long-term trend as survival from the 2012 biological year was good but recruitment rates were variable and low. Future recruitment and survival estimates from collared adult females will continue to inform and support the population trend information.

Other long-term trend indicators suggest range recession has occurred within the Churchill Range and some areas in the southern portion of the range are no longer occupied by caribou (Figure 5-Figure 7).

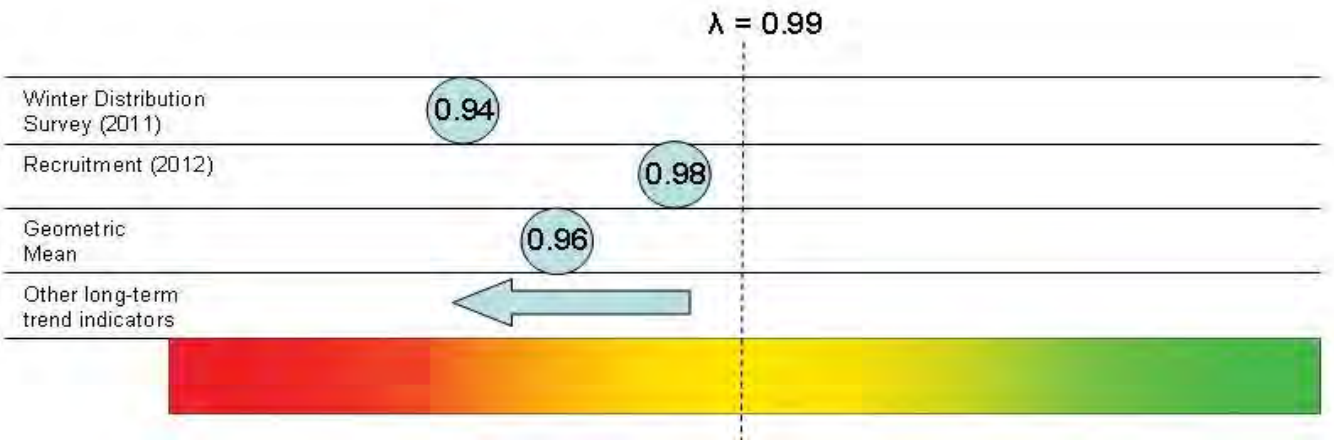


Figure 35. Estimated population trend (λ) for the Churchill Range according to the source of the data (i.e. survey) and the corresponding biological year (not the survey year), as well as the short-term trend (geometric mean) and long-term trend as determined from other trend indicators.

7.3 Disturbance analysis

The Churchill Range is 41.3% disturbed (Figure 36). Calculated values of disturbance range from 41.3-51.7%, depending on the treatment of water. When considering the accuracy of fine-scale data used in the disturbance analysis, the calculated value of 41.3% provides a realistic depiction of the amount of disturbance in the Churchill Range. This level of disturbance would suggest that the likelihood of stable or increasing population growth is approximately 0.47 and is considered uncertain.

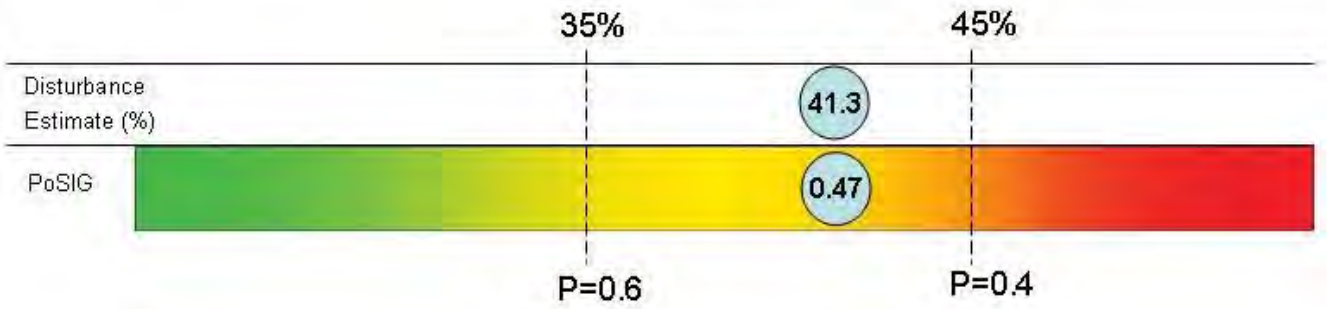


Figure 36. Disturbance estimate as a percentage of area within the Churchill Range as it relates to the probability of stable or increasing population growth (PoSIPG).

7.4 Integrated risk assessment process

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

Step 1: Lambda is less than 0.99 and likelihood of stable or increasing population growth is greater than 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 less 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 6: Likelihood of stable or increasing population growth is greater than 0.4; *AND* the probability of persistence based on the MAC of 262 is greater than 0.6 (for T=20).

Based on this analysis, risk to caribou in the Churchill Range is intermediate.

7.5 Range condition

Risk is estimated to be intermediate in the Churchill Range. Amount of both winter and refuge habitat is within the interquartile range and the arrangement of winter and refuge habitat is not fragmented relative to the SRNV. Thus the amount and arrangement of habitat does not support a range condition different from that suggested by risk analysis. Therefore, the Assessment Team determined that it is uncertain if the range condition is sufficient to sustain caribou.

8.0 Involvement of First Nation Communities

The MNRF submitted letters of notification to the Lac Seul First Nation, Grassy Narrows First Nation, Wabauskang First Nation, Eagle Lake First Nation, Ojibway Nation of Saugeen, Mishkeegogamang First Nation, Slate Falls First Nation, Cat Lake First Nation, Wabigoon Lake Ojibway Nation, and Wabigoon Metis in the months prior to aerial survey work. A presentation was made to Eagle Lake First Nation prior to the integrated range assessment aerial survey.

9.0 Comparison with the Federal Generalized Approach

Environment Canada published a *Scientific Assessment to Inform the Identification of Critical Habitat for Woodland Caribou (Rangifer tarandus caribou), Boreal Population, in Canada* (EC 2011). Based on the limited available information and specific methodologies used by EC (2011), it was determined that caribou occupying the Churchill Range were likely self-sustaining. EC concluded that the Churchill Range was 31% disturbed and the population size was estimated to be 300 caribou; no probability of persistence was given based on insufficient available 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 EC 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 262, and suggests the population is larger than 300 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. Current recruitment and adult survival estimates derived from the winter 2012 distribution survey collared caribou resulted in lambda calculations that suggest a declining trend over the short-term. Other long-term trend indicators suggest a declining trend.
4. MNRF considered amount and arrangement of caribou habitat in the determination of overall range condition, which was not considered by EC.

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