

Imminent Threat Assessment for the Caribou, Boreal Population

(Rangifer tarandus)



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IMMINENT THREAT ASSESSMENT FOR THE CARIBOU (*RANGIFER TARANDUS*), BOREAL POPULATION

EXECUTIVE SUMMARY

This imminent threat assessment has been developed to help the federal Minister of the Environment form an opinion on whether the Caribou (*Rangifer tarandus*), Boreal population, is facing imminent threats to its survival or recovery in Canada pursuant to section 80 of the *Species at Risk Act*.

This assessment was triggered by the Minister's receipt of official correspondence from several First Nations in Quebec asking him to implement concrete and effective measures to ensure the survival and recovery of the boreal caribou, including the adoption of an emergency order under section 80 of the *Species at Risk Act*. The assessment examines current threats to the caribou in Quebec, but also aims to determine whether the species overall is exposed to imminent threats. The precautionary principle and the best available information have been taken into account in conducting the assessment.

Species information

The boreal caribou was added to Schedule 1 of the *Species at Risk Act* in 2003 as a threatened species. This status was reconfirmed in 2015 following the re-examination of the species' status by the Committee on the Status of Endangered Wildlife in Canada in 2014.

These medium-sized cervids require large areas of undisturbed, interconnected old-growth coniferous forest to spatially separate themselves from predators. In Canada, the main factor in the decline of boreal caribou populations is habitat disturbance, which favours other prey species and, by extension, their predator populations. This results in increased predation pressure on caribou, to the point that caribou may not be able to withstand it. Many human activities contribute to the disturbance of caribou habitat in Quebec, and likely pose threats to the survival and recovery of the species. A number of these activities have been ongoing for several decades and are likely to continue in the coming years.

In 2012, an initial recovery strategy was drawn up in accordance with section 37 of the *Species at Risk Act*. This document, which was partially updated in 2020, establishes that the recovery goal is to achieve self-sustaining local populations in all the boreal caribou ranges throughout the species' current distribution in Canada, to the extent possible. The document also sets out a maximum disturbance management threshold of 35%, which, when it is exceeded, reduces the probability of a population being self-sustaining to less than 60%.

In 2021, the Quebec government identified 10 local population ranges and two knowledge acquisition areas for the species. These ranges represent the best available information on the structure and distribution of caribou populations in Quebec, and are used as the unit of analysis in this assessment. Based on three indicators of self-sustainability (population size, finite growth rate of population and level of habitat disturbance), three of these local populations face a particularly high level of risk (Val-d'Or, Charlevoix and Pipmuacan). In addition, two other local populations (Assinica and Témiscamie) have a level of habitat disturbance exceeding the 35% threshold. This threat assessment covers all boreal caribou populations in Quebec, but focuses on these five local populations.

Information on new or evolving threats

The anthropogenic activities taking place in Quebec that have contributed the most to habitat disturbance to date are logging and the road network. Consequently, this assessment focuses on these two activities. The Quebec government's 2023–2024 *Programmations annuelles des activités de récolte* (PRANs) [annual harvesting programs] represent the best available information for assessing the effects of logging and road construction on boreal caribou. Environment and Climate Change Canada (ECCC) quantified the planned logging and road construction activities in the Val-d'Or, Charlevoix, Pipmuacan and Témiscamie ranges. Based on the partial data available for the Assinica range, these activities are also planned in this range, although they have not been quantified.

Threat assessment

The impact of at least two threats—logging and the road network—is intensifying, particularly in the case of the Val-d'Or, Charlevoix, Pipmuacan and Témiscamie populations. Disturbance mapping by ECCC in 2010 and 2020 indicates that the level of disturbance linked to logging has increased, at least in the Val-d'Or (from 33% to 43%), Charlevoix (from 51% to 62%), Pipmuacan (from 46% to 53%), Assinica (from 27% to 33%) and Témiscamie (from 21% to 25%) ranges. The level of disturbance related to the road network has also increased, at least in the Val-d'Or (31% to 37%), Charlevoix (36% to 40%), Pipmuacan (18% to 24%), Assinica (13% to 16%) and Témiscamie (8% to 10%) ranges. In addition, according to the work planned in the 2023–2024 PRANs, the level of disturbance linked to logging will likely increase (relative to 2020) in the Val-d'Or (< 1%), Charlevoix (between 2% and 3%), Pipmuacan (between 2% and 3%) and Témiscamie (< 1%) ranges. The level of disturbance associated with multi-purpose roads (which make up the majority of the road network) will also likely increase (relative to 2020) in the Val-d'Or (< 1%), Charlevoix (< 1%), Pipmuacan (~ 1%) and Témiscamie (< 1%) ranges. In the Val-d'Or range, the projected increases will probably be lower than those in a typical year. At the time of this assessment, 2023–2024 PRAN data

were available for only a small portion of the Assinica range and consequently were not taken into account. The 2023–2024 PRAN data for the Témiscamie range were also incomplete, only covering 44% of this range.

Implications for survival: It is the view of ECCC that the threats examined will not make the survival of boreal caribou in Canada highly improbable or impossible, particularly in the short term, since self-sustaining local populations with very little habitat disturbance exist elsewhere in Canada, and would not be affected by the threats in Quebec.

Implications for recovery: ECCC believes that the probability of achieving the species' recovery objectives is already low, based on the status of the Quebec populations, and that the implementation of the logging operations and road construction planned in the 2023–2024 PRANs would make the recovery of the species extremely unlikely, even if the impacts on caribou populations would not necessarily be measurable in the short term. ECCC has not specifically assessed the effect of threats other than logging and the road network (e.g., mining, and vacation and recreational infrastructure), but anticipates that they will have additional and cumulative impacts. The Val-d'Or population has already dropped below the quasi-extinction threshold (i.e., it currently has fewer than 10 reproductively active females), the Charlevoix population crossed that threshold in 2020 and now has just over 10 reproductively active females, and the Pipmuacan population could do so within 10 years. The Assinica and Témiscamie populations also face a certain degree of risk, and could reach the quasi-extinction threshold in the longer term if no measures are taken to halt their decline. Although significant measures have been taken in the past, notably to protect individuals, the scope of the measures currently implemented or planned to protect or restore the species' habitat is deemed to be insufficient to address the main threats assessed. Measures to protect and restore habitat are essential in the short term if the boreal caribou is to recover.

CONTEXT

According to section 80 of *the Species at Risk Act (SARA)*, if the competent minister is of the opinion that a listed wildlife species faces imminent threats to its survival or recovery, he or she must recommend to the Governor in Council that an emergency order be made for the protection of the species. The federal Minister of the Environment is the competent minister for the Caribou (*Rangifer tarandus*), Boreal population.

The boreal caribou was added to Schedule 1 of SARA in 2003 as a threatened species. This status was reconfirmed in 2015 following a re-examination of the species' status by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2014.

This assessment was carried out to help the Minister form an opinion on whether this wildlife species is facing imminent threats to its survival or recovery in Canada, pursuant to section 80 of SARA.

Assessment trigger

The Minister of the Environment has received five pieces of official correspondence from five First Nations in Quebec asking him to implement concrete and effective measures to ensure the survival and recovery of the boreal caribou, notably the adoption of an emergency order under section 80 of SARA. This correspondence refers to a range of activities that have taken place on an ongoing basis in caribou habitat in Quebec for decades and may continue in the coming years. These activities include resource development (forestry, mining, energy), vacation and recreational infrastructure, roads, and anthropogenic disturbance (associated with all-terrain vehicles, snowmobiles, and other means of transportation, among others). In their letters, the First Nations indicate that, among all the activities likely to pose a threat to caribou, forest management activities in certain areas that they have identified as being of interest for caribou are likely among the greatest threats to the species' survival and recovery. However, the wide range of threats mentioned in the letters also highlights the cumulative impact that the First Nations fear these threats will have on the caribou. In addition, several First Nations address the degradation, alteration and fragmentation of the species' habitat, and the increase in the level of habitat disturbance, in a more general way. Consequently, Environment and Climate Change Canada (ECCC) believes that it has sufficient credible and verifiable evidence to undertake an assessment to determine whether the species faces one or more imminent threats to its survival or recovery in the Quebec portion of its range. The purpose of this assessment is therefore to respond to the five pieces of correspondence received concerning imminent threats to the survival or recovery of boreal caribou in Quebec. The main cause of the decline of the boreal caribou is the disturbance of its habitat due to various

anthropogenic activities (Environment Canada [EC],¹ 2012; ECCC, 2020; see Part 1.4). Owing to the fact that these activities are governed by land-use planning regimes specific to each province and territory, and so as to not postpone the adoption of efficient measures (precautionary principle), ECCC has focused its assessment on the threats occurring in Quebec.

HOW THIS DOCUMENT IS DESIGNED

This assessment was completed in accordance with the Policy on Assessing Imminent Threats under Sections 29 and 80 of the Species at Risk Act: Terrestrial Species – [proposed] (ECCC, 2023a), and, in particular, the precautionary principle. It is based on the best available knowledge of the species' biology and ecology, threats to its survival or recovery, and population and habitat trends. It also takes into account the recovery objectives defined in the Recovery Strategy for the Woodland Caribou² (*Rangifer tarandus caribou*), Boreal Population, in Canada (EC, 2012; ECCC, 2020).

The document is divided into three parts:

Part 1: Information on the species

This part presents the species' characteristics, its range in Canada (including the best available information on its distribution in Quebec), its status, population parameters, habitat quality and size, threats, and recovery objectives.

Part 2: Information on new or evolving threats

This part presents the best available information on threats.

Part 3: Assessment of threats

This part is intended to help the Minister form an opinion as to whether there are imminent threats to the survival or recovery of the species, by answering the following questions:

- Is the wildlife species facing a new or evolving human-induced threat(s) or is the impact of an existing human-induced threat intensifying?
- Will the impact of the threat(s) make:
 - Survival of the wildlife species highly unlikely or impossible?
 - Recovery of the wildlife species highly unlikely or impossible?
- Do the threat(s) require immediate intervention beyond existing protection measures?

¹ Prior to 2015, Environment and Climate Change Canada (ECCC) was known as Environment Canada (EC). Depending on the period, the appropriate term (EC or ECCC) has been used in this document. Please note that the legal name of the department remains Department of the Environment.

² The Caribou, Boreal population was formerly listed on Schedule 1 of SARA as Woodland Caribou, Boreal population. Its name on Schedule 1 of SARA was modified on February 16, 2022. Documents published by ECCC prior to this date refer to the species using its former name.

To conduct this assessment using the best available information, ECCC submitted a request for information to the Quebec government on September 20, 2023. The request sought to obtain information and data on the planning of forest management activities, other threats to the species, and current or future measures to protect the species' habitat or address potential threats to its survival or recovery. The Quebec government has not responded to this request. ECCC therefore examined, and based its assessment on, the publicly available information.

During the various discussion forums involving ECCC and the First Nations, notably the round tables held on September 14 and December 11, 2023, ECCC invited the First Nations to transmit any information that they felt was important to share regarding threats that could make the survival or recovery of boreal caribou highly improbable or impossible. The information communicated by the First Nations is considered, along with the publicly available information, to be the best information available to support the completion of this assessment.

PART 1: INFORMATION ON THE SPECIES

1.1 Species characteristics

The Caribou, Boreal population³ (hereinafter referred to as boreal caribou)⁴ is a medium-sized (1.0–1.2 m shoulder height and weighing 110–210 kg) member of the deer family (Cervidae) (Thomas and Gray, 2002). Adults have a dark brown coat (Banfield, 1974; Aboriginal Traditional Knowledge Summary Reports on Woodland Caribou, Boreal Population, 2010–2011). Both males and females have antlers during part of the year, although some females may only have one antler or no antlers at all (Thomas and Gray, 2022; Aboriginal Traditional Knowledge Summary Reports for Woodland Caribou, Boreal Population, 2010–2011).

Longevity is generally less than 10 years for males and less than 15 years for females (COSEWIC, 2014). The latter can reproduce beginning at the age of three, giving birth to a maximum of one calf per year (COSEWIC, 2014). Even when conditions are ideal, the species' reproductive rate is considered low compared with that of other cervids present in North America (COSEWIC, 2014). The average duration of a generation is estimated to be six years (COSEWIC, 2014).

The boreal caribou is a forest-dwelling species whose habitat-use strategy consists primarily of avoiding disturbance in its habitat, in order to geographically separate itself from other prey (e.g., moose [*Alces alces*]) and predators (e.g., gray wolves [*Canis lupus*] and black bears [*Ursus americanus*]), thereby reducing the risk of predation (Bergerud, 1974; Rettie and Messier, 2000; Racey and Arsenault, 2007; EC, 2012; Viejou *et al.*, 2018).

Caribou are central to the identity, cultures, and way of life of many First Nations (AFNQL – FNQLSDI, 2022). Boreal caribou are also an umbrella species for the conservation of biodiversity in the boreal forest.⁵ Therefore, caribou embody the fundamental connection between the First Nations and their territory (FNQLSDI, 2010; AFNQL – FNQLSDI).

³ Please note that, elsewhere in this document, the word “population,” when not accompanied by a qualifier or details on the scale, is used to refer to local boreal caribou populations, as defined in the species' recovery strategy (ECCC, 2020), i.e., “a group of boreal caribou occupying a defined area distinguished spatially from areas occupied by other groups of boreal caribou. Local population dynamics are driven primarily by local factors affecting birth and death rates, rather than immigration or emigration among groups.”

⁴ The Caribou, Boreal population, is recognized as a designatable unit of caribou (*Rangifer tarandus*). However, to be consistent with the terminology in SARA, the term “species” is used in this document to refer to the Caribou, Boreal population. Indeed, under SARA, the term “species” can also refer to a geographically or genetically distinct population.

⁵ An umbrella species is defined as a species whose protection contributes to the conservation of several other species with similar ecological requirements (Bichet *et al.*, 2016; Labadie *et al.*, 2024).

1.2 Population and distribution

Canada

In 2014, COSEWIC estimated the Canadian boreal caribou population to consist of between 33,000 and 34,000 individuals, predicting that the decline in the Canadian population would exceed 30% over the next three generations (18 years; COSEWIC, 2014). When the status report on the species was published (COSEWIC, 2014), most of the 37 local populations for which a finite growth rate estimate (λ) was available were in decline. Given this information and the declines observed in the last decade (ECCC, 2017), it is reasonable to believe that the current size of the Canadian boreal caribou population is smaller than it was in 2014.

In Canada, boreal caribou are found in the boreal forest, from northeastern Yukon in the west to Labrador in the east, and southward to Lake Superior (EC, 2008, 2011). Across Canada, the southern limit of the boreal caribou range⁶ has progressively receded northward since the early 1900s, a trend that continues today (Thomas and Gray, 2002; Schaefer, 2003; Festa-Bianchet *et al.*, 2011; Morineau *et al.*, 2023). Indigenous knowledge indicates that the boreal caribou's range has moved northward as a result of habitat loss in the south (Aboriginal Traditional Knowledge Summary Reports on Woodland Caribou, Boreal Population, 2010–2011). A recent study also suggests that human activities (i.e., anthropogenic land use and hunting) are likely the main factors responsible for the contraction of the boreal caribou's range in Quebec since 1850 (Morineau *et al.*, 2023). Figure 1 shows the species' Canadian range as of 2012; it is broken down into 51 local ranges that also correspond to the polygons within which critical habitat was identified in the federal recovery strategy (EC, 2012; ECCC, 2020; see Part 1.6). The boundaries of these local ranges are associated with varying degrees of certainty, depending on the data available at the time these delineations were established (see Appendix A).

To assess the extent to which local caribou populations in Canada are likely to be self-sustaining over time, EC (2011) carried out an integrated risk assessment, considering population sizes and trends, the level of habitat disturbance in the corresponding local ranges, and the quality of data available in relation to these indicators. The results of this analysis were then used to assign each population to one of the following classes

⁶ The term "range" is used to designate the territory occupied by a species at different spatial scales. It may refer, for example, to the global, national or provincial range of a species, including all populations, or to the range used by a specific population. The recovery strategy for boreal caribou defines the concept of range as "the geographic area occupied by a group of individuals that are subject to similar factors affecting their demography and used to satisfy their life history processes (e.g. calving, rutting, wintering) over a defined time frame," thus referring to "local" ranges within the Canadian range, which are occupied by more or less distinct populations. Elsewhere in this document, when the expression "range" is used without qualifiers or scale, it refers to local ranges.

based on the probability of it being self-sustaining: “self-sustaining”⁷ (15 populations), “as likely as not to be self-sustaining” (10 populations) or “not self-sustaining” (26 populations) (Figure 1).

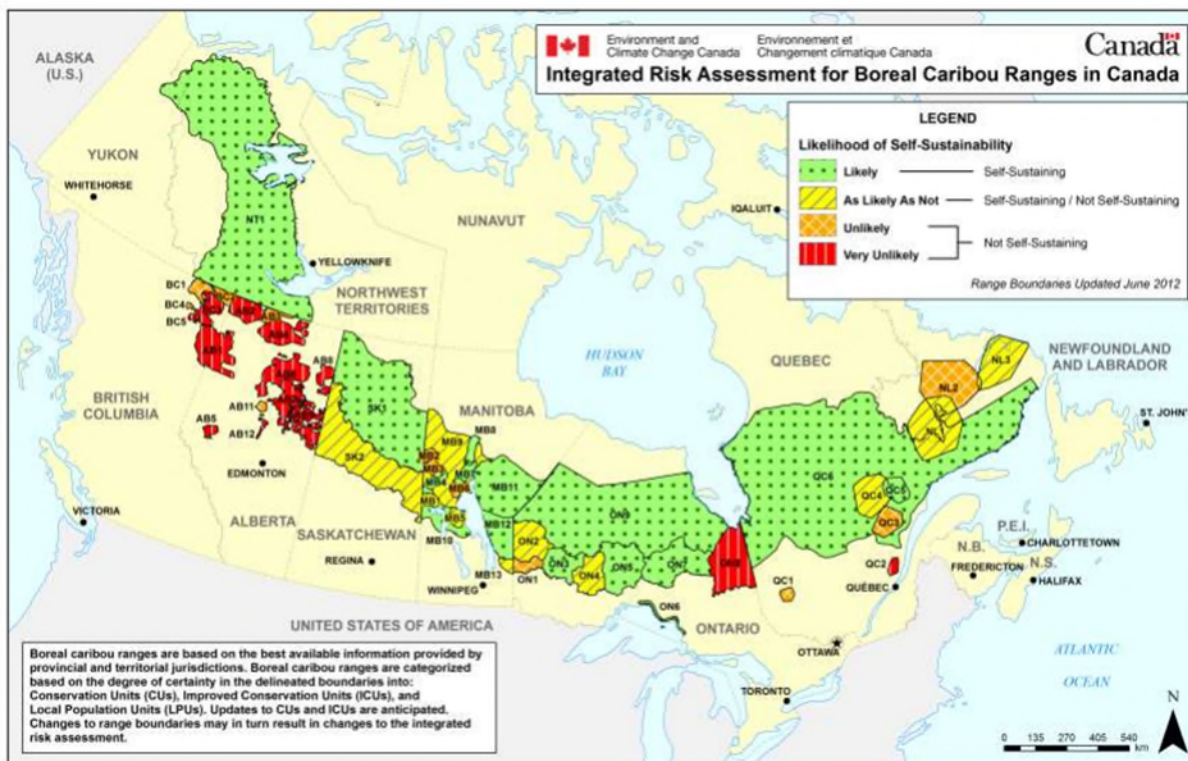


Figure 1. Integrated risk assessment for boreal caribou ranges in Canada as of June 2012, reflecting the capacity of each range to maintain a self-sustaining population. The probability of self-sustainability for the Boreal Shield range (SK1) has been updated from “unknown” to “likely” in the 2020 recovery strategy (ECCC, 2020), but the integrated risk assessments for the other ranges have not been updated since 2012. Figure taken from ECCC (2020).

Quebec

The federal recovery strategy for the species (EC, 2012; ECCC, 2020) identifies six ranges in Quebec, their delineation associated with a degree of certainty ranging from low to high (see Appendix A).

Since the publication of the recovery strategy (EC, 2012), technological advances (e.g., the advent of GPS telemetry tracking) and significant population monitoring efforts by the Quebec government have enabled the latter to refine the limits of the ranges

⁷ According to EC (2011), the concept of a “self-sustaining local population” is defined as a local population of boreal caribou that, on average demonstrates stable or positive population growth over the short-term (≤ 20 years), and is large enough to withstand stochastic events and persist over the long-term (≥ 50 years), without the need for ongoing active management intervention (e.g. predator management or transplants from other populations).

present in the province, particularly federal range QC6, on which very little information was available in 2012. Today, 10 ranges are recognized by the province (“provincial ranges”; MFFP, 2021a).⁸ Their delineation differs from those identified in the federal recovery strategy (“federal ranges”; EC, 2012; ECCC, 2020; Figure 2). The Quebec government also identified two knowledge acquisition areas where the species is known to be present, but where the existing data do not allow the range boundaries to be precisely identified. Despite changes to the delineations of these local ranges in recent years, taken together, they represent the same Quebec-wide population as that identified in the recovery strategy (EC, 2012).

⁸ The ranges are presented and described in MFFP (2021a). In 2022, the *Commission indépendante sur les caribous forestiers et montagnards* [independent commission on woodland and mountain caribou] made available on its website shapefiles that included the boundaries of these ranges. These correspond to minimum convex polygons and include 100% of the telemetry data available in Quebec between 2004 and 2020. ECCC used these boundaries in the present assessment for the purposes of geomatic analysis. On November 30, 2023, new range boundaries for woodland (boreal) caribou were published by the Quebec government on its interactive map of occurrences for special-status species (CDPNQ, 2023). The differences between the ranges delineated in 2023 (CDPNQ, 2023) and those in the previous version (MFFP, 2021a) mainly concern the eastern part of the range on the Basse-Côte-Nord, where new populations have been identified. Given the timing of the release of these data, they could not be considered in the present assessment.

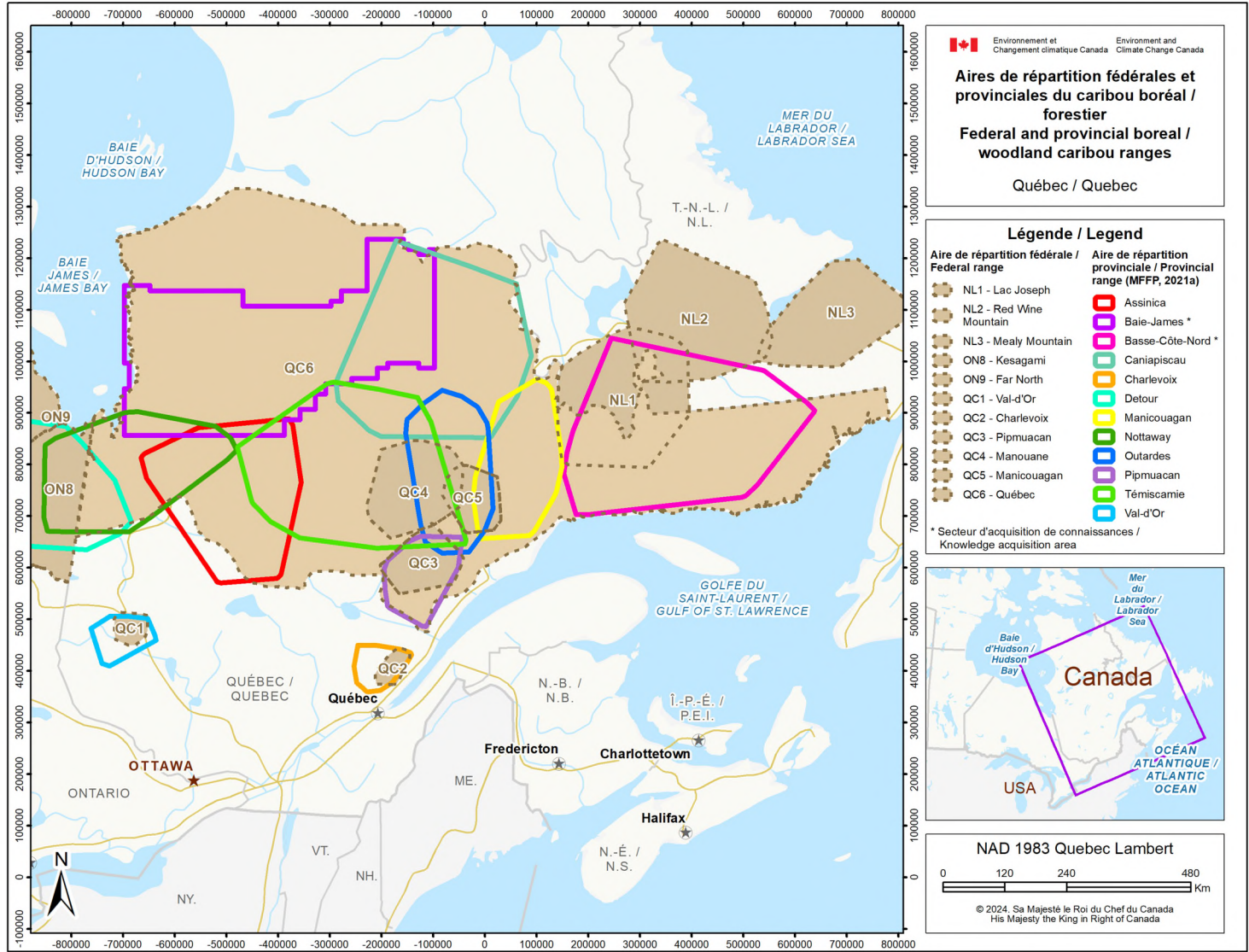


Figure 2. Federal (EC, 2012; ECCC, 2020) and provincial (MFFP, 2021a) ranges, including knowledge acquisition areas identified by the Quebec government.

Although the provincial ranges (as identified by MFFP [2021a]) differ from the ranges identified in the federal recovery strategy (EC, 2012; ECCC, 2020), the former represent the best available information on the distribution and population structure of boreal caribou in Quebec at the time of this assessment. Several First Nations representatives with whom ECCC has had the opportunity to discuss boreal caribou in Quebec in recent years also recognize the added value of the ranges identified by the Quebec government (MFFP, 2021a) compared with those presented in the recovery strategy (EC, 2012; ECCC, 2020), since they incorporate more recent and more complete data. Therefore, the provincial ranges and corresponding local populations are used as the units of analysis in the remainder of the document (see Appendix A for the full rationale for this decision).

In Quebec, among the populations identified by the province (MFFP, 2021a), only one is increasing, eight are declining, and the demographic trend in the remaining one is unknown (Table 1). In the two knowledge acquisition areas, the demographic trend is unknown in one and declining in the other. In the case of the Val-d'Or population, the situation was so critical in 2020 that all the remaining individuals (n=7) were put in an enclosure to protect them from excessive predation (Pellerin and Naud, 2020). In 2023, the herd consisted of nine individuals, including four adult males and three adult females, as well as one juvenile male and one juvenile female (MELCCFP, 2023a). A similar operation was carried out in Charlevoix in 2022, where 16 individuals were placed in an enclosure (MFFP, 2022a). The Charlevoix population stands at 31 individuals in 2023 (MELCCFP, 2023a). Therefore, even though the Val-d'Or and Charlevoix populations are considered to be “declining” according to the latest finite growth rate estimates (Table 1), they have in fact grown in recent years. Observed growth is not, however, a reliable indication of the likelihood of these populations' self-sustainability, since the latter is dependent on significant and ongoing active management intervention (enclosures).

Table 1 presents the size and finite growth rate (λ) of the boreal caribou populations present in Quebec. Population sizes are presented in classes (< 100, 100–300, > 300 individuals) to take account of the variability in the accuracy of the estimates. These classes also reflect different levels of risk in relation to the likelihood of the populations' persistence.⁹ Below 100 individuals, populations are more vulnerable to stochastic effects and the effects of genetic drift (Shaffer, 1981, 1987; Lande, 1993; EC, 2011). Similarly, it is estimated that a minimum of 300 individuals are required for a population to be considered self-sustaining (EC, 2008). The demographic trends in the populations are described based on the finite growth rate, which considers the recruitment rate and individual survival rate observed in a population. Increasing populations have a finite growth rate of greater than one ($\lambda > 1$), stable populations have a finite growth rate equal to one ($\lambda = 1$) and declining populations have a finite growth rate of less than one

⁹ Probability of a population surviving a given period.

($\lambda < 1$). Demographic parameters can vary within the same range. For example, as part of an aerial survey of the Témiscamie population carried out in 2019, the Quebec government observed that the recruitment rate (measured as the number of fawns per 100 females) varied considerably between the southern and northern portions of the range, with the highest values in the northern portion, where the level of habitat disturbance was lower (Szor *et al.*, 2019). The values presented in Table 1 provide a population-level demographic picture, but do not consider local variations that may exist within populations.

Table 1. Size and trend of boreal caribou populations in Quebec.

Population or knowledge acquisition area ¹	Estimated population size by class: < 100, 100–300 or > 300 individuals (year of estimate)	Short-term demographic trend, finite population growth rate (λ) (years taken into account to estimate survival [S] and recruitment [R] rates) ²
Assinica	> 300 ³ (2013)	Declining $\lambda = 0.97$ (S: 2017–2019, R: 2016–2018) ³
Baie-James ⁴	> 300 ³ (2020)	Not available
Basse-Côte-Nord ⁴	> 300 ³ (2019)	Declining $\lambda = 0.96$ (S: 2018–2019, R: 2018) ³
Caniapiscau	> 300 ³ (2018)	Increasing $\lambda = 1.07$ (S: 2018–2019, R: 2017) ³
Charlevoix	< 100 ³ (2020)	Declining $\lambda = 0.67$ (S: 2017–2019, R: 2016–2018) ³
Detour	> 300 ⁵ (2022)	Not available ⁶
Manicouagan	> 300 ⁷ (2020–2021)	Declining $\lambda = 0.87$ (S: 2018–2019, R: 2019) ³
Nottaway	100–300 ⁸ (2022)	Declining $\lambda = 0.95$ (S: 2016–2022, R: 2016–2022) ⁸
Outardes	> 300 ⁹ (2022)	Declining $\lambda = 0.89$ (S: 2018–2021, R: 2022) ⁹
Pipmuacan	100–300 ³ (2020)	Declining $\lambda = 0.76$ (S: 2018–2019, R: 2019) ³
Témiscamie	> 300 ³ (2019)	Declining $\lambda = 0.97$ (S: 2017–2019, R: 2018) ³
Val-d'Or	< 100 ³ (2020)	Declining $\lambda = 0.81$ (S: 2015–2019, R: 2015–2019) ³

¹ According to the range limits identified in the *Revue de littérature sur les facteurs impliqués dans le déclin des populations de caribous forestiers au Québec et de caribous montagnards de la Gaspésie* (MFFP, 2021a)

² Since the finite growth rate of populations can fluctuate from year to year, it is preferable to consider growth rates that incorporate observations of survival and recruitment rates spanning a number of years. When this is not possible, the finite growth rate may provide an incomplete or erroneous picture of population trends. The finite growth rate values presented in this table should be interpreted with caution.

³ According to MFFP (2021a)

⁴ According to MFFP (2021a), the population structure is unknown in the Baie-James and Basse-Côte-Nord knowledge acquisition areas. The data presented in this table for these areas should be interpreted

with caution, as they may not accurately represent the current status of populations present in these areas.

⁵ According to Szor *et al.* (2023), the Detour population occurs on both sides of the Ontario-Quebec border. The population size estimate presented here considers the caribou present in both provinces.

⁶ Local observations suggest that the population is declining (Conseil de la Première Nation Abitibiwinni – Territoire et Environnement, 2024).

⁷ According to Heppell and Boissonneault (2021)

⁸ According to Szor and Gingras (2022)

⁹ According to Brodeur *et al.* (2022)

1.3 Habitat size and quality

Biological and habitat requirements

Boreal caribou require large range areas comprising continuous tracts of undisturbed habitat. In general, boreal caribou prefer habitat consisting of mature to old-growth coniferous forests (e.g., jack pine [*Pinus banksiana*], black spruce [*Picea mariana*] with abundant lichens, or muskeg and peatlands intermixed with upland or hilly areas; Stuart-Smith *et al.*, 1997; Rettie and Messier, 2000; Courtois, 2003; Brown *et al.*, 2007; Aboriginal Traditional Knowledge Summary Reports on Woodland Caribou, Boreal Population, 2010–2011). Large range areas reduce the risk of predation by allowing boreal caribou to maintain low population densities throughout the range and to avoid areas of high predation risk, such as areas with high densities of alternate prey species (e.g., moose and deer) and predators (e.g., wolves and bears; Rettie and Messier, 2001; Brown *et al.*, 2003; Whittington *et al.*, 2011). According to Lesmerises *et al.* (2013), in habitats with a particularly high level of disturbance, residual forest patches should be at least 100 km² in size to prevent caribou from concentrating in habitat patches that are too small, where their vulnerability to predation is greater.

Connectivity

Connectivity of habitat, both within a range and between ranges, is essential for the persistence of boreal caribou on the landscape. Within a range, habitat connectivity allows boreal caribou to undertake seasonal movements between habitats to obtain the different resources that they need to satisfy their life history requirements (see Appendix B for a detailed description of the biophysical attributes of the critical habitat), and to use different areas as they respond to disturbance or as disturbed habitat recovers (Saher and Schmiegelow, 2005).

Connectivity between boreal caribou ranges allows for immigration and emigration between local populations, which increases gene flow, thereby helping to maintain the species' genetic diversity and its subsequent resilience to environmental stressors (e.g., disease, severe weather). Isolated populations such as Val-d'Or and Charlevoix are therefore subject to an additional risk, since individuals cannot naturally immigrate to these populations.

In Quebec, a north-south gradient is observed in the intensity of anthropogenic disturbance of boreal caribou habitat: the territory is very heavily disturbed (mainly by logging) in the southern portion of the range, and less so towards the north (Figure 3). There is also a west-to-east gradient in the availability of quality habitats for caribou, with better-quality habitats more strongly represented in the eastern part of the range (Morin, 2023). Areas of functional connectivity¹⁰ in the continuous range of boreal caribou in Quebec are mainly found north of the northern limit for commercial timber allocation¹¹ and particularly in the eastern part of the range (Morin, 2023). However, the quality of the forest habitat beyond the northern limit for commercial timber allocation may be insufficient to sustain viable boreal caribou populations, particularly west of the 73rd meridian (Szor and Gingras, 2020, 2022).

¹⁰ Functional connectivity is defined as the degree to which the structural elements of the landscape facilitate or impede organisms' movements across that landscape (Taylor *et al.*, 2006).

¹¹ According to the Ministère des Ressources naturelles du Québec (2013), "the northern boundary of allocatable forests is the boundary of the commercial forest beyond which sustainable forest management cannot be practiced." [translation]

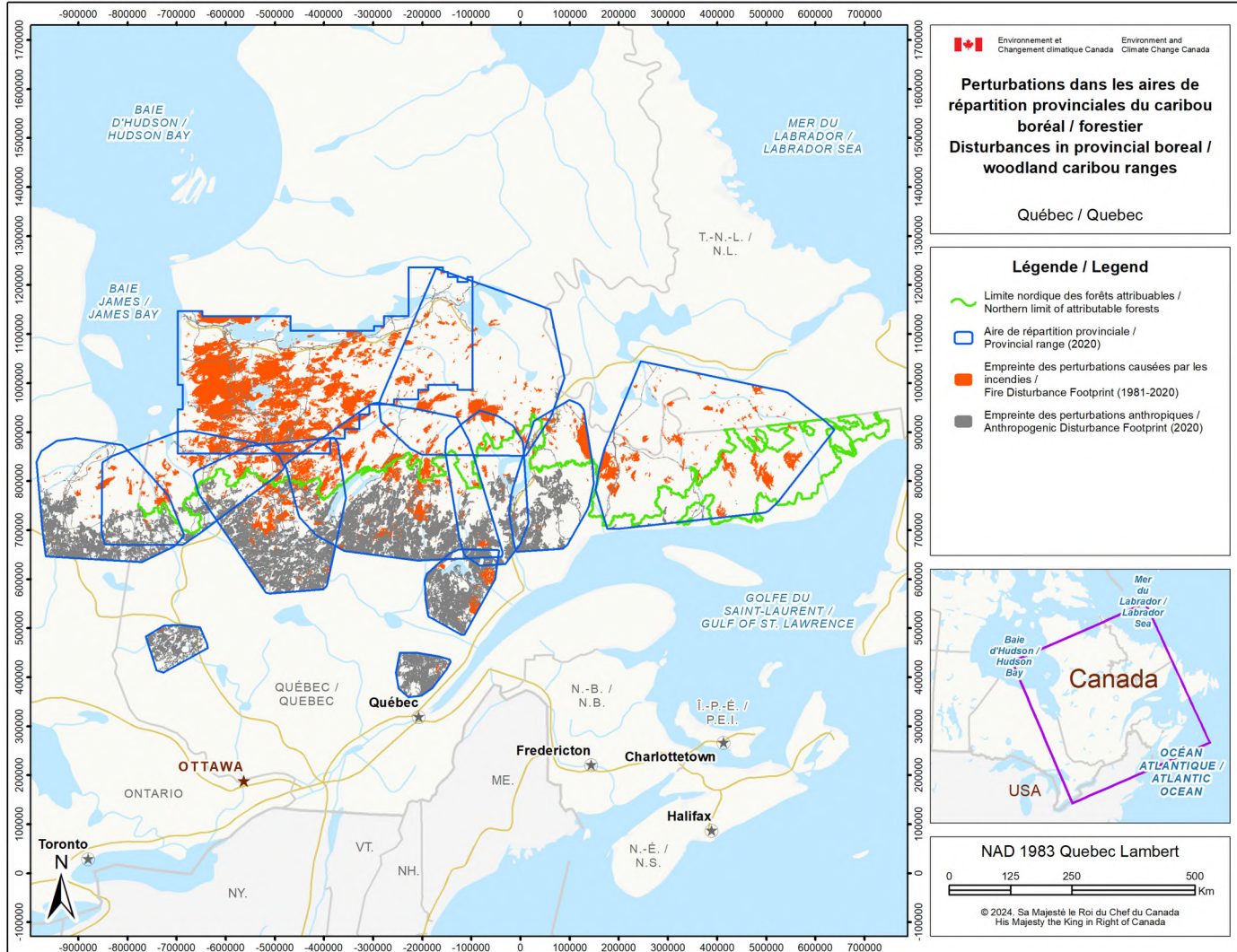


Figure 3. Mapping of habitat disturbances (anthropogenic and natural) in the provincial boreal caribou ranges (MFFP, 2021a), based on 2020 disturbance data and the methodology described in Appendix C. The anthropogenic disturbance footprint includes a buffer of 500 m (in accordance with EC [2011]).

Relationship between the level of habitat disturbance and probability of a population being self-sustaining

Several studies have highlighted the adverse effects of the disturbance of boreal caribou habitat on population recruitment (measured as the ratio of fawns to adult females; EC, 2011, Fortin *et al.*, 2017; Rudolph *et al.*, 2017). According to a study of 24 boreal caribou ranges in Canada, a composite measure of total habitat disturbance (i.e., anthropogenic disturbance including a 500-m buffer and forest fires that occurred no more than 40 years ago) alone likely explains nearly 70% of the observed variation in recruitment rate (EC, 2011). EC (2011) used this relationship to predict population trends as a function of the level of habitat disturbance. The resulting model provides an estimate of the probability that a given population will be stable or increasing over a 20-year period as a function of the level of habitat disturbance (Figure 4). It should be noted that this model assumes that the average annual survival rate of adult females is equivalent to the national average (85%). Consequently, in populations where this condition is not met, it is expected that the level of disturbance they can tolerate to maintain stable or positive growth will vary accordingly (lowering the threshold in the case of adult female survival below 85%, and vice versa). More recently, Johnson *et al.* (2020) reconfirmed the relationship between disturbance level and recruitment, also showing that the effect of fire-associated disturbances on recruitment was three to four times weaker than the effect of disturbances of anthropogenic origin. These authors also highlighted the link between the level of anthropogenic disturbance in a range and the survival of adult females, with the adult female survival rate lower in ranges with higher levels of human disturbance.

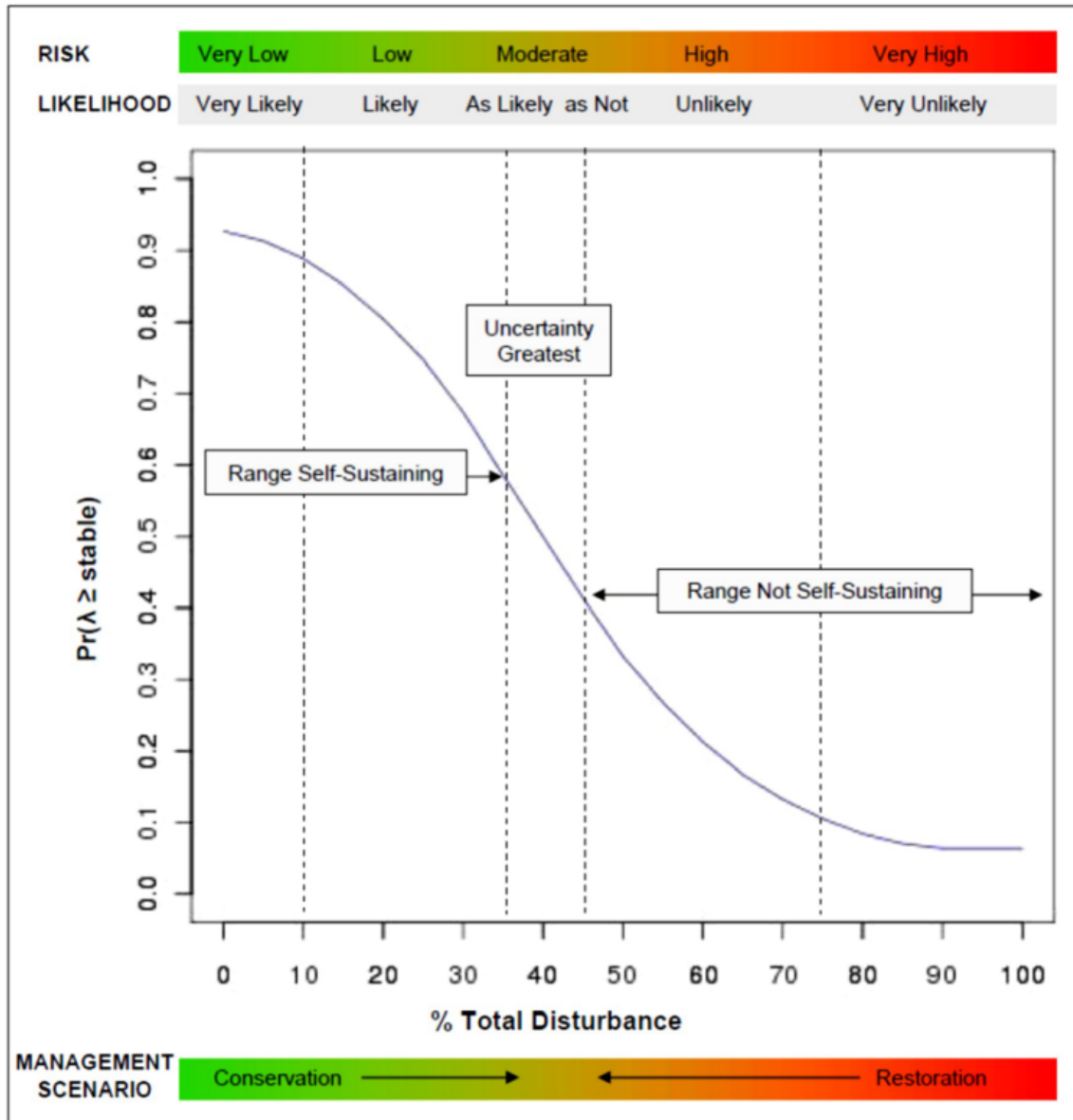


Figure 4. Probability of stable or increasing growth ($\lambda \geq \text{stable}$) of caribou populations over a 20-year period at various levels of total disturbance (fire \leq 40 years + anthropogenic disturbance with a 500-m buffer). The finite growth rate (λ) was calculated using recruitment values specific to the disturbance levels resulting from the EC (2011) meta-analysis, with an average annual adult female survival rate of 0.85 consistent with the other components of the critical habitat assessment. The degree of certainty of the result, ecological risk and management scenarios are represented on a continuum of conditions. (Figure taken from EC, 2011).

Based on this relationship, ECCC established a maximum disturbance management threshold of 35%¹² in its recovery strategy (EC, 2012; ECCC, 2020). Above a 35% level of habitat disturbance, the probability of a population experiencing stable or increasing

¹² For all ranges, except for SK1 in Saskatchewan, for which the threshold was set at 40%. The recovery strategy (ECCC, 2020) explains why a different threshold was chosen for this population.

growth over a 20-year period is less than 60%, and the population is considered not to be self-sustaining. Among other things, this threshold has been used to identify the species' critical habitat (see Part 1.6). ECCC presumes that the relationship highlighted by EC (2011; see also Figure 4) should remain valid, even considering the level of disturbance at the scale of the provincial ranges (MFFP, 2021a), but recognizes that the exact threshold of disturbance that can be tolerated by populations to maintain stable or positive growth may vary. Table 2 presents the levels of habitat disturbance in each of Quebec's provincial ranges, as of 2020. Additional natural and anthropogenic disturbances have occurred in boreal caribou habitat in Quebec since 2020. For example, the summer of 2023 was a record season for forest fires in Canada (Natural Resources Canada, 2023), particularly affecting certain areas of habitat in the northern and western portions of the boreal caribou's range in Quebec.

It should be noted that there are several methods for mapping disturbances to boreal caribou habitat and calculating the level of disturbance. The method used by EC (2011), on which the identification of the 35% disturbance threshold in the federal recovery strategy was based (EC, 2012; ECCC, 2020), relies on the visual identification of disturbances on 1:50,000-scale Landsat images. This method was chosen at the time due to the availability of data covering the areas of interest across Canada, as well as the time and resources required to carry out the mapping. In recent work in Quebec (e.g., St-Laurent and Gosselin, 2020; MFFP, 2021a), more precise geospatial data have been used to calculate levels of habitat disturbance. To ensure consistency between the disturbance levels compiled in this document and the disturbance threshold identified in the federal recovery strategy, ECCC has continued to use the methods described in EC (2011) and Appendix C to map disturbances and calculate disturbance levels. Consequently, ECCC acknowledges that the levels of disturbance presented do not taken into account all existing disturbances, but believes that they are nevertheless an appropriate estimate of the degree of habitat disturbance for the purposes of this assessment (i.e., in relation to the probability of the self-sustainability of the Quebec populations).

Table 2. Levels of habitat disturbance in boreal caribou provincial ranges in Quebec (MFFP, 2021a), as of 2020.

Range or knowledge acquisition area ²	Habitat disturbance level (%) ¹			Probability of stable or increasing ($\lambda \geq$ stable) growth in caribou populations over a 20-year period (according to EC [2011]; see Figure 4)
	Fire	Anthropogenic disturbances	Total (without overlap)	
Assinica	22	39	57	Unlikely
Baie-James	33	4	36	More or less likely
Basse-Côte-Nord	7	1	9	Very likely
Caniapiscau	8	1	9	Very likely
Charlevoix	2	75	76	Very unlikely
Detour	4	30	33	Probable
Manicouagan	7	23	29	Probable
Nottaway	14	16	28	Probable
Outardes	7	23	28	Probable
Pipmuacan	11	64	72	Unlikely
Témiscamie	18	30	44	More or less likely
Val-d'Or	1	60	61	Unlikely

¹ To calculate the disturbance level, a disturbance mapping process following the method described in Appendix C was used. Anthropogenic disturbances include a 500-m buffer (in accordance with EC [2011]). Fire-associated disturbances correspond to areas where a fire has occurred in the last 40 years (without buffer; as per EC [2011]). This method does not aim to compile a precise inventory of all habitat disturbances that could be perceived by caribou and affect their behaviour or demographics. It does, however, provide a reliable indication of the degree of habitat disturbance, which has also been linked to demographic parameters such as recruitment and adult female survival (EC, 2011; Johnson *et al.*, 2020).

² According to MFFP (2021a); Baie-James and Basse-Côte-Nord are not considered ranges, but rather knowledge acquisition areas, where caribou are known to be present, but where the population structure and range boundaries are unknown.

1.4 Threats to the species

Canada

Table 3 is an extract from the table in Appendix 1 of the COSEWIC Assessment and Status Report on the Caribou *Rangifer tarandus*, Newfoundland Population, Atlantic-Gaspésie Population and Boreal Population, in Canada (COSEWIC, 2014). It presents an assessment of the direct threats to the species across Canada. The threat assessment is based on the unified threats classification system developed by the International Union for Conservation of Nature and the Conservation Measures Partnership.

Table 3. Threat calculator for Caribou, Boreal population. This table is taken from the COSEWIC Assessment and Status Report on the Caribou Rangifer tarandus, Newfoundland Population, Atlantic-Gaspésie Population and Boreal Population, in Canada (COSEWIC, 2014).

#	Threat	Impact¹ (calculated)	Scope² (next 10 years)	Severity³ (10 years or 3 generations)	Timing⁴
1	Residential & commercial development	Negligible	Negligible	Extreme	High (continuing)
1.1	Housing & urban areas	Negligible	Negligible	Extreme	High (continuing)
1.2	Commercial & industrial zones	Negligible	Negligible	Extreme	High (continuing)
1.3	Tourism & recreational areas	Negligible	Negligible	Negligible	High (continuing)
2	Agriculture & aquaculture	Negligible	Negligible	Extreme	High (continuing)
2.3	Livestock farming & ranching	Negligible	Negligible	Extreme	High (continuing)
3	Energy production & mining	Medium-Low	Large-Restricted-Large	Moderate-Slight	High (continuing)
3.1	Oil & gas drilling	Medium-Low	Large-Restricted	Moderate-Slight	High (continuing)
3.2	Mining & quarrying	Low	Small	Extreme	High (continuing)
4	Transportation & service corridors	Medium	Large	Moderate	High (continuing)
4.1	Roads & railroads	Medium-Low	Large-Restricted	Moderate	High (continuing)
4.2	Utility & service lines	Low	Restricted-Small	Moderate-Sight	High (continuing)
5	Biological resource use	Medium-Low	Large-Restricted	Moderate-Slight	High (continuing)
5.1	Hunting & collecting terrestrial animals	Medium-Low	Large-Restricted	Moderate-Slight	High (continuing)
5.2	Gathering terrestrial plants	Low	Small	Extreme	High (continuing)
5.3	Logging & wood harvesting	High	Large	Extreme	High (continuing)
6	Human intrusions & disturbance	Unknown	Pervasive	Unknown	High (continuing)

#	Threat	Impact ¹ (calculated)	Scope ² (next 10 years)	Severity ³ (10 years or 3 generations)	Timing ⁴
6.1	Recreational activities	Unknown	Large	Unknown	High (continuing)
6.2	War, civil unrest & military exercises	Negligible	Negligible	Unknown	High (continuing)
6.3	Work & other activities	Unknown	Pervasive	Unknown	High (continuing)
7	Natural system modifications	Low	Restricted-Small	Moderate-Slight	High (continuing)
7.1	Fire & fire suppression	Low	Restricted-Small	Moderate-Sight	High (continuing)
7.2	Dams & water management/use	Negligible	Negligible	Extreme	High (continuing)
8	Invasive & other problematic species & genes	High-Medium	Pervasive	Serious-Moderate	High (continuing)
8.1	Invasive non-native/ alien species	Unknown	Unknown	Unknown	Moderate (possibly short-term, < 10 years)
8.2	Problematic native species	High-Medium	Pervasive	Serious-Moderate	High (continuing)
9	Pollution	Negligible	Negligible	Unknown	High (continuing)
9.2	Industrial & military effluents	Negligible	Negligible	Unknown	High (continuing)
11	Climate change & severe weather	Unknown	Small	Unknown	High (continuing)
11.1	Habitat shifting & alteration	Unknown	Small	Unknown	High (continuing)
11.3	Temperature extremes	Not Calculated (outside the evaluation period)	Pervasive	Unknown	Low (possibly long-term, > 10 years)

¹ **Impact** - The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on the Severity and Scope ratings and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment (e.g., timing is insignificant/negligible [past threat] or low [possible threat in long term]). Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

² **Scope** - Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

³ **Severity** - Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or 3-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit > 0%).

⁴ **Timing** - High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

In accordance with the threat assessment process used by COSEWIC, Table 3 presents the assessment of *direct* (immediate or proximate) threats, without considering *ultimate* (underlying) threats. Thus, the threat “Problematic native species” (which refers to excessive predation) is the most important direct threat according to this assessment. It is important to note, however, that excessive predation on boreal caribou is most often the result of habitat disturbances that lead to changes in predator-prey relationships, through a mechanism known as “apparent competition” (Holt, 1977; Seip, 1991; DeCesare *et al.*, 2010; Latham *et al.*, 2011a). Indeed, when caribou habitat is disturbed (e.g., by resource exploitation activities, fire or insect outbreaks), the forest is rejuvenated and this younger forest is suitable for other prey species (Gagné *et al.*, 2016; Anderson *et al.*, 2018). These prey species increase in abundance and support predator populations that are also more abundant, increasing the predation pressure on boreal caribou (Seip, 1991; Serrouya *et al.*, 2017). Therefore, all threats that result in habitat disturbance contribute cumulatively to this phenomenon of apparent competition. In addition to their direct effects, these threats are also associated with such things as habitat loss or fragmentation, or sensory disturbances, which are assessed in Table 3.

Linear features (e.g., roads, seismic lines, power lines) have a particularly detrimental impact on caribou. This is because, in addition to the habitat disturbance and fragmentation they cause, they facilitate the efficient movement of predators in the habitat (Latham *et al.*, 2011b; Dickie *et al.*, 2017, 2020) and increase human access to the territory, which promotes the occurrence of other threats (e.g., recreational activities; Pigeon *et al.*, 2016; Keim *et al.*, 2019).

After a disturbance, the forest takes several decades to regenerate before once again displaying the characteristics sought by the species (Lee and Boutin, 2006; Jandt *et al.*, 2008; Aboriginal Traditional Knowledge Summary Reports on Woodland Caribou, Boreal Population, 2010–2011; Bartels *et al.*, 2016). Therefore, although some activities may be limited in time or space, if they cause habitat disturbance, the impact may persist for several decades. Furthermore, even though the footprint of the disturbances associated with a given activity may seem small, the impact of these disturbances must be assessed by considering the other disturbances already present in the habitat, in order to adequately take account of the cumulative impacts of habitat disturbances (see Figure 4).

In addition to the threats related to habitat disturbance, COSEWIC (2014) identifies other threats with more direct effects on individuals. Among these, activities that generate sensory disturbances (noise, light)—due to, for example the use of motorized vehicles or machinery—can have non-negligible repercussions on individuals (e.g., behaviour modification, changes in habitat use, stress; Duchesne *et al.*, 2000; Vistnes and Nelleman, 2008). These effects may also result from threats that affect the species’ habitat, such as mining, or vacation and recreational infrastructure.

Quebec

The relative scope of the various threats to boreal caribou habitat varies between ranges. In Quebec, logging is considered to be the main *ultimate* threat to boreal caribou (MFFP, 2021a), and is responsible for the majority of disturbances to the species' habitat (see Part 2, Table 5). Roads are also a major source of disturbance in caribou habitat (Table 5). Most of the road network in the boreal caribou's range in Quebec consists of multi-purpose roads, which are built mainly to enable the forest industry to carry out logging activities (MRNF, 2023a; see Part 2). Several First Nations in Quebec have emphasized to ECCC the key role of vacation and recreational infrastructure in the disturbance of caribou habitat and individuals in the province. In particular, the presence of vacation leases on public land in caribou ranges means that the roads that provide access to leased land will be maintained over the long term to ensure this access, which limits opportunities for natural regeneration or active restoration efforts. Conversely, oil and gas drilling, which is widespread elsewhere in Canada (COSEWIC, 2014), is virtually absent in the boreal caribou ranges in Quebec (see Part 2, Table 5). Other threats vary in scope depending on the range. For example, the footprint of disturbances related to mining and mining exploration is greater in the Val-d'Or and Assinica ranges than in the other ranges, which are virtually unaffected by this threat (Table 5). Similarly, forest fires and insect outbreaks represent a major source of disturbance in some ranges, while their scope is negligible in others (Table 5; Labadie *et al.*, 2021).

Hunting boreal caribou has been prohibited in Quebec since 2001 (Gouvernement du Québec, 2023a). To the best of ECCC's knowledge, many First Nations that once hunted boreal caribou on a cultural or subsistence basis have ceased to do so, to maximize the species' chances of recovery (e.g., Lochon *et al.*, 2022). However, some communities have continued to harvest, particularly in the eastern part of the boreal caribou's range in Quebec. Harvesting represents an additional pressure on populations, but its impact is difficult to accurately quantify, because the data required to do so are fragmented.

Exceptional measures have been adopted in some Quebec ranges to temporarily reduce the impact of the proximate threat posed by excessive predation. For example, the last remaining individuals in the Val-d'Or and Charlevoix populations were put in enclosures in 2020 and 2022 to protect them from predators (Gouvernement du Québec, 2023a). Therefore, predation is not an immediate threat to these populations. However, the current levels of habitat disturbance in these ranges (61% and 76%, respectively, in 2020, Table 2) greatly favour the populations of other prey and predator species. Consequently, with these enclosures, the impact of excessive predation is only temporarily avoided, and could become critical again if these individuals are released, or in the event of a break in the enclosure fencing that would allow predators to enter or caribou to escape.

1.5 Status, legislation and existing conservation measures

Federal protection

The boreal caribou was added to the List of Wildlife Species at Risk in Schedule 1 of SARA in 2003, when the Act came into force. Individuals and residences are protected on federal lands under sections 32 and 33 of SARA, which prohibit killing, harming, harassing, capturing, or taking an individual, as well as damaging or destroying its residence. In 2019, a ministerial order was made under section 58 of SARA, prohibiting the destruction of the species' critical habitat on federal lands unless authorized under section 73 of the Act. Certain portions of critical habitat are excluded from the application of the order (ECCC, 2019).¹³ The total area covered by the order is around 14,500 km² (ECCC, 2021).

The Government of Canada reports on actions taken to protect the critical habitat of species at risk through reports published on the Species at Risk Public Registry. Since 2018, 12 reports have been published, with two of these specific to boreal caribou (in 2018 and 2019).

Provincial protection

In Quebec, a number of laws can help to protect individuals and habitats of the species. The following paragraphs describe the main laws, which were also analyzed in a recent report, entitled Protection Assessment of Critical Habitat and Individuals of Boreal Caribou in Quebec, published online by ECCC (2023b). An updated summary of the main elements in this report is provided below. On January 30, 2023, the federal Minister of the Environment concluded that almost all of the critical habitat of the boreal caribou located on non-federal lands in Quebec is not effectively protected.

In the province of Quebec, the species is referred to as the woodland caribou.¹⁴ The vast majority of its range (98%) is on provincial Crown land.

Some laws provide a certain level of protection for the species and portions of its habitat, but these protections apply to only a small percentage of its total range. Two separate acts are designed to provide some form of protection for species at risk: the *Act Respecting Threatened or Vulnerable Species (ATVS)* and the *Act Respecting the Conservation and Development of Wildlife (ACDW)*. The boreal caribou was designated as a vulnerable species in 2005 under ATVS and the *Regulation Respecting Threatened or Vulnerable Wildlife Species and Their Habitats* (paragraph 2(7)(a) of the

¹³ Section 1 of the order lists the exclusions, which include lands that are on a reserve or other land that has been set apart for the use and benefit of a band under the *Indian Act*; lands under the authority of the Parks Canada Agency; and lands under the administration and control of the Commissioner of the Yukon or the Commissioner of the Northwest Territories.

¹⁴ In Quebec, boreal caribou are referred to as woodland caribou, woodland ecotype (or the forest-dwelling ecotype of woodland caribou). This text uses the term boreal caribou for the sake of consistency.

Regulation). The protection of individuals is ensured under ACDW, which prohibits the hunting of boreal caribou. This prohibition is the main tool for protecting individuals of this species under ACDW and applies to both provincial Crown land and private land.

In addition, the legislation affords protection to some portions of the species' habitats, and prohibits certain activities. The *Regulation Respecting Wildlife Habitats* (RWH) enables the protection of specific boreal caribou habitats, notably if they are located on land in the domain of the State and are identified by a plan drawn up by the Minister (sections 128.1 and 128.2 of ACDW). In the case of boreal caribou, this protection applies to the caribou range south of the 52nd parallel as designated in the *Gazette officielle du Québec*, which covers virtually all of the critical habitat in the federal Charlevoix range (QC2; Figure 2).¹⁵ In addition, some activities are permitted in wildlife habitats, notably forest management activities (section 8 of the RWH).

In addition, boreal caribou habitat can be protected under the *Natural Heritage Conservation Act* (NHCA), which enables the designation of various types of protected areas, including ecological reserves (sections 48 and 49 of the NHCA), biodiversity reserves (sections 50 and 51 of the NHCA) and *réserves de territoires aux fins d'aires protégées* (RTFAPs) [land set aside for protected areas] (subsections 12.3 to 12.6 of the NHCA). The *Parks Act* (PA) also allows for the establishment of national parks. In total, an area of 5.1 million hectares, or 50,705 km², is protected under these various designations (Bureau du forestier en chef, 2022), representing roughly 9% of the species' range in Quebec.¹⁶ In addition, some reserves have been established specifically for the species, such as the 2009 Caribous-de-Val-d'Or Biodiversity Reserve, and the Manouane-Manicouagan and Caribous-de-Nottaway RTFAPs.

In the rest of the species' range, the provincial legislation does not prevent activities that threaten the species, but enables these activities to be managed. The *Environment Quality Act* (EQA) is not specifically aimed at protecting species at risk, given its general intent. However, as part of the ministerial authorization process set out in the EQA, the Minister may, at his or her discretion, refuse to authorize a project located in the habitat of a vulnerable species for which a plan has been prepared under the *Regulation Respecting Wildlife Habitats* (section 31.0.3, paragraph 2(4) of the EQA). In addition, threatened and vulnerable species must be included in the inventories required to obtain authorization for projects under this Act. Enforceable conditions attached to authorizations, such as avoidance, mitigation, and compensation measures, can provide a form of protection for boreal caribou. Despite all of the above, some projects may be carried out in caribou habitat.

¹⁵ In addition, two caribou calving grounds north of the 52nd parallel are protected as wildlife habitats designated in the *Gazette officielle du Québec*.

¹⁶ Areas and percentages are also provided in the 2023 Protection Assessment of Critical Habitat and Individuals of Boreal Caribou in Quebec (ECCC, 2023b), calculated based on the federal ranges. These figures are similar to those presented by the Bureau du forestier en chef (2022).

The *Sustainable Forest Development Act* (SFDA) sets out the rules for sustainable forest management, notably on provincial Crown land. This law divides the forest territory into 57 management units, which cover 25% of the boreal caribou's range in Quebec; the remainder of the range is mostly located beyond the northern limit for commercial timber allocation. The SFDA contains no specific mentions of threatened or vulnerable species or boreal caribou.

The *Regulation Respecting the Sustainable Development of Forests in the Domain of the State* (RSDF), made under the SFDA, stipulates that no forest management activities shall be carried out in a caribou calving ground north of the 52nd parallel (subsection 47(1) of the RSDF). However, forest management activities that are carried out for the purposes of exercising mining rights are exempt (section 49 of the RSDF), which precludes protecting caribou from one of the main anthropogenic threats occurring beyond the northern limit for commercial timber allocation. In addition, logging restrictions apply in the area covered by the *Plan de rétablissement du caribou forestier* [woodland caribou recovery plan] (section 59, paragraph 1, of the RSDF), although the Minister of the Environment (MELCCFP) and the Minister of Forests (MRNF) may issue authorizations for these operations under the EQA or the SFDA respectively (section 59, paragraph 2, of the RSDF). In addition, certain rules apply to roads in the area covered by the woodland caribou recovery plan (sections 60 and 61 of the RSDF).

History of recovery measures

The measures implemented in Quebec during the 2012–2023 period are described in detail in the Report on the Progress of Recovery Strategy Implementation for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population in Canada for the Period 2012 to 2017 (ECCC, 2017) and in a similar report being prepared for the 2018–2023 period (ECCC, in preparation). These reports focus primarily on the actions taken by the federal, provincial and territorial governments, and do not reflect the entirety of the work being done by Indigenous Peoples, non-governmental stakeholders, universities and private citizens to promote the recovery of boreal caribou across the country. The following paragraphs provide a summary of the main measures implemented in Quebec in recent years.

Federal measures

In October 2012, under section 37 of SARA, EC published the first version of the Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada (EC, 2012). In 2020, the recovery strategy was amended under section 45 of SARA to complete the identification of critical habitat (specifically in the SK1 range in Saskatchewan), update the data on population and habitat status and make other minor changes. However, the delineation of the ranges of the local populations in Quebec, and their population and distribution objectives, remain the

same. The resulting Amended Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada, 2020 (ECCC, 2020) replaces the 2012 version (EC, 2012).

In 2018, ECCC published the Action Plan for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada: Federal Actions (ECCC, 2018). This plan emphasizes that the recovery of the boreal caribou requires unprecedented commitment, collaboration and cooperation among the various groups involved in caribou conservation.

Provincial measures

A recovery plan for woodland caribou in Quebec was produced by the Équipe de rétablissement du caribou forestier du Québec (hereinafter, the recovery team) for the 2005–2012 period and was approved by the Ministère des Ressources naturelles et de la Faune du Québec (MRNF) [Quebec Department of Natural Resources and Wildlife] (Équipe de rétablissement du caribou forestier du Québec, 2008). In 2013, the recovery team produced guidelines on the management of woodland caribou habitat (Équipe de rétablissement du caribou forestier au Québec, 2013a) and a second recovery plan (Équipe de rétablissement du caribou forestier du Québec, 2013b), but they have not been adopted by the Quebec government. The integration of these recommendations is left to the discretion of the Minister of Forests. For the period from 2013 to 2023, the recovery team also produced a report outlining the progress of the actions set out in the woodland caribou recovery plan published in 2013 (Équipe de rétablissement du caribou forestier du Québec, 2023).

When the action plan for managing woodland caribou habitat (*Plan d'action pour l'aménagement de l'habitat du caribou forestier*) was published in 2016, the Quebec government announced that it would be followed in 2018 by a long-term strategy (MFFP, 2016). In 2019, the Quebec government presented to ECCC the approach it wished to take in developing the strategy. Now referred to as the woodland and mountain caribou strategy (*Stratégie pour les caribous forestiers et montagnards*), it was still not published at the time of this assessment. Until the strategy is adopted, interim caribou habitat management measures have been put in place in some sectors that the Quebec government considers sensitive (Gouvernement du Québec, 2019). On November 5, 2021, the Quebec government announced the establishment of an independent commission on woodland and mountain caribou (*Commission indépendante sur les caribous forestiers et montagnards*) to hold consultations and propose scenarios for developing the strategy; its final report was published on August 19, 2022 (Commission indépendante sur les caribous forestiers et montagnards, 2022).

Some recovery measures for boreal caribou have been put in place by the Quebec government since 2016. The main ones include the designation of protected areas, the

implementation of a moratorium on logging in certain parts of caribou habitat, the dismantling of more than 157 km of roads in caribou habitat since 2017 (ECCC, in preparation) and the use of enclosures for the remaining members of the Val-d'Or population in 2020 and the Charlevoix population in 2022 (Gouvernement du Québec, 2023a).

Agreement between the governments of Quebec and Canada

On August 18, 2018, the Government of Canada and the Government of Quebec signed a one-year agreement (2018–2019) for boreal caribou (Government of Canada and Government of Quebec, 2018) under the Collaborative Agreement for the Protection and Recovery of Species at Risk in Quebec (Government of Canada and Government of Quebec, 2006). Subsequently, in September 2019, the parties signed the Cost-Sharing Understanding Concerning the Implementation of the Cooperation Agreement for the Protection and Recovery of Species at Risk in Quebec Applied to Boreal Caribou and its Habitat, which covers the 2019–2022 period (Government of Canada and Government of Québec, 2019). These two agreements supported some of the measures listed in the previous section on provincial measures.

In 2022, negotiations began on a new agreement on boreal caribou recovery, but were put on hold until the publication of the Quebec government's woodland and mountain caribou strategy. ECCC needs to know the elements in the provincial strategy in order to develop a collaboration agreement with the Quebec government.

Measures undertaken by Indigenous peoples and organizations

In Quebec, more than a hundred projects conducted by Indigenous peoples or organizations have been carried out since 2013. The scope of these projects and the activities they involve vary according to the issues specific to each Nation. They include habitat restoration measures, including road revegetation; protected area projects targeting habitats of interest; predator control activities to reduce caribou mortality; drafting of action plans to identify strategic measures to be implemented on the territory; awareness-raising activities; and knowledge acquisition. Owing to the bio-cultural importance of caribou, and the sacred ties that Indigenous Peoples maintain with their traditional territories, the latter are deeply involved in the recovery of the species and the restoration of its habitat. ECCC has not listed all the projects carried out; many other measures may have been implemented by Indigenous peoples and organizations, without financial participation from ECCC (see Lochon *et al.*, 2022).

1.6 Recovery objectives

According to the recovery strategy for the Woodland Caribou, Boreal population (EC, 2012; ECCC, 2020) the recovery of the species is technically and biologically feasible throughout its Canadian range. The recovery goal for boreal caribou is to achieve self-

sustaining local populations in all boreal caribou ranges throughout the species' current distribution in Canada, to the extent possible. Achieving the recovery goal would allow for local population levels sufficient to sustain traditional Indigenous harvesting activities, consistent with existing Aboriginal and treaty rights.

In order to work towards achieving the recovery goal, population and distribution objectives have been identified for the species. These objectives are, to the extent possible, to:¹⁷

- i) Maintain the current status of the 15 existing self-sustaining local populations; and
- ii) Stabilize and achieve self-sustaining status for the 36 not self-sustaining local populations.

In the case of the recovery objectives, “not self-sustaining” refers to local populations assessed as “as likely as not to be self-sustaining” or “not self-sustaining.”

The notion of self-sustainability refers to processes that take place at the population level. However, the most recent data on the size of and trends in caribou populations in Quebec are reported for the populations identified by the Quebec government (MFFP, 2021a), not for those identified in the recovery strategy (EC, 2012; ECCC, 2020). Although it is relatively easy to establish a correspondence between some of the populations recently identified by the Quebec government (MFFP, 2021a) and those set out in the recovery strategy (EC, 2012; ECCC, 2020; e.g., QC1 and Val-d'Or or QC2 and Charlevoix), this direct correspondence is lacking for several populations. The populations recently identified by the Quebec government (MFFP, 2021a) are nevertheless associated with ranges covering approximately the same territory as the ranges identified in the recovery strategy (EC, 2012; ECCC, 2020). Consequently, ECCC considers that no population present in Quebec in 2012, when the first draft of the recovery strategy was produced, is excluded from the set of populations identified by the Quebec government in 2021. For these reasons, as well as those set out in Appendix A, ECCC believes that it is appropriate to use the populations and ranges identified by the province as the units of analysis for evaluating the achievement of recovery objectives in this assessment.

Table 4 shows the recent status of the three indicators used by EC (2011) to carry out the integrated risk assessment. For the purposes of this assessment, and given the time constraints, the integrated risk assessment has not been updated. The values of the indicators presented in Table 4 nevertheless enable us to assess the degree of risk

¹⁷ The current data support the conclusion that the recovery of all local populations is technically and biologically feasible. In some cases, the recovery of a particular local population may prove, over time and due to unforeseen circumstances, to be technically or biologically unfeasible, which in turn may affect the likelihood of achieving population and distribution targets for these local populations.

faced by each population. The rate of population finite growth (λ) and the level of habitat disturbance provide an indication of the extent to which populations are likely to show stable or positive growth in the future. Indeed, populations whose current growth rate is equal to or greater than one (≥ 1) are more likely to remain stable in the long term. Similarly, the lower the level of habitat disturbance, the more likely conditions are to support stable or increasing populations. In addition, the population size reflects the risk associated with stochastic phenomena; smaller populations run a greater risk of reaching the quasi-extinction threshold of 10 females capable of reproduction over a 50-year period (EC, 2011). According to the data presented in Table 4, the Val-d'Or, Charlevoix and Pipmuacan populations face a particularly high risk in this respect. Indeed, at least two of the three self-sustainability indicators indicate a "high" or "very high" degree of risk for these populations. In addition, the considerable levels of habitat disturbance (i.e., approaching or already exceeding 35%) and declining demographic trends associated with most of the other populations suggest that they, too, face a significant degree of risk.

Table 4. Indicators of self-sustainability and levels of risk faced by boreal caribou populations in Quebec (MFFP, 2021a) as a function of each indicator. The gradient from green to dark red reflects an increasing risk gradient. This table shows the population sizes and trends compiled in Table 1, as well as the disturbance levels compiled in Table 2 (see Table 2 for the references associated with these data).

Population or Knowledge Acquisition Area	Self-sustainability Indicators					
	Population Size		Habitat Conditions		Population Trends	
	Population size (individuals) ¹	Level of risk, based on population size ¹	Level of habitat disturbance (%) ²	Level of risk, based on the observed level of disturbance ³	Finite population growth rate (λ) ⁴	Level of risk as a function of the finite population growth rate ⁵
Assinica	> 300	Low	57	High	0.97	Moderate
Baie-James ⁶	> 300	Low	36	Moderate	Not available	
Basse-Côte-Nord ⁶	> 300	Low	9	Very low	0.96	Moderate
Caniapiscau	> 300	Low	9	Very low	1.07	Very low
Charlevoix	< 100	High	76	Very high	0.67	Very high
Detour	> 300	Low	33	Low	Not available	
Manicouagan	> 300	Low	29	Low	0.87	Very high
Nottaway	100-300	Moderate	28	Low	0.95	High
Outardes	> 300	Low	28	Low	0.89	Very high
Pipmuacan	100-300	Moderate	72	Very high	0.76	Very high
Témiscamie	> 300	Low	44	Moderate	0.97	Moderate
Val-d'Or	< 100	High	61	High	0.81	Very high

¹ Since methods for estimating population size may vary, population sizes are presented in classes of <100, 100-300 and >300 individuals. These classes are associated with different levels of risk. Indeed, more than 300 boreal caribou would be needed for a local population to be considered self-sustaining (EC, 2008). Similarly, maintaining a population size of 100 gives a 0.7 probability of not reaching the quasi-extinction threshold of fewer than 10 females capable of reproduction under stable conditions over 50 years (EC, 2011).

² Disturbance levels were calculated based on a disturbance mapping process following the method described in Appendix C. Anthropogenic disturbances include a 500-m buffer (in accordance with EC [2011]). Fire-associated disturbances correspond to areas where a fire has occurred in the last 40 years (without buffer; as per EC [2011]). This method does not aim to provide a precise inventory of all habitat disturbances that could be perceived by caribou and affect their behaviour or demographics. It does, however, provide a reliable indication of the degree of habitat disturbance, which has also been linked to demographic parameters such as recruitment and adult female survival (EC, 2011; Johnson *et al.*, 2020).

³ According to the relationship shown in Figure 4 (EC, 2011).

⁴ Since the finite growth rate of populations (λ) can fluctuate from year to year, calculating values for this parameter that take account of estimates of survival and recruitment rates based on a limited number of years of data may provide an incomplete or erroneous picture of population trends. The finite growth rate values presented in this table should be interpreted with caution.

⁵ The risk classes associated with the finite growth rate (λ) for each population were identified based on the projected population trajectory over three generations (18 years), assuming that the growth rate would not change. The risk categories and thresholds used were inspired by the A3 quantitative criterion used by COSEWIC to assess the status of wildlife species (COSEWIC, 2021), which looks at the projected decline over a period of 10 years or three generations (whichever is longer). This criterion establishes a decline threshold of at least 30% for “Threatened” status and at least 50% for “Endangered” status. ECCC has used these thresholds to identify different risk categories. Thus, the “very low” risk class is associated with a stable or positive trend expected over a period equivalent to three generations (corresponding approximately to values of $\lambda \geq 1$); the “low” risk class is associated with an expected decline of less than 30% over three generations (corresponding approximately to values of $\lambda \geq 0.98$ and < 1); the “moderate” risk class is associated with an expected decline of at least 30% over three generations (corresponding approximately to values of $\lambda \geq 0.96$ and < 0.98); the “high” risk class is associated with an expected decline of at least 50% over three generations (corresponding approximately to values of $\lambda \geq 0.94$ and < 0.96); and the “very high” risk class is associated with an expected decline of at least 50% in two generations [12 years] or less (corresponding approximately to values of $\lambda < 0.94$).

⁶ In the Baie-James and Basse-Côte-Nord knowledge acquisition areas, the self-sustainability indicators should be interpreted with caution, as the population structure in these areas is unknown. The self-sustainability indicators may not accurately reflect the level of risk faced by populations in these areas.

1.7 Critical habitat

Under SARA, critical habitat is defined as “the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species’ critical habitat in the recovery strategy or in an action plan for the species.” The use of the territory by boreal caribou varies over space and time, in accordance with changes in the location of biophysical attributes within the range as areas of disturbed and undisturbed habitat cycle on the landscape. For a local population to be self-sustaining over time, this habitat supply system (i.e., critical habitat) must function perpetually. Therefore, for boreal caribou, the most relevant spatial scale for identifying critical habitat is the range (EC, 2008).

In light of the foregoing, the critical habitat of boreal caribou is identified in all ranges¹⁸ (except the Boreal Shield range [SK1] in northern Saskatchewan)¹⁹ as follows:

- The area within the boundaries of each boreal caribou range that provides an overall ecological condition that will allow for an ongoing recruitment and retirement cycle of habitat, which maintains a perpetual state of a minimum of 65% of the area as undisturbed habitat; and
- Biophysical attributes required by boreal caribou to carry out life processes (see Appendix B).

In ranges where the percentage of undisturbed habitat is below the threshold, critical habitat is initially defined as existing habitat that, over time, will contribute to reaching the 65% threshold of undisturbed habitat (except for SK1). Existing habitat is defined as the entire range of boreal caribou, with the exception of areas where alterations are permanent (permanent alterations: existing features found within a range, such as industrial and urban developments, permanent infrastructure and graded or paved roads that do not currently possess or have the potential to possess the biophysical attributes of critical habitat for boreal caribou).

Based on the methodology developed by EC (2011), a disturbance management threshold of 65% has been identified, meaning that a minimum of 65% undisturbed habitat must be maintained or achieved in order to provide a measurable probability of 60% of a local population being self-sustaining. The precise location of the 65% undisturbed habitat in a range will vary over time. The habitat within a range should exist in an appropriate spatial configuration, such that boreal caribou can move throughout the range and access the required habitat when needed.

¹⁸ It is important to note that, although this assessment uses provincial ranges (MFFP, 2021a) as the units of analysis, the critical habitat remains associated with the ranges identified in the federal recovery strategy (EC, 2012; ECCC, 2020).

¹⁹ The description of critical habitat for the SK1 range is available in the recovery strategy (ECCC, 2020).

Box 1 – Findings from Part 1

- Boreal caribou need large areas of undisturbed and interconnected old-growth forest to separate themselves spatially from their predators.
- The main factor in the decline of boreal caribou populations is habitat disturbance, which favours other prey species and, consequently, predator populations. This results in greater predation pressure on caribou, a phenomenon referred to as “apparent competition.”
- ECCC’s recovery strategy for the boreal caribou established the recovery goal of achieving self-sustaining local populations throughout the species’ current distribution in Canada to the extent possible. The document also establishes a maximum disturbance management threshold of 35%, above which the probability of a population being self-sustaining is less than 60%.
- Using caribou location data from between 2004 and 2020 (MFFP, 2021a), the Quebec government has identified 10 local population ranges and two knowledge acquisition areas. At the time of this assessment, these ranges constitute the best information available on the structure and distribution of caribou populations in Quebec, and are used as the unit of analysis.
- Taking into account the self-sustainability indicators considered (size and finite growth rate of the population, level of habitat disturbance), three of the 10 populations identified by the Quebec government (Val-d’Or, Charlevoix and Pipmuacan) face a particularly high level of risk, while two other populations (Assinica and Témiscamie) have a level of habitat disturbance that exceeds the 35% threshold.
- In February 2023, the federal Minister of the Environment concluded that almost all of the critical habitat of boreal caribou in Quebec located outside federal lands is not effectively protected.

PART 2: INFORMATION ON NEW OR EVOLVING THREATS

2.1 General information on major threats

This threat assessment focuses on anthropogenic activities²⁰ that contribute to the increased disturbance of boreal caribou habitat, i.e., activities that constitute ultimate threats to the species, given the strong relationship between a caribou population's probability of self-sustainability and the level of disturbance to its habitat (see Part 1.4). According to the calculations of the relative contributions of the different disturbance classes (Table 5), the anthropogenic activities are responsible for the majority of disturbance in the species' habitat are logging (cutblocks) and the road network (roads). Consequently, the threat assessment focuses on these two sources of disturbance. The threats associated with other anthropogenic activities are described in less detail, so as to not postpone the adoption of efficient measures (precautionary principle). Since the other activities' relative contribution to the level of habitat disturbance is smaller, ECCC considers that the risk of them jeopardizing the survival or recovery of the species in the near future is also lower, even if they contribute to increased cumulative effects on the species. Some of these other threats—such as mining, and vacation and recreational infrastructure development—have been identified as significant threats to boreal caribou in the correspondence received by ECCC.

Furthermore, given the extent of the boreal caribou ranges in Quebec, this assessment only examines the threats in ranges where the level of disturbance is greater than 35%,²¹ since threats in these ranges are more likely to have a significant immediate impact on the survival or recovery of the species. Owing to this risk-based approach, the assessment can focus on the most significant threats, in accordance with the emergency context referred to in section 80 of SARA.

²⁰ Since threats of natural origin (e.g., fires) are unpredictable, and potential interventions to address them are limited, they are not assessed here, even though they may represent the source of a significant proportion of disturbance in certain ranges.

²¹ The Baie-James knowledge acquisition area is not included, even though its disturbance level is 36%. Since this is a knowledge acquisition area rather than the range of a local population, it is more difficult to establish the relationship between habitat disturbance and the self-sustainability of the population(s) on the territory. Furthermore, this area is mostly affected by natural disturbances (fires, see Table 2), which are not addressed in this assessment.

Table 5. Relative contribution of different disturbance classes, as of 2020, in the five provincial boreal caribou ranges (MFFP, 2021a) for which the level of habitat disturbance was greater than 35% in 2020.¹

Disturbance classes	Relative contribution (%) based on total surface area of all disturbance classes in each range ²				
	Val-d'Or	Charlevoix	Pipmuacan	Assinica	Témiscamie
Cutblocks	50	58	61	46	51
Roads	42	37	28	23	20
Fires	<1	1	9	25	29
Power lines	2	3	2	3	<1
Mines	2	<1	<1	1	<1
Urban development	2	<1	<1	<1	<1
Railways	<1	0	0	<1	0
Unknown polygonal entities	<1	<1	<1	<1	<1
Agriculture	<1	0	0	<1	0
Unknown linear entities	<1	0	<1	<1	<1
Landing strips	0	0	<1	<1	<1
Oil and gas infrastructure	0	0	0	<1	0
Pipelines	<1	0	0	0	0
Dams	0	0	0	0	0
Seismic exploration lines	0	0	0	0	0
Well sites	0	0	0	0	0

¹ The Baie-James knowledge acquisition area was not included, despite its disturbance level of 36%. This is because it is not directly linked to the range of a local population, and because the level of anthropogenic disturbance is only 4%.

² The calculation of disturbance levels is based on a disturbance mapping process following the method described in Appendix C. Anthropogenic disturbances include a buffer of 500 m (in accordance with EC [2011]). Fire-associated disturbances correspond to areas where a fire has occurred in the last 40 years (buffer not included; in accordance with EC [2011]). This method does not aim to compile a precise inventory of all habitat disturbances that could be perceived by caribou and affect their behavior or demography. Assigning a class to disturbances is an intermediate step in the disturbance mapping process described in EC (2011) and Appendix C, and may result in inaccuracies. As such, the values in this table should be interpreted with caution. Values greater than 1 have been rounded to the nearest whole number, and values between 0 and 1 are indicated as < 1. A given area may be affected by more than one disturbance class, due mainly to the 500-m buffers added to anthropogenic disturbances (see Appendix C). In the table above, each disturbance class is considered independently of the others, and overlaps between classes are not considered. To calculate the relative contribution of each disturbance class, the area affected by that disturbance class was compared to the sum of the areas affected by all disturbance classes, without merging areas of overlap (this sum is therefore greater than the true area of

disturbed habitat in a given range). The methodology used underestimates the relative contribution of linear disturbances (e.g., roads; see Appendix C).

2.2 Logging

Forest management activities in Quebec are governed by the *Sustainable Forest Development Act* (SFDA; see Section 1.5). Among other things, this law governs the steps involved in establishing both the volumes of wood to be harvested and the areas where this harvesting will take place (Figure 5).

Figure 5

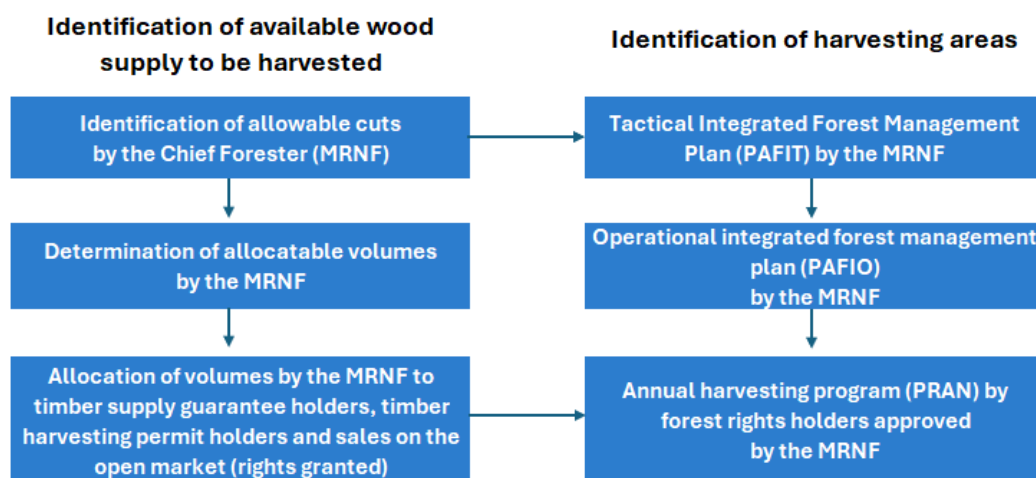


Figure 5. Summary of the main stages in forest planning leading to commercial forestry operations in Quebec.

Every five years, the Forestier en chef du Québec [Chief Forester of Quebec] establishes the allowable cuts in each of the 57 forest management units, which correspond to the maximum annual timber harvest (section 48 of the SFDA). The allowable cuts in effect at the time of this assessment were established for the 2023–2028 period.

The Ministère des Ressources naturelles et des Forêts (MRNF) applies reduction factors to the allowable cut, in order to subtract unusable wood volumes and obtain the net merchantable volumes (NMV) (MFFP, 2022b). In addition, other volumes are subtracted according to the department’s list of criteria until the allocatable volume is obtained, which can then be granted as forestry rights—in the form of timber supply guarantees (*garanties d’approvisionnement*) or licenses to harvest timber for the purpose of supplying a wood processing plant (*Permis d’intervention pour la récolte de bois aux fins d’approvisionner une usine de transformation du bois*) (PRAU) or for sale on the open market. Allocatable volumes are generally not assigned or harvested in full.

However, to the best of ECCC's knowledge, there is nothing to prevent all volumes from being allocated should the industry demand increase. Between 2013 and 2022, wood harvesting on public land in Quebec represented 89% of allocated volumes and 73% of allowable cuts on average.²²

For each forest management unit, the Quebec government draws up tactical integrated forest management plans (*plans d'aménagement forestier intégré tactiques*) (PAFITs). The PAFITs in effect at the time of this assessment target the 2023–2028 period. These five-year plans establish management objectives and the strategies selected to achieve them (section 54 of the SFDA). The PAFITs are followed by operational integrated forest management plans (*Plans d'aménagement forestier intégré opérationnels*) (PAFIOs), which map the areas where timber harvesting and other forest management activities are to take place (section 54 of the SFDA). The PAFIOs are updated on an ongoing basis, in accordance with MRNF's objective of identifying potential forest operations areas that provide 300% of the timber supply required to meet companies' annual needs, or the equivalent of three years of operations, to offer latitude and predictability to forestry rights holders (MFFP, 2021b).

In keeping with the PAFITs and PAFIOs, the forestry rights holders in each forest management unit jointly prepare an annual program of commercial silvicultural work (e.g., total cutting, partial cutting, commercial thinning), while the provincial government draws up a program of non-commercial silvicultural work (e.g., reforestation, precommercial thinning). This information is made available in the annual harvesting program (*Programmation annuelle des activités de récolte*) (PRAN), which presents the

²² The averages were calculated by ECCC based on the data in the statistical portraits of the forestry sector. In the event of a discrepancy between the data from two different documents, ECCC used the data from the most recent one. For the allowable cut, ECCC used the amount in the "*Total des forêts publiques (UA et TFR)*" [total for public forests (MU and PFL)] line of the table "*Possibilités forestières ('000 m³), volume marchand net*" [allowable cut ('000 m³), net merchantable volume] prepared by MRNF (2022) for the years 2021–2022, 2020–2021 and 2019–2020; by MFFP (2021c) for the year 2018–2019; by MFFP (2020a) for the year 2017–2018; by MFFP (2019) for the year 2016–2017; and by MFFP (2018) for the years 2015–2016, 2014–2015 and 2013–2014. For allocations, ECCC used the total amounts from the tables "*Volumes de bois attribués dans les forêts publiques en 2020-2021 ('000 m³ net)*" [wood volumes allocated in public forests in 2020-2021 ('000 m³ net)], "*Volumes de bois attribués dans les forêts publiques en 2019-2020 ('000 m³ net)*" [wood volumes allocated in public forests in 2019-2020 ('000 m³ net)] and "*Volumes de bois attribués dans les forêts publiques en 2018-2019 ('000 m³ net)*" [wood volumes allocated in public forests in 2018-2019 ('000 m³ net)] prepared by MRNF (2022); the totals from the table "*Volumes de bois attribués dans les forêts publiques en 2017-2018 ('000 m³ net)*" [wood volumes allocated in public forests in 2017-2018 ('000 m³ net)] by MFFP (2021c); the totals from the table "*Volumes de bois attribués dans les forêts publiques en 2016-2017 ('000 m³ nets)*" [wood volumes allocated in public forests in 2016-2017 ('000 m³ net)] by MFFP (2019); and the totals from the table "*Volumes de bois attribués dans les forêts publiques ('000 m³)*" [wood volumes allocated in public forests ('000 m³)] by MFFP (2018) for the years 2015–2016, 2014–2015 and 2013–2014. For harvesting, ECCC used the "*Territoire public*" [public land] line from the table "*Volumes totaux de bois récoltés dans les forêts publiques et privées (VMN) par tenure*" [total wood volumes harvested in public and private forests (NMV) by tenure] taken from MRNF (2022) for the years 2021–2022 (provisional data), 2020–2021, 2019–2020, 2018–2019, 2017–2018 and 2016–2017; from MFFP (2021c) for the year 2015–2016; from MFFP (2020a) for the year 2014–2015; and from MFFP (2019) for the year 2013–2014.

areas where forest management activities are scheduled to take place over the course of the year, based on a cycle running from April 1 to March 31 (Gouvernement du Québec, 2022a). Once MRNF has approved the PRAN in whole or in part, these operations can proceed. However, the PRANs may be subject to minor modifications during the year, mainly due to operational constraints or fluctuations in timber markets.

The government may also produce special management plans, which may deviate from the *Regulation Respecting the Sustainable Development of Forests in the Domain of the State* (RSDF), in order to recover timber in areas affected by natural disturbances (fires, disease outbreaks, windthrow) or anthropogenic disturbances (hydroelectric projects).²³ As soon as they come into effect, these special plans replace all other management plans and annual harvesting programs in force in the area affected by the disturbance. They may result in the allowable cut for a given management unit being exceeded.

Areas specified in the PAFIOs and PRANs are not always fully harvested. However, areas can be added to the PRANs during the year. ECCC therefore considers that, even if the actual areas and locations of logging operations may differ slightly from those shown in the forestry planning documents, the PRANs provide a good estimate of the areas targeted by the current year's forestry operations, while the PAFIOs provide a good estimate of the areas targeted by forestry operations to take place in the next three years.

The Quebec government publishes the PRAN and PAFIO data through interactive map applications, on a region-by-region basis.²⁴ PAFIO data are made available online for consultation purposes, and are not necessarily edited to reflect changes once the consultations have been completed. The publication of PRAN data is not a legal requirement under the SFDA, and their availability varies from region to region. For example, the interactive map application for the 2023–2024 Nord-du-Québec PRAN was not available at the time of this assessment, which resulted in incomplete data being available on the planned logging operations in the Assinica and Témiscamie ranges. This does not mean that no harvesting is planned in this region for 2023–2024, but rather that MRNF has not published the data for the annual program. However, the PAFIO data for the Nord-du-Québec region indicate planned logging operations over a three-year horizon. When schedules of the PRAN updates were available for the other regions, they indicated that the data were updated two to three times a year, at different times depending on the region.

²³ Salvage logging can amplify the impact of natural disturbances on caribou by removing standing trees from the habitat. Furthermore, salvage logging may require the creation of a new network of roads, which facilitates predators' movements (Labadie *et al.*, 2021).

²⁴ The regions discussed in the context of forest management planning have the same names and numbers as Quebec's administrative regions, but their boundaries may differ slightly since they follow the limits of the territorial forest subdivisions (e.g., the northern limit for commercial timber allocation or the boundaries of management units).

In the absence of information and data shared directly by the Quebec government, ECCC considers that the published PRAN data constitute the best available information on planned forest management activities for the year 2023–2024. In the remainder of this document, the expression “2023–2024 PRAN” is used as a generic term to refer to the annual planning data for the 2023–2024 period made available by MRNF between October 15 and December 22, 2023. Therefore, the area of cuts in the PRANs could possibly be modified (e.g., cutblocks added or moved) after they have been published. More details on the geospatial information available are presented in Appendix D. Table 6 shows the total area of the cuts planned according to the 2023–2024 PRANs in the boreal caribou ranges where the level of habitat disturbance is greater than 35%.

Table 6. Total area of cuts planned for 2023–2024 in the boreal caribou ranges (MFFP, 2021a) with a level of habitat disturbance greater than 35% in 2020, according to the annual harvesting programs (PRANs) (see Appendix D).¹

Boreal caribou range	Range area (km²)	Area of planned cuts (km²)²
Val-d'Or	8,202	11
Charlevoix	7,248	53
Pipmuacan	18,432	170
Assinica	70,875	Present ³
Témiscamie	105,332	518 ³

¹ The Baie-James knowledge acquisition area was not included, even though it has a disturbance level of 36%. This is because it is not directly linked to the range of a local population, and because the anthropogenic disturbance level is only 4%.

² For the purposes of this assessment, the areas of planned cuts correspond to the total areas in the map elements entitled “*Programmation annuelle commerciale septembre 2023*” [annual commercial program, September 2023] in the 2023–2024 PRANs for the Saguenay–Lac-Saint-Jean region; “*Travaux sylvicoles commerciaux - Secteurs d'intervention autorisées*” [commercial silvicultural work –authorized intervention sectors] in the 2023–2024 PRANs for the Capitale-Nationale region; “*Activités planifiées – 2023–2024 – Travaux commerciaux*” [planned activities, 2023-2024, commercial work], “*Activités planifiées - 2023–2024 - Travaux commerciaux*” [planned activities, 2023-2024, commercial work], and “*Activités planifiées - 2023–2024 - Chantiers (Bureau de mise en marché des bois)*” [planned activities, 2023-2024, work sites (timber marketing board)] in the 2023–2024 PRANs for the Abitibi-Témiscamingue region; and “*Récolte*” [harvest] and “*Bureau de mise en marché des bois*” [timber marketing board] in the 2023–2024 PRANs for the Côte-Nord region. These areas do not include buffers.

³ In total, 29% of the Assinica range is located beyond the northern limit for commercial timber allocation and 67% is in the Nord-du-Québec region. An interactive map application for the 2023–2023 PRAN for this region was not available at the time of this assessment. The partial calculation of the area of cuts planned in the Saguenay–Lac-Saint-Jean and Mauricie regions according to the 2023–2024 PRANs was not carried out, but, based on a qualitative analysis, it can be determined that logging is planned in the range (Gouvernement du Québec, 2023b,c).

⁴ In total, 39% of the Témiscamie range is located beyond the northern limit for commercial timber allocation and 16% is in the Nord-du-Québec region, for which no interactive map application was available for the PRAN 2023–2024 at the time of this assessment. The area of planned cuts shown is therefore incomplete.

Given the continuous nature of forest harvesting activities, a significant portion of the planned cuts in the 2023-2024 PRANs may already have taken place at the time of this assessment. However, since the allowable cuts and volume allocations have been established for the 2023–2028 period, it is expected that they will remain relatively stable over this period, at least for the Val-d’Or, Charlevoix and Pipmuacan ranges.²⁵ Consequently, ECCC considers that the area of the planned cuts shown in the 2023–2024 PRANs can be used as an indicator of the area of the cuts that could take place in these ranges until 2028. The area of cuts can nevertheless vary annually; ECCC has noted three factors in particular that could result in the 2023-2024 PRANs being more or less representative of the area of the annual cuts. Approximately 25% of the allocatable volumes are set aside for the timber marketing board, and the areas specified in the PRAN for these volumes can be harvested over two years (MFFP, 2023a), which can result in the areas appearing in the PRANs being larger or smaller depending on the year. In addition, several special management plans are currently in effect in the caribou ranges, mainly as a result of the numerous forest fires in the summer of 2023, and were not considered in the analyses carried out for this assessment. These special plans could also modify the location and area of the cuts that will be carried out relative to the cuts specified in the PRANs published by MRNF. In such cases, ECCC believes that, despite the different locations of the cuts, the areas harvested are likely similar to or greater than those planned, even though the harvests would take place in areas where natural disturbances already occur. In addition, cuts authorized under the PRANs, but not carried out during the year, can be carried out in subsequent years. Lastly, the situation of the Val-d’Or range is special, since 92% of it is included in forest management unit 083-51. Some Anishnabe²⁶ communities currently hold licenses to harvest timber for the purpose of supplying a wood processing plant (PRAU), which operates in this management unit. Forestry rights holders in the same management unit must agree on an annual program of commercial silvicultural work (which is then published in a PRAN). In 2023–2024, one of the Anishnabe communities holding a PRAU had not ratified the annual program of commercial silvicultural work (Anishnabe Nation of Lac Simon, pers. comm., 2023). As a result, the PRAN was not finalized or approved by the Quebec government and the planned cuts in 2023–2024 in the Val-d’Or range are lower than in a typical year.

2.3 Road network

The road network in Quebec—which is managed by the Ministère des Transports et de la Mobilité durable (MTMD) [Department of Transport and Sustainable Mobility] and consists of highways and national and regional roads (hereinafter referred to as the

²⁵ On November 29, 2023, the Chief Forester recommended a reduction in the allowable cut for 11 management units in the Nord-du-Québec, Abitibi-Témiscamingue and Mauricie regions. This represents a reduction of 1.8% for the whole of Quebec. The affected management units do not overlap the Val-d’Or, Charlevoix or Pipmuacan caribou ranges (Bureau du forestier en chef, 2023).

²⁶ The spellings Anishnabe, Anishinaabe, Anishinabeg, Anishnabeg, Anishabeg, Anicinape, Anicinapek and Anichinabé also exist.

main road network)—accounts for a small proportion of the disturbances classified as “roads” in boreal caribou habitat. To the best of ECCC’s knowledge, no development projects involving the main road network are planned in the short term in ranges where the level of habitat disturbance is greater than 35% (MTMD, 2023).

In each of the provincial ranges evaluated (Val-d’Or, Charlevoix, Pipmuacan, Assinica and Témiscamie), multi-purpose roads accounted for over 90% of the road network in 2021²⁷ (unpublished data obtained using AQRéseau+ [2021 version]). A multi-purpose road is defined as a road in the forest, other than a mining road, built or used for multiple purposes, notably to give access to the forest and its resources (*Sustainable Forest Development Act*, CQLR c A-18). As multi-purpose roads are unpaved, natural regeneration may occur on the road bed, requiring a variable amount of time depending on the degree of soil compaction (St-Pierre *et al.*, 2021). However, these roads are often maintained for various activities in the forest.

Multi-purpose roads can be built with authorization from MRNF and in compliance with the RSDF. A large proportion of these roads are built by the forest industry for timber harvesting purposes (MRNF, 2023a). The construction, improvement, repair, and closure of roads are considered forest management activities under the *Sustainable Forest Development Act* and are included in forest planning. Forest management activities associated with the multi-purpose road network are included in the 2023–2024 PRANs. Table 7 shows the extent of the roads planned in the 2023–2024 PRANs in the boreal caribou ranges where habitat disturbance exceeds 35%. MRNF can also authorize the construction of multi-purpose roads for activities other than forest management, but these roads will not appear in the 2023-2024 PRANs. It is also possible that some of the roads planned in the PRAN will not be built. The same factors that can cause discrepancies between the logging work planned and carried out are also valid for road construction. For example, special harvesting plans could result in the construction of additional roads to allow timber harvesting in more remote areas than originally planned. Nevertheless, for the purposes of this assessment, ECCC considers that the data on the roads planned in the 2022–2024 PRANs provide the best estimate available of the length of roads that will be constructed in 2023–2024. As in the case of forest harvesting, some of the roads planned in the interactive PRAN maps for 2023–2024 may already have been constructed at the time of this assessment; the road lengths are used as an indicator of the extent of the new roads that may be established in a given year.

²⁷ Multi-purpose roads correspond to class 01, 02, 03, 04 and 05 roads, non-standard roads, unclassified roads, winter roads and roads whose class is unknown class in the AQRéseau+ database (2021 version).

Table 7. Planned roads under the annual harvesting programs (PRANs) for 2023–2024 (see Appendix D) in the boreal caribou ranges (MFFP, 2021a) with a habitat disturbance level greater than 35% in 2020¹.

Range	Length of roads to be built (km) ²
Val-d'Or	16
Charlevoix	115
Pipmuacan	288
Assinica	Present ³
Témiscamie	996 ⁴

¹ The Baie-James knowledge acquisition area was not included, even though its disturbance level is 36%, because it is not directly linked to the range of a local population, and because the anthropogenic disturbance level is only 4%.

² The lengths used were taken from the following map elements in the 2023–2024 PRANs: “*Chemin de la programmation annuelle septembre 2023 - PRAN_chemin_09_2023*” [roads in annual program, September 2023, PRAN_chemin_09_2023] in the Saguenay-Lac-Saint-Jean region PRAN; “*Chemins forestiers - Chemins autorisés*” [logging roads, approved roads] in the Capitale-Nationale region PRAN; “*Activités planifiées - 2023-2024 - Chemins*” [planned activities, 2023-2024, roads] and “*Activités planifiées - 2023-2024 - Chemins (Bureau de mise en marché des bois)*” [planned activities, 2023-2024, roads (timber marketing board)] in the Abitibi-Témiscamingue region PRAN; and “*Chemin*” [road] in the Côte-Nord region PRAN.

³ At the time of this assessment, an interactive map application was not available for the 2023–2024 PRANs for the Nord-du-Québec region, which represents 67% of the entire Assinica range and 94% of the portion of this range located in the commercial forest. The partial calculation of the road lengths to be established in the Saguenay–Lac-Saint-Jean, Mauricie and Côte-Nord regions based on the 2023–2024 PRANs for these regions was not prioritized, given the time frame of the assessment.

⁴ At the time of this assessment, an interactive map application was not available for the 2023–2024 PRANs for the Nord-du-Québec region, which represents 16% of the Témiscamie range and 27% of the portion of this range located in the commercial forest. The road lengths shown are therefore incomplete. Some roads in the Saguenay–Lac-Saint-Jean region seem to be duplicates. These represent less than 0.5% of all the roads digitized in the Témiscamie range.

2.4 Mining development

Mining operations can be authorized in most boreal caribou habitat in Quebec, mainly that outside protected areas (ECCC, 2023b), if the conditions of the *Mining Act* and the *Environment Quality Act* are met.

Exploration rights, also known as a claim, must be obtained before proceeding with mining exploration on a piece of land (section 19 of *the Mining Act*). Mining exploration requires removing the vegetation and drilling into the rock in a number of places to find ore (MERN and MAMOT, 2016). The cutting of timber during the exploration phase is limited to the area required to carry out the work and may not exceed 2% of the wooded area of the parcel of land covered by the mining title (section 213 of *the Mining Act*). A claim is valid for three years, and the mineral exploration phase generally lasts at least two years (section 61 of *the Mining Act*; MERN and MAMOT, 2016). The number of drill holes increases if the project moves on to the mineral deposit appraisal (development) phase. This phase lasts an average of three to eight years and is used to complete the mining lease application to the Quebec government, which will grant the right to develop

the land (MAMOT and MERN, 2016). In most cases, mining projects are subject to Quebec's environmental impact assessment and review process, and some projects may also be subject to the federal impact assessment process. Under both processes, mitigation measures must be identified to avoid, mitigate or offset the effects of the project on boreal caribou habitat and individuals.

The construction of the mine, followed by its operation, can begin as soon as a mining lease is obtained (section 100 of *the Mining Act*). Construction is the phase that causes the most habitat disturbance. However, the surface area impacted by mining activities may also increase while the mine is in operation, notably due to the waste rock, tailings and ore slurry stored at the site (MRNF, 2023b). Mine operations generally last from 5 to 30 years (MERN and MAMOT, 2016). The mining company must have a government-approved mine rehabilitation and restoration plan before operations begin (section 101 of *the Mining Act*). This plan may allow for the restoration of part of the habitat disturbed by the project. However, even with active restoration efforts, timelines of several decades must be considered before the habitat once again presents favorable conditions for caribou (Ray, 2014).

Mines do not account for a significant proportion of the disturbed areas in caribou habitat (Table 5), and their effects are not further quantified in this assessment. However, mining is a growing activity across Quebec. MRNF publishes the *Mines et projects* [mines and mine projects] dataset, as well as the "Producing Mines and Mines in Care and Maintenance" and "Mining Projects" maps. According to these sources, in 2023, Quebec had 20 active mines and six mines undergoing maintenance²⁸ or reopening (MRNF, 2023c,d). The Val-d'Or range has four active mines, including an approximately 25-km² section of the Canadian Malartic development, one of the largest mining projects in Canada (MRNF, 2023e). Furthermore, despite the rehabilitation and restoration requirements, on March 31, 2023, the Quebec government calculated that there were 31 abandoned contaminated mining sites under effective public responsibility within the boundaries of the Val-d'Or, Assinica and Témiscamie ranges (MRNF, 2023f; Government of Quebec, 2023d). Mining activities at these sites ceased between 1935 and 2008 (MRNF, 2023f). Three sites are currently being rehabilitated, and two others are at the post-reclamation monitoring and maintenance stage; all the other sites are still at the characterization (environmental site assessment) stage (MRNF, 2023f).

Across Quebec, 35 mining projects are at the mineral deposit appraisal (or development) stage (MRNF, 2023c, d), including one in the Pipmuacan range and one in the Val-d'Or range, where construction has already begun (Agnico-Eagle Mines, 2023). Four other projects are located close to the Val-d'Or range. In the Assinica range, there is currently one mine under maintenance, and seven projects in the

²⁸ Mines "in maintenance" have ceased operations but continue to maintain their facilities with a view to potentially quickly reopening.

development stage, two in the area where the Assinica and Témiscamie ranges intersect (see Figure 2). In 2022, ECCC also identified 132 additional mining projects in the five ranges where the habitat is already more than 35% disturbed. These are projects at the exploration phase.

It has been reported in the media that the number of mining claims more than doubled between March 31, 2021, and December 20, 2023, increasing from 165,155 to 347,955. Together, these claims cover an area of 176,000 km² (Shields, 2023). The Quebec government also wishes to encourage the exploration and development of Quebec's critical and strategic minerals, notably by increasing support for exploration (MERN, 2020), which could increase the impact of exploration and mining in the coming years. The development of critical and strategic minerals would particularly affect the Val-d'Or and Assinica ranges.

The *Mining Act* also governs the development of surface mineral substances,²⁹ the mining of which generates disturbances in boreal caribou habitat in the same way as standard mines do. Potential operators of surface mineral mining operations must meet various requirements before obtaining a lease from the Quebec government. The process for developing surface mineral resources is simpler and faster than that in standard mining (MRNF, 2023g). In 2021, there were 3,866 sand and gravel extraction sites in Quebec with active leases to mine surface mineral substances, the majority of them in the Abitibi-Témiscamingue, Saguenay–Lac-Saint-Jean, Côte-Nord and Nord-du-Québec regions (MRNF, 2023h).

Although the footprint of the disturbances resulting from mines is small, mining can result in the creation of new roads in an area, and mining activities also cause disturbance due to blasting operations, heavy traffic, the crushing and grinding of ore, and the emission of dust and vibrations that disturb the adjacent natural environment (MAMOT and MERN, 2016) and can harm caribou (see ECCC, 2020 for a description of the effects).

2.5 Vacation and recreational infrastructure

Vacation leases on public land, cottages, hunting camps, rough shelters and other types of vacation and recreational infrastructure are present in caribou habitat, particularly in the southern part of the caribou's provincial range. This was among the major threats to the species raised by some of the First Nations that have asked the federal government to intervene to protect boreal caribou. As of October 1, 2021, 49,991 leases for personal

²⁹ The *Mining Act* defines surface mineral substances as “peat; sand including silica sand; gravel; limestone; calcite; dolomite; common clay and argillaceous rocks used in the manufacture of clay products; all types of rocks used as dimension stone, crushed stone or silica ore or in the making of cement; and every mineral substance that is found in its natural state as a loose deposit, except the tilth, as well as inert mine tailings, where such substances and tailings are used for construction purposes, for the manufacture of construction materials, or for the improvement of soils.”

purposes had been issued on Quebec public land, the vast majority of which are private vacation leases (MERN, 2022). These plots of land are generally allocated by random draw and average 4,000 m² (Gouvernement du Québec, 2023e). Under the 2022–2026 *Plan de mise en valeur du territoire public* (PMVTP) [public land development plan] (MERN, 2022), new vacation leases will be made available on an accelerated basis, with an overall objective of 1,000 additional lots in Quebec for the 2022–2026 period.

In 2022–2023, 257 vacation leases were awarded across Quebec, the highest number since 2019–2020 (MRNF, 2023i). In the time available for this assessment, ECCC was unable to find any information on the process for selecting the lots for the random draw. However, the 2022–2026 PMVTP provides for the modernization of regional public land development plans, which could facilitate the allocation of vacation leases, as well as commercial or industrial leases, on public land (MERN, 2022). These objectives cover all public land in Quebec and do not directly target the boreal caribou ranges, but the species' habitat makes up a large proportion of public land and will certainly be affected by these initiatives.

According to the COSEWIC (2014) status report, tourism and recreation areas are considered to have a “Negligible” impact on caribou, while recreational activities have an “Unknown” impact on the species as a whole (see Table 3). Furthermore, it is impossible to map most of the disturbances generated by vacation and recreational infrastructure using the methods described in EC (2011) and Appendix C. Consequently, the impact of this threat is not further quantified in this assessment. However, a portion of the disturbances linked to vacation and recreational infrastructure are captured under the road network (multi-purpose roads) category (MFFP, 2015), particularly in the 500-m buffer that is applied to them, which is used in the method described in EC (2011) and Appendix C. However, numerous studies on both caribou and reindeer suggest that these activities have a larger zone of influence on caribou behaviour (MFFP, 2021a). In 2013, the recovery team proposed using a zone of influence with a 1-km radius specifically around cabins, which is almost twice the size of the buffer used for calculating disturbances in the current assessment (Équipe de rétablissement du caribou forestier au Québec, 2013a).

The use of the multi-purpose roads makes their natural regeneration or active restoration almost impossible, particularly since the Quebec government wants to guarantee access to the territory. Quebec also considers that roads leading to vacation leases constitute permanent habitat disturbances, while class 3, 4, unclassified and unknown roads that do not lead to rights granted on the territory are considered temporary disturbances (MFFP, 2015). A portion of the multi-purpose road network was probably established solely to provide access to vacation and recreational infrastructure and recreational and tourism development projects.

Therefore, the upward trend in granting vacation leases on public land is worrisome, since it could increase disturbances that will be considered permanent due to their nature. Disturbances of this type are already very prevalent in the Val-d'Or and Pipmuacan ranges (MRNF, 2023j). The ranges, in particular Charlevoix and Pipmuacan, also include several structured recreational areas, such as wildlife reserves and controlled exploitation zones (ZEC; MRNF, 2023k). These recreational areas have extensive infrastructure such as trails, cabins and campgrounds, and more intensive use by vacationers is encouraged there.

Since 2022, the Government of Quebec has also offered an assistance program for the development of public land, in order to increase the development of recreational infrastructure on public land (Gouvernement du Québec, 2023f).

2.6 Other threats

As shown in Table 5, there are other sources of disturbance to boreal caribou habitat. Given the small relative contribution of these activities to the level of disturbance in the ranges, their impacts have not been further quantified by ECCC. However, some upcoming development projects could increase the level of disturbance in boreal caribou habitat, notably the Des Neiges wind farm (Charlevoix sector) in the Charlevoix range (MELCCFP, 2023b), and the QcRail project, a proposed railway line between Dolbeau-Mistassini and Baie-Comeau that passes through the Pipmuacan range (MELCCFP, 2023b). These projects are currently in the midst of the provincial environmental assessment process.

Other activities that represent threats but are not directly related to habitat may impede the species' recovery. Indeed, at various discussion forums with ECCC, some First Nations raised concerns about chronic wasting disease (which could also affect caribou), sensory disturbance caused by low-flying aircraft, and other sources of human disturbance, such as (in some cases) pursuing caribou in snowmobiles.

Box 2 - Findings from Part 2

- A number of anthropogenic activities contribute to the disturbance of caribou habitat and are likely to constitute threats to the survival and recovery of the species. Several of these activities have been carried out continuously for several decades and will likely continue in the coming years.
- This threat assessment covers all populations of boreal caribou present in Quebec, but places greater emphasis on the Val-d'Or, Charlevoix, Pipmuacan, Assinica and Témiscamie populations, for which the level of habitat disturbance already exceeds 35%.
- The anthropogenic activities taking place in Quebec that have contributed the most to habitat disturbance to date are logging and the road network, which is why this assessment focuses in particular on these two activities.
- The annual harvesting programs (PRANs) provide the best information available for assessing the threats associated with logging and road construction in 2023–2024. The 2023–2024 PRANs map the planned cuts and roads and can serve as an indicator of the footprint of these activities over the course of a year.
- ECCC quantified the logging and road construction planned for 2023–2024 in the Val-d'Or, Charlevoix, Pipmuacan and Témiscamie ranges using the PRAN data available. The partial data published for the Assinica range allowed ECCC to determine that some activities are also planned in this range, although the planned cuts and roads have not been quantified.

PART 3. ASSESSMENT OF THREATS

According to the Policy on Assessing Imminent Threats under Sections 29 and 80 of the Species at Risk Act: Terrestrial Species – [proposed] (ECCC, 2023a), a wildlife terrestrial species is considered to be facing an imminent threat to its survival or recovery if the threats identified render its survival or recovery highly unlikely or impossible and cannot be eliminated or mitigated without immediate intervention. According to this policy, the issue of whether a specific threat is “imminent” is assessed on a case-by-case basis, taking into account the nature of the threat as well as biological considerations related to the wildlife species and its habitat. This context-specific analysis may involve taking into account various factors, in particular, the severity and timing of the threats to the species and their likelihood, the potential scope and timing of the impacts, and the conservation status of the species and its habitat.

The following questions, rationale, and applicable evidence are key considerations in supporting the Minister in forming an opinion on whether a wildlife species is facing imminent threat(s).

To respond to the following questions, ECCC specifically considered the work planned (logging and construction of multi-purpose roads) in the 2023–2024 PRANs made available by the Government of Quebec. Since forest management activities take place year after year in Quebec on a continuous basis, impacts similar to those described in this part of the assessment are likely to occur annually, if no additional measures are taken to reduce or eliminate the threats examined—particularly for the duration of the PAFIT currently in effect (2023–2028). More broadly, ECCC considered other threats likely to have an impact during the 2023–2024 period, but it did not quantify this impact.

The term “2023–2024 PRAN” used in this part of the document is a generic term that designates the annual planning files made available by MRNF for the 2023–2024 period in the areas targeted by this threat assessment. The data sources that were publicly available and used to conduct this assessment contain some uncertainties and limitations of use, requiring some interpretation. In addition, the way the information is presented in the PRAN files differs depending on the region, which creates additional uncertainties and limitations of use. Appendix D sets out the methodology used to address this, particularly the list of data and the criteria used in processing the data, their description, and the validation protocol applied.

Question 1. Is the wildlife species facing a new or evolving human-induced threat(s) or is the impact of an existing human-induced threat intensifying?

Yes, the impact of at least two threats, logging and the road networks, is intensifying.

For the purposes of this assessment, an increase in the scope of the threats (represented by the level of disturbance) was interpreted as an intensification of their impact.³⁰ Therefore, the intensification of the impact of logging was established by examining the change in the level of disturbance attributable to this threat between 2010 and 2020 and by projecting the anticipated level of disturbance from logging in 2023–2024. The same process was used for roads. A summary of the results is presented here for each of the ranges where the level of habitat disturbance was above the 35% threshold in 2020.³¹

2010–2020 Period

The analysis for the 2010–2020 period is based on disturbance mapping using the visual interpretation of Landsat images from 2010 (EC, 2011) and 2020 (Appendix C). Although these data have some limitations (see Appendix C), they provide an indication of the changes in the scope of the threats under examination between these two reference years. The results obtained, which are rounded to the nearest unit, indicate an increase in the level of habitat disturbance caused by cutblocks and roads in all ranges where the level of habitat disturbance exceeded the 35% threshold in 2020 (see Appendix E). The terms “cutblocks” and “roads” correspond to those used in ECCC’s disturbance mapping process. “Cutblocks” correspond to logged areas. “Roads” correspond to the road network.

2020–2023 Period

The most recent disturbance mapping was based on Landsat images obtained in 2020, but has not been updated since then, given the significant resources and processing time required. Additional disturbances that have appeared between 2020 and 2023 are therefore not considered in this analysis, as well as the sectors where regeneration may have taken place during this period (i.e., sectors that went from a disturbed to a non-disturbed state, according to the method described in EC [2011]). However, based on the following elements, it seems virtually impossible that sufficient habitat would have been regenerated during this period to offset the increase in the disturbance levels observed between 2010 and 2020:

³⁰ The impact is determined by taking into account the methodology inherent in the unified threat classification system of the IUCN-CMP (World Conservation Union—Conservation Measures Partnership). This system is used notably by COSEWIC and ECCC to assess the status of a species at risk and plan its recovery (see Part 1.4). In this section, the impact on boreal caribou corresponds to the interaction between the scope and the severity. The severity corresponds to the level of anticipated damage (theoretical) to the species from the threat (when present). The severity of the threats under study is already documented and the values established by COSEWIC (2014; Table 3) are deemed valid because the nature of the threats has remained the same since then. The scope corresponds to the proportion of the range that is being affected by the threat (represented by the disturbance level).

³¹ The Baie-James knowledge acquisition area was not included, even though it has a disturbance level of 36%. This is because it is not directly linked to the range of a local population, and because the anthropogenic disturbance level is only 4%.

- Quebec’s wood production strategy (*Stratégie nationale de production du bois*) (MFFP, 2020b) has the objective of increasing the annual timber harvest in the province by 4-million m³ by 2025.
- In 2021, the Government of Quebec established a program to reimburse the costs of forest management activities on multi-purpose roads (*Programme de remboursement des coûts pour les activités d’aménagement forestier sur des chemins multiusages*). A total of \$50M (including over \$31M in administrative regions 02, 08, 09 and 10) was invested in 2021–2022 (MFFP, 2022c), and a similar amount (\$50M, breakdown by region is not available) was expected in the 2022–2023 budget (Gouvernement du Québec, 2022b);
- The summer of 2023 was a record season for forest fires in Canada (Natural Resources Canada, 2023), which specifically affected certain portions of habitat in the northern and western portions of the Quebec range of the boreal caribou.

2023–2024 Period

Annual planning data for 2023–2024 were used to estimate the scope of logging and roads planned in 2023–2024. If these activities are carried out, they will result in new disturbed areas, which will be added to the ones already present in the ranges in question. The addition of these new disturbances to those present in 2020 (Appendix C) likely provides a conservative estimate, given the fact that the disturbances that appeared between 2020 and 2023 have not been taken into account. The term “road” is used by the Quebec government in forestry planning. “Roads” correspond to a portion of the road network (see Part 2.3).

Val-d’Or

The scope of the disturbance from cutblocks increased by 10% (851 km²) between 2010 and 2020, covering 33% and 43% of the range respectively (see Appendix E). According to the logging planned in the 2023–2024 PRANs (11 km²; Table 6), an additional area of 54 km² of disturbed habitat will be created (including the 500 m-buffer; see EC, 2011). By adding this new area of disturbance to the one calculated in 2020 (without overlap), the scope of this threat would increase by less than 1%, and affect 44% of the range.

The scope of the disturbance from roads increased by 6% (457 km²) between 2010 and 2020, from 31% to 37% of the range (see Appendix E). According to the new roads planned in the 2023–2024 PRANs (16 km; Table 7), 20 km² of disturbed habitat would be generated (including the 500-m buffer; see EC, 2011). By adding this new disturbed area to that calculated in 2020 (without overlap), the scope of this threat would increase slightly, but would remain at 37% of the range.

Since the PRAN for forest management unit 083-51 has not been finalized or approved by the Quebec government, no logging or road construction data for this unit is included in the geospatial data used in this assessment. This unusual situation (which is not representative of a typical year) explains why the expected increase in the scope of these threats in this range is lower than what is expected in the Charlevoix and Pipmuacan ranges.

Charlevoix

The scope of the disturbance from cutblocks increased by 11% (808 km²) between 2010 and 2020, from 51% to 62% of the range (see Appendix E). According to the logging planned in the 2023–2024 PRANs (53 km²; Table 6), an additional area of 319 km² of disturbed habitat would be created (including the 500-m buffer; see EC [2011]). By adding this new disturbed area to that calculated in 2020 (without overlap), the scope of this threat would increase by between 2% and 3%, affecting 65% of the range.

The scope of the disturbance from road construction increased by 4% (280 km²) between 2010 and 2020, from 36% to 40% of the range (see Appendix E). According to the information in the 2023–2024 PRANs on new roads (115 km; Table 7), 131 km² of disturbed habitat would be created (including the 500-m buffer; see EC [2011]). By adding this new disturbed area to that calculated in 2020 (without overlap), the scope of this threat would increase by less than 1%, but would continue to affect 40% of the range.

Pipmuacan

The scope of the disturbance from cutblocks increased by 7% (1,268 km²) between 2010 and 2020, from 46% to 53% of the range (see Appendix E). According to the logging planned in the 2023–2024 PRANs (170 km²; Table 6), an area of 768 km² of disturbed habitat would be created (including the 500-m buffer; see EC [2011]). By adding this new disturbed area to that calculated in 2020 (without overlap), the scope of this threat would increase by between 2% and 3% to affect 55% of the range.

The scope of the disturbance from roads increased by 6% (1,106 km²) between 2010 and 2020, from 18% to 24% of the range (see Appendix E). According to the new roads planned in the 2023–2024 PRANs (288 km; Table 7), 298 km² of disturbed habitat would be generated (including the 500-m buffer; see EC [2011]). By adding this new disturbed area to that calculated in 2020 (without overlap), the scope of this threat would increase by roughly 1%, affecting 25% of the range.

Assinica

Part of the Assinica range lies beyond the northern limit for commercial timber allocation (i.e., 29%; Figure 3). South of this limit, 2023–2024 PRAN data is not available for the Nord-du-Québec region, which represents 67% of the range. Therefore, in order to estimate the extent of the cutblocks and roads to be developed in 2023–2024, only the PRAN data for the Saguenay–Lac-Saint-Jean and Mauricie regions are considered here, which represent 4% of the range.

The scope of the disturbance from cutblocks increased by 6% (3,959 km²) between 2010 and 2020, from 27% to 33% of the range. The scope of the disturbance from roads increased by 3% (2,138 km²) between 2010 and 2020, from 13% to 16% of the range (see Appendix E). Given that the 2023–2024 PRAN data are only available for a

very small portion of the range (i.e., 4%), the scope of the threat from the cutblocks and roads to be created in 2023–2024 has not been quantified. However, a partial qualitative analysis was conducted, allowing it to be determined that cutblocks are planned in the portion of the range in the Saguenay–Lac-Saint-Jean and Mauricie regions (Government of Quebec, 2023b,c). In addition, roads are planned in the portion of the range in the Saguenay–Lac-Saint-Jean region; however, this information is not available for the Mauricie region (Government of Quebec, 2023b,c)

Témiscamie

The Témiscamie range is partially located beyond the northern limit for commercial timber allocation (i.e., 39%; Figure 3). South of this limit, 2023–2024 PRAN data are not available for the Nord-du-Québec region, which represents 16% of the range. Therefore, in order to estimate the scope of the new cutblocks and roads planned in 2023–2024, only the PRAN data for the Saguenay–Lac-Saint-Jean and Côte-Nord regions, which represent 44% of the range, were analyzed and presented here.

The scope of the disturbance from cutblocks increased by 4% (4,738 km²) between 2010 and 2020, from 21% to 25% of the range (see Appendix E). According to the logging planned in the 2023–2024 PRANs for the Saguenay–Lac-Saint-Jean and Côte-Nord regions (518 km²; Table 6), an area of 1,921 km² of disturbed habitat would be generated (including the 500-m buffer; see EC [2011]). By adding this new disturbed area to that calculated in 2020 (without overlap), the scope of this threat would increase by less than 1%, affecting 26% of the range.

The scope of the disturbance from roads increased by 2% (2,341 km²) between 2010 and 2020, from 8% to 10% of the range (see Appendix E). According to the roads planned in the 2023–2024 PRANs for the Saguenay–Lac-Saint-Jean and Côte-Nord regions (996 km³²; Table 6), 937 km² of disturbed area would be created (including a 500-m buffer; see EC [2011]). By adding this new disturbed area to that calculated in 2020 (without overlap), the scope of this threat would increase by less than 1%, affecting 11% of the range.

³² Some roads in the Saguenay-Lac-Saint-Jean region seem to be duplicates. They represent less than 0.5% of all scanned roads within the Témiscamie range.

Box 3 – Findings from Part 3, Question 1

- It is the view of ECCC that the impact of at least two threats (logging and the road network) is intensifying, particularly for the Val-d'Or, Charlevoix, Pipmuacan and Témiscamie populations.
- The scope of the disturbances linked to cutblocks increased between 2010 and 2020, at least in the Val-d'Or (from 33% to 43%), Charlevoix (from 51% to 62%), Pipmuacan (from 46% to 53%), Assinica (from 27% to 33%) and Témiscamie (from 21% to 25%) ranges.
- The scope of the disturbances related to the road network increased between 2010 and 2020, at least in the Val-d'Or (from 31% to 37%), Charlevoix (from 36% to 40%), Pipmuacan (from 18% to 25%), Assinica (from 13% to 16%) and Témiscamie (from 8% to 10%) ranges.
- In the Val-d'Or range, according to the work planned in the PRAN, the scope of the threat from logging and the road network would increase by less than 1%, respectively, relative to the scope in 2020, for the 2023–2024 period. These results are likely lower than in a typical year.
- In the Charlevoix and Pipmuacan ranges, the scope of the threat from logging is expected to increase by 2% to 3% in each range relative to the 2020 levels for the 2023–2024 period. The scope of the threat from the road network will likely increase by close to 1% over the 2020 levels for the 2023–2024 period.
- In the Témiscamie range, according to the partial data available, the scope of the threat from logging and the road network will likely increase by less than 1% for both threats for the 2023–2024 period relative to the 2020 levels.
- At the time of this assessment, 2023–2024 PRAN data was only available for a very small portion of the Assinica range. The scope of the threat from logging and road construction was not quantified, but a partial qualitative analysis determined that these activities are planned within the range.

Question 2. Will the impact of the threat(s) make:

a) survival of the wildlife species highly unlikely or impossible?

No. If the threats described in Part 2 and in Question 1 occurred, ECCC is of the view that they would not be likely to render the survival of the boreal caribou impossible or highly unlikely throughout its range in Canada, particularly in the short term. As specified in the Context section, this assessment only deals with threats present in Quebec. However, Question 2 (a) deals with the species' survival across its entire Canadian range.

According to the Species at Risk Policy on Recovery and Survival (Government of Canada, 2020), "A species at risk will be considered to have an acceptable likelihood for long-term survival in Canada when it has achieved a stable (or increasing) state, exists

in the wild in Canada, and is not at significant risk of extirpation or extinction.” A species is considered more likely to survive if it possesses the characteristics described below. The more of these characteristics a species possesses, the greater its probability of survival. In the context of the present analysis, it is difficult to predict with certainty the long-term likelihood of survival of boreal caribou in Canada in the event that the assessed threats materialize. However, it is possible to state that there is very little risk in the short term that the species will disappear from the wild in Canada, or will become extirpated.

- 1. Stability:** A species that has a stable (or increasing) population and distribution is more likely to survive over the long term.
- 2. Resilience:** A species that has large enough population size(s) to rebound from periodic disturbance and avoid demographic and genetic collapse is more likely to survive over the long term.
- 3. Redundance:** A species that has multiple (sub) populations or locations, or a distribution that is very widespread, is more likely to survive over the long term because of the reduced risk of catastrophic loss or extirpation from a single, local event.
- 4. Connectivity:** A species that has more continuity (less fragmentation) in Canada is, in general, more likely to survive in the long term since recolonization would be facilitated following a local extirpation event.
- 5. Protection from human-caused threats:** A species for which significant impacts caused by humans are eliminated, avoided, or mitigated is more likely to survive over the long term.

Given the cumulative nature of the impacts, their partially indirect nature and the anticipated time lag between the point at which threats occur and the demographic response of the populations, it is difficult to accurately assess to what extent the threats under review would affect each of the indicators described earlier. ECCC is of the view that the occurrence of the threats under review would reduce the stability, resilience, redundance and connectivity of most of the populations in Quebec. In fact, the threats would contribute to the decline of the populations concerned and to habitat fragmentation, and could lead to range contraction, particularly in the southern parts of the Quebec range. Although this could have an impact on some of the characteristics listed above (particularly stability and redundance) across Canada, ECCC does not consider this impact sufficient to render the survival of the species highly unlikely or impossible, primarily because most of the populations in Canada would not be directly affected by the threats discussed here. Moreover, some populations in the country are considered to be self-sustaining (ECCC, 2020; Figure 1) and they have relatively undisturbed habitat (ECCC, 2020), which suggests that the scope of anthropogenic threats for them is limited. The self-sustaining status of these populations means that they should be able to persist over the long term (≥ 50 years) without the need for active management. Therefore, it is reasonable to believe that the species would persist within these populations, at least at a low level, even if some populations in Quebec were affected significantly by the threats reviewed here. In addition, considering the self-sustainability indicators presented in Table 4, the disturbance level in the

Caniapiscau range suggests that the risk for this population is “very low” (Table 4). Although the demographic data on this population are limited, the size and trend of this population suggest that the short-term risk is low. There are other regions in Quebec (such as the Basse-Côte-Nord) where the level of habitat disturbance is low, specifically outside the commercial forest (see Figure 3) where the main threats (logging, multi-purpose roads) are avoided. Taking into account these elements, it is reasonable to believe that, even within Quebec, the species would be able to persist over the long term despite the effect of the assessed threats.

ECCC acknowledges that most of the threats reviewed in this assessment are activities that are widespread elsewhere in Canada, that other threats may exert significant pressure on the species (such as activities related to oil and gas exploration and development in western Canada), and that the accumulated impact of all these activities could significantly reduce the likelihood of the species’ long-term survival.

b) recovery of the wildlife species highly unlikely or impossible?

Yes. The threats described in Part 2 and in Question 1 would render the recovery of the species highly unlikely, even if the impacts of the threats on caribou populations are not necessarily measurable in the short term (see Part 1.4). The recovery objectives for boreal caribou are, to the extent possible, to maintain self-sustaining local populations and to stabilize and achieve self-sustaining status for all the local populations that are currently not self-sustaining. Taking into account the situation of the populations in Quebec, ECCC considers that the likelihood of reaching the recovery objectives is already low,³³ although recovery is still technically and biologically feasible (if the main threats are avoided or mitigated). The challenges associated with reaching the objectives have increased over the past decade, primarily because of the increase in the level of disturbance in the species’ habitat, and any additional disturbances would exacerbate the problem. The threats reviewed as part of this assessment would cause a further deterioration in the indicators of self-sustainability and thus reduce the likelihood of achieving self-sustaining status for the populations concerned. Among them, the Val-d’Or population has already fallen below the quasi-extinction threshold (i.e., it currently has fewer than 10 reproductively active females; MELCCFP, 2023a), the Charlevoix population crossed this threshold in 2020 (Hins and Rochette, 2020) and now has just over 10 reproductively active females, and the Pipmuacan population could do so within

³³ In the recovery strategy (EC, 2012; ECCC, 2020), ECCC determined that the recovery of the species is both technically and biologically feasible because the following criteria were met: (1) Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance; (2) Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration; (3) The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated; (4) Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe. Currently, ECCC is of the view that there are some unknowns related to some of these criteria, specifically with regard to populations that have reached the quasi-extinction threshold.

about 10 years.³⁴ ECCC is of the view that, once this quasi-extinction threshold is reached, if the main threats to boreal caribou are not mitigated or avoided³⁵, there is little likelihood of a population returning to self-sustaining status, which would make it highly unlikely or impossible to attain the recovery goals for the species. Even though the other populations for which the habitat disturbance level exceeds 35% (Assinica and Témiscamie) are not at high risk of reaching the quasi-extinction threshold in the short term since their numbers are still fairly high (i.e., > 300 individuals; see Table 4), a decrease in their likelihood of becoming self-sustaining would jeopardize the species' recovery. More broadly, the self-sustainability indicators (Table 4) suggest that nearly all the other boreal caribou populations in Quebec (Detour, Manicouagan, Nottaway, Outardes, but probably not Caniapiscau) are at risk to some extent. These populations are located at least partly within the commercial forest zone (Figure 3), their disturbance level was close to the 35% threshold in 2020 (Table 4), and in some ranges, the disturbance level could exceed 35% by 2024. If nothing is done to prevent new disturbances in these ranges, these populations could also reach the quasi-extinction threshold (although it would take some time for populations with a large number of individuals [100–300 or > 300] to do so). Furthermore, the fact that almost all the populations in Quebec are currently in decline reduces the likelihood that individuals would be available at the right time to repopulate ranges in which populations have become extirpated.

In the case of the Val-d'Or and Charlevoix populations, which currently benefit from significant measures (enclosures) that mitigate the immediate impact of predation, ECCC is of the view that new disturbances would reduce the likelihood of these populations becoming self-sustaining. In fact, as long as they are kept within enclosures, they would not be self-sustaining because maintaining their numbers would depend on active management intervention. Consequently, new disturbances in these ranges would further reduce the likelihood that the populations will be able to return to their natural habitat and move towards self-sustainability in the future.

Like other activities that have increased the disturbance level (see Part 2, Table 5), logging and road construction have caused a gradual but significant decrease in the

³⁴ For information purposes only, ECCC produced a projection of the population's demographic trajectory starting in 2020 (date of the last aerial survey; Plourde *et al.*, 2020) by assuming that the growth rate reported in Table 4 would remain stable over time and that the age and sex structure of the population would not change from the levels observed in 2020. This projection does not take into account environmental stochasticity, the demographic effects associated with a small population size (EC, 2011) or any other factor that could affect the growth rate or structure of the population (age and sex of individuals) over time.

³⁵ In the recovery feasibility summary section of the recovery strategy (EC, 2012; ECCC, 2020), it states that "the primary threat to most boreal caribou local populations is unnaturally high predation rates as a result of human-caused and natural habitat loss, degradation and fragmentation" (see Part 1.4) and that "this threat can be mitigated through coordinated land and/or resource planning, and habitat restoration and management, in conjunction with predator and alternate prey management where local population conditions warrant such action."

quantity and quality of available habitat (see Question 1). Allowing these activities to continue under the same management regime would further compromise the achievement of the recovery objectives. Table 8 provides estimates of the percentage of undisturbed habitat in 2020 that could become disturbed as a result of the work planned in the 2023–2024 PRANs (logging and road construction) in ranges where the level of disturbance already exceeded 35% in 2020³⁶. The work included in the 2023-2024 PRANs is expected to reduce the quantity of undisturbed habitat available to boreal caribou as well as alter or destroy biophysical attributes of the critical habitat³⁷ (Appendix B. Biophysical Attributes of critical habitat). In fact, the work planned in the 2023-2024 PRANs (logging and road construction), at least for the Val-d'Or, Charlevoix, and Pimpuacan ranges, primarily targets mature forests (Appendix F), which constitute quality habitat for the species (Leblond *et al.*, 2014). ECCC has not assessed how the work included in the 2023-2024 PRANs would affect the various habitat categories in the other ranges, notably Assinica and Témiscamie; however, it expects that the work would have an impact similar to that anticipated in the Val-d'Or, Charlevoix, and Pimpuacan ranges. Even with active restoration measures (e.g., closing of roads, revegetation; Ray, 2014), the critical habitat that is altered or destroyed as a result of this work would take decades to regenerate to the point where it once again provides suitable conditions for the species and can support its recovery.

³⁶ The Baie-James knowledge acquisition area was not included, even though its level of disturbance is 36%, because it is not directly linked to the range of a local population, and because the level of anthropogenic disturbance is only 4%.

³⁷ See Part 1.7 for more details on the critical habitat components.

Table 8. Level of habitat disturbance in 2020 in the ranges (MFFP 2021a) that are in the most precarious situation, and percentage of ranges that are likely to become disturbed as a result of the work planned in the annual harvesting programs for 2023–2024 (logging and construction of new roads).

Range	Level of disturbance ¹ in 2020 (%)	Area of disturbance ² arising from work set out in the 2023–2024 PRANs (km ²)	Area of undisturbed habitat in 2020 that would become disturbed as a result of the logging and road construction work planned in the 2023–2024 PRANs ² (km ²)	Percentage of the range that was not disturbed in 2020 but would become disturbed as a result of the logging and road construction work planned in the 2023–2024 PRANs ³ (%)
Val-d'Or	61	56	25	0.30
Charlevoix	76	347	108	1.49
Pipmuacan	72	866	251	1.36
Assinica	57	Presence ⁴	n.a.	n.a.
Témiscamie	44	2,178 ⁵	728	0.69

¹ The calculation of disturbance levels is based on a disturbance mapping exercise using the method described in Appendix C. Anthropogenic disturbances include a 500-m buffer (in accordance with EC [2011]). Disturbances caused by fires correspond to areas where a fire has occurred in the last 40 years (no buffer; in accordance with EC [2011]). This method does not aim to compile a precise inventory of all the habitat disturbances that could be perceived by caribou and affect their behaviour or demography. It does, however, provide a reliable indication of the degree of habitat disturbance, which has been linked to demographic parameters such as recruitment and adult female survival (EC, 2011; Johnson *et al.*, 2020).

² The logging and road construction work planned in the 2023–2024 PRANs includes 500-m buffers. These different areas are combined to avoid double-counting overlapping zones (in accordance with the methodology set out in EC [2011] and in Appendix C).

³ The percentage of the range that would be disturbed as a result of the work planned in the 2023–2024 PRANs was calculated using the disturbance map for 2020 (ECCC, currently being developed) as a reference point.

⁴ At the time of this assessment, no interactive map application was available for the 2023–2024 PRANs for the Nord-du-Québec region, which contains 67% of the entire Assinica range and 94% of the portion of this range that is located in the commercial forest. In addition, no interactive map application was available for the roads in the Mauricie region, which accounts for just under 1% of the range, and just over 1% of the portion of this range located in the commercial forest zone. The partial calculation of road lengths to be constructed (based on the 2023–2024 PRANs for the Saguenay–Lac-Saint-Jean region) was not prioritized within the time frame of the assessment.

⁵ At the time of this assessment, no interactive map application was available for the 2023–2024 PRANs for the Nord-du-Québec region, which contains 16% of the Témiscamie range and 27% of the portion of this range located in the commercial forest zone. The road lengths are therefore incomplete.

With regard to individual caribou, the anticipated impacts of the threats under review would translate into avoidance of the disturbed sectors (Beauchesne *et al.*, 2013; 2014), particularly because caribou are more likely to encounter predators there (Wittmer *et al.*, 2007; Whittington *et al.*, 2011; Leblond *et al.*, 2013). An increase in the habitat

disturbance level is associated with a decrease in survival (Courtois *et al.*, 2007; Fortin *et al.*, 2017; Fryxell *et al.*, 2020) and recruitment (Fortin *et al.*, 2017) as well as a decrease in the likelihood that a population will remain stable or grow over a 20-year period (EC, 2011). These effects are indirect and may not occur for a number of years (Vors *et al.*, 2007), creating a time lag between the occurrence of habitat disturbance and the impact on the population. It is therefore difficult to accurately estimate the specific effect that new habitat disturbances would have on population sizes and trends.

It should be noted that other activities which are not discussed in this part of the assessment could cause new disturbances in the boreal caribou ranges in Quebec in 2023–2024 (e.g., recreational tourism development and mining exploration or development). Considering the relative contribution of these activities to the level of disturbance in the ranges (Table 5), ECCC believes that the increase associated with these activities would be low, but not negligible, and agrees that they would contribute to the cumulative effects of habitat disturbance on the species. Moreover, natural disturbances, such as forest fires (which are expected to increase in frequency and severity in the future due to climate change; Splawinski *et al.*, 2019; Leblond *et al.*, 2022), could also increase the level of habitat disturbance. Other activities not directly related to habitat or activities not considered here could have negative effects on the species. For example, the use of motorized vehicles in caribou habitat is associated with sensory disturbances (noise, light) that can increase the stress that individuals experience and affect their behaviour (Duchesne *et al.*, 2000; Vistnes and Nelleman, 2008). The opening of new roads would make it more likely for most threats to occur, given that roads improve access to the territory.

Box 4 – Findings from Part 3, Question 2

1. ECCC is of the view that the threats under review would not render the survival of the boreal caribou in Canada highly unlikely or impossible, particularly in the short term, because there are self-sustaining local populations elsewhere in Canada that have relatively undisturbed habitat and that would not be affected by the threats that exist in Quebec.
2. Taking into account the situation of the populations in Quebec, ECCC considers that the likelihood of meeting the recovery objectives for the species is already low and would be further compromised if the threats examined (logging and road network) were to materialize.
3. ECCC has not specifically assessed the effect of threats other than logging and the road network (e.g., mining, and vacation and recreational infrastructure), but anticipates that they will have additional and cumulative impacts.
4. The Val-d'Or population has already dropped below the quasi-extinction threshold (i.e., it currently has fewer than 10 reproductively active females), the Charlevoix population crossed this threshold in 2020 and now has just over 10 reproductively active females, and the Pimpuacan population could do so within about 10 years.
5. With the exception of the Caniapiscou population, all the other populations in Quebec, in particular Assinica and Témiscamie populations, face a certain degree of risk and could reach the quasi-extinction threshold over the longer term if no action is taken to stop their decline.

Question 3. Does the threat(s) require immediate intervention beyond existing protection measures?

Yes. The measures currently in place cannot help to prevent the expected impacts of the threats examined as part of this assessment, specifically logging and road construction planned in the short term (i.e., in the 2023–2024 PRANs), and these threats could render the recovery of the species highly unlikely or impossible. Consequently, additional measures are needed to address these threats. Boreal caribou are found in mature boreal forest ecosystems that take decades to recover from disturbance. Reversing harmful ecological processes that are detrimental to boreal caribou (e.g., habitat degradation and loss, increase in predator and alternate prey populations) often requires time frames in excess of 50 to 100 years. In the meantime, it is critical to stem the increase in the level of habitat disturbance by avoiding or mitigating activities that pose a threat to the species. This is essential in order to avoid further decreasing the likelihood that populations that are not self-sustaining at present will achieve self-sustaining status. As a result of ongoing disturbance, it will take longer to restore habitat, and even greater efforts will be required to maintain the populations

until the habitat recovers to the point where it once again has suitable characteristics for the species.

In recent years, the Government of Quebec has implemented some measures to contribute to caribou conservation (e.g., creating large protected areas specifically designed to support the recovery of the caribou, see Part 1.5). Although these actions help maintain quality habitat for the species locally, the analysis results presented in the response to Question 1 show that the quality of habitat has continued to decline since 2010 across at least five ranges (Val-d'Or, Charlevoix, Pipmuacan, Assinica, Témiscamie). Similarly, the indicators of self-sustainability (Table 4) indicate that most of the boreal caribou populations in Quebec still face a certain level of risk, despite the adoption of these measures. It is important to note that, following the analysis of the protection of critical habitat and individuals of boreal caribou in Quebec (ECCC, 2023b), the federal Minister of Environment formed the opinion that almost all boreal caribou critical habitat located on non-federal lands in Quebec is not effectively protected. Furthermore, the recovery strategy (EC, 2012; ECCC, 2020) indicates that it is crucial to plan and implement, across the provinces and territories, a coordinated habitat management framework that includes measurable objectives to help meet the recovery goal (see Part 1.7) and that takes into account the cumulative effects of all the activities that cause disturbance throughout boreal caribou habitat. Such a management framework has not yet been established in Quebec. This element supports the conclusion that ECCC has reached, specifically that immediate action is required beyond the measures that are currently being implemented.

Box 5 – Findings from Part 3, Question 3

1. ECCC is of the view that immediate action is required, beyond the measures already implemented, in order to avoid the occurrence of the threats under review.
2. Although important measures have been taken in the past, primarily to protect individuals, the scope of the measures that are planned or are currently being implemented to protect or restore the species' habitat is considered insufficient to address the main threats examined. Such measures aimed at protecting and restoring habitat are essential to enable the recovery of boreal caribou.

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APPENDIX A. BEST AVAILABLE INFORMATION ON BOREAL CARIBOU RANGES IN QUEBEC

Environment Canada (2011) has defined three types of boreal caribou ranges based on the level of certainty in their delineated boundaries (in ascending order of certainty: conservation unit, improved conservation unit, local population; Figure A.1). Given their low degree of certainty, “conservation units” should be considered provisional ranges until data are available to assess the certainty of the delineated boundaries (EC, 2011). Similarly, given the dynamic nature of ranges, their boundaries need to be re-evaluated and updated periodically to incorporate the best available information on caribou populations and their use of the territory (EC, 2011). In Quebec, the federal recovery strategy (EC, 2012; ECCC, 2020) identifies six ranges: two (QC1 and QC2) are considered “local populations” (high level of certainty), three (QC3, QC4 and QC5) are considered “improved conservation units” (medium level of certainty) and one (QC6) is considered a “conservation unit” (low level of certainty). These ranges reflected the best information available at the time the first version of the boreal caribou recovery strategy was published, in 2012 (EC, 2012). EC (2011) acknowledges that very large ranges (e.g. QC6) may mask local variations in habitat condition, and that it may be appropriate to identify smaller ranges within the same territory to help achieve the recovery goal. ECCC considers that the range boundaries identified by the Province of Quebec (MFFP, 2021a) represent the best available information on the distribution and population structure of boreal caribou in that province at the time of this assessment. Several First Nations representatives with whom ECCC has had discussions about boreal caribou in Quebec in recent years also recognize the added value of the ranges identified by the Quebec government (MFFP, 2021a) compared to those presented in the federal recovery strategy (EC, 2012; ECCC, 2020). It is important to note that the population and distribution objectives, as well as the identified critical habitat, currently remain linked to the local population ranges identified in the federal recovery strategy. However, the recovery goal is to achieve self-sustaining local populations throughout the species' current distribution in Canada, to the extent possible (ECCC, 2020). This goal is not explicitly linked to the delineation of boundaries of local population ranges, like the boundaries used to define the population and distribution objectives and identify critical habitat. Based on this understanding, it appears legitimate to use the best available information on local populations throughout the current range in Quebec, specifically, the information published by the Government of Quebec (MFFP, 2021a).

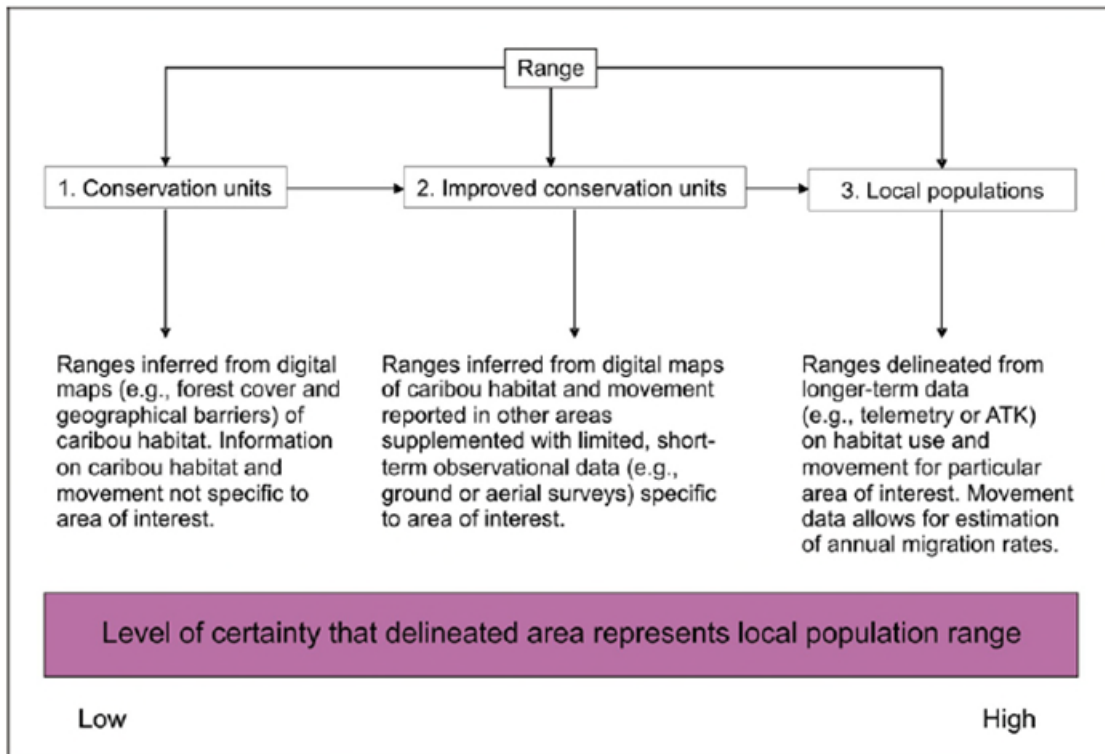


Figure A.1 Data requirements for types of boreal caribou ranges (from conservation units to local population ranges) and associated level of certainty; figure taken from EC [2011]). The acronym "ATK" stands for Aboriginal traditional knowledge.

The area covered by the provincial ranges³⁸ (547,652 km²; non-overlapping) differs by 130,359 km² (19%) from that covered by the federal ranges (678,011 km²). More specifically, the provincial ranges cover 8,853 km² (134%) more than the federal ranges with regard to isolated ranges (corresponding to QC1 and QC2), and 139,212 km² (20%) less than the federal ranges for the continuous portion of the range (corresponding to QC3, QC4, QC5 and QC6). The table below shows the area of each of the federal and provincial ranges. Figure 2 shows the location of these ranges.

³⁸ Also including the Baie-James and Basse-Côte-Nord knowledge acquisition areas.

Table A.1. Area of federal (EC, 2012; ECCC, 2020) and provincial (MFFP, 2021a) ranges.

Range or knowledge acquisition area (federal or provincial)	Area ¹ (km ²)
Val-d'Or (QC1; federal)	3,469
Charlevoix (QC2; federal)	3,128
Pipmuacan (QC3; federal)	13,769
Manouane (QC4; federal)	27,165
Manicouagan (QC5; federal)	11,341
Quebec ² (QC6; federal)	621,561
Assinica (provincial)	70,875
Basse-Côte-Nord ^{2,3} (provincial)	116,638
Baie-James ^{2,3} (provincial)	146,952
Caniapiscau ² (provincial)	107,312
Charlevoix (provincial)	7,248
Detour ² (provincial)	59,009
Manicouagan (provincial)	39,697
Nottaway ² (provincial)	62,756
Outardes (provincial)	41,885
Pipmuacan (provincial)	18,432
Témiscamie (provincial)	105,332
Val-d'Or (provincial)	8,202

¹ The map projection used to calculate these areas is Canada Albers Equal Area Conic. There are overlaps between the different provincial ranges or knowledge acquisition areas.

² These ranges or knowledge acquisition areas are partly located outside Quebec. The areas indicated are therefore partly outside Quebec.

³ Baie-James and Basse-Côte-Nord are knowledge acquisition areas.

APPENDIX B. BIOPHYSICAL ATTRIBUTES OF CRITICAL HABITAT

In addition to differing from one ecozone or ecoregion to another, the biophysical attributes required by boreal caribou vary both between and within ranges. Table B.1 shows the ecozones and ecoregions in which the local boreal caribou populations in Quebec are found, and the associated biophysical attributes.

Table B.1 Biophysical attributes of critical habitat by ecozone/ecoregion and by type of habitat for local boreal caribou populations in Quebec. The description of the biophysical attributes of critical habitat is taken from Appendix H of the recovery strategy (ECCC, 2020).

Ecozone or ecoregion	Target population(s)	Type of habitat	Description
Boreal Shield Central	Val-d'Or (QC1) Quebec (QC6)	Broad Scale	Late seral-stage black spruce-dominated lowlands and jack pine-dominated uplands. Open black spruce lowlands. Low-density late seral-stage jack pine or black spruce forests and black spruce/tamarack-dominated peat lands with abundant terrestrial and moderate arboreal lichens. Caribou also use areas with dry to moist sandy to loamy soils and shallow soils over bedrock. Elevations of 300 m. Intermediate values of Normalized Difference Vegetation Index ¹ . Selection for old (>40 years) burns.
		Calving	Open canopies of mature black spruce and mesic peat land with ericaceous species are selected for calving in the Claybelt region. Females with calves selected areas with more abundant ericaceous shrubs and terrestrial lichens during the summer compared to females without calves.
		Winter	Large areas of contiguous forests dominated by black spruce. Open conifer forests or forests with lower tree densities where terrestrial and arboreal lichens are abundant and there is significant less snow (e.g., shorelines) are also selected.
Boreal Shield Southeast	Charlevoix (QC2); Quebec (QC6)	Broad scale	Late seral-stage black spruce-dominated lowlands and jack pine-dominated uplands, balsam fir stands, marshlands and abundant lichen.
		Calving	Open, medium-closed conifer forests. Elevations of 300 m. Intermediate values of Normalized Difference Vegetation Index ¹ . Selection for old (>40 years) burns.
		Rutting	Dense and open mature conifer forests of spruce, tamarack, jack pine and young conifer forests between 30–50 years old.
		Winter	Open stands of balsam fir, balsam fir-black spruce, black spruce, black-spruce-tamarack and jack pine stands older than 70 yrs. Dry bare lands, 30 to 50-year-old stands of balsam fir or fir-black spruce, as well as 50-year-old jack pine stands, and arboreal and terrestrial lichens.
Boreal Shield East	Pipmuacan (QC3);	Broad scale	Conifer-feather moss forests on poorly drained sites and mature conifer uplands with abundant terrestrial lichen.

	Manouane (QC4); Manicouagan (QC5); Quebec (QC6)		Black spruce, jack pine and balsam fir stands present with abundant lichen. Water bodies and wetlands (swamps, marshy areas with tamarack). Mountains or rolling hills. Elevations of 300 m. Intermediate values of Normalized Difference Vegetation Index ¹ . Selection for old (>40 years) burns.
		Calving	Open wetlands, peninsulas and islands. Sedges, ericaceous species, bryophytes, alder and larch selected in spring. Balsam fir, dense black spruce stands, spruce-fir forests older than 40 years, and dry bare land with high lichen densities. Mature conifer stands, as well as wetlands (marshes, peat moss areas). Higher elevations used for calving in this area rather than lakes or water bodies.
		Post-calving	Open and forested wetlands (marshes, swamps), and continued use of peninsulas and islands. Hilly areas, coastal sites, shorelines (rivers, lakes, creeks). Aquatic plants, dwarf birch (<i>Betula glandulosa</i>), deciduous shrubs, ericaceous species and moss.
		Rutting	Open wetlands selected, swamps. Terrestrial and arboreal lichens, forbs, sedges, mosses and coniferous and deciduous shrubs. Balsam fir stands, dense spruce stands, mature and regenerating conifer stands, other forest stands (tamarack, pine) with abundant lichens, wetlands (swamps) and dry bare lands.
		Winter	Forested wetlands. Some use of upland tundra for loafing. Mountainous terrain. Dry bare land, wetlands, mature conifer forests with lichen, balsam fir stands, dense spruce stands, and mixed spruce-fir forests older than 40 years selected in southern areas. Observed along frozen bodies of water. Use of mature forests protected from harvesting increases probability of encounters with wolves that select the same habitats in winter. Shallow snow depths selected in late winter.
		Travel	Caribou move greater distances during the rutting season.
Hudson Plain	Quebec (QC6)	Broad scale	Habitats selected generally to reduce predation risk. Shrub-rich treed muskeg and mature conifer forests with abundant lichens. Shorelines of deep lakes and rivers (birch trees). Poorly drained areas dominated by sedges, mosses and lichens, as well as open black spruce and tamarack forests. Elevations of 150 m. Intermediate levels of ruggedness ² and Normalized Difference Vegetation Index ¹ .
		Calving	Mature conifer stand with and without lichens and muskegs. Preference for higher elevations compared to habitat use during other periods.
		Post-calving	Fens, bogs and lakes.

		Rutting	Wetlands and conifer stands with lichen. Mature and regenerating conifer stands are also used, albeit to a lesser degree. Caribou use hills in the lowlands and treed islands in muskegs with several different tree species.
		Winter	Dense and mature conifer forests with lichens and wetlands. Peat lands dominated by open bogs and terrestrial lichens. Large patches of intermediate and mature black spruce, shrub-rich treed muskeg and mixed conifer stands all used in late winter.
		Travel	Movements greatest in fall/winter when caribou transition from calving to winter habitat. Long-range movements are greater in areas with high moose densities, presumably to reduce predation risk.
Taiga Shield	Quebec (QC6)	Broad scale	Upland tundra dominated by ericaceous shrubs (<i>Ericaceae</i> spp.), lichen, grasses and sedges. Lowland tundra composed of peat land complexes (muskeg and string bogs), wetlands (swamps, marshes), lakes, rivers and riparian valleys. Dense mature jack pine and black spruce stands with balsam fir and tamarack present and open conifer forests with abundant lichens.
		Calving	String bogs, treed bogs, small open wetlands (< 1 km ²), large muskeg, marshes along water bodies. Barren grounds. Calving on peninsulas and islands increases with amount of open water.
		Post-calving	Forested wetlands. Hilly areas, coastal sites, along shorelines of water bodies (rivers, lakes, creeks), marshes with lichen availability.
		Rutting	Open wetlands, swamps. Mature forests, mountainous terrain with forests of black spruce, tamarack and pine trees with abundant lichen.
		Winter	Forested areas are used in years of low snow accumulation; otherwise, winter habitat selection reflects general avoidance of deep snow, including use of tundra habitat at higher elevations in mountainous regions and bogs along lakes or oceans. Forested wetlands. Tundra uplands and sand flats in proximity to water. Barren grounds. Bog edges, glacial erratics and bedrock erratics with lichen and lakes. Some use of mature white spruce and fir stands as alternative to habitat with arboreal lichens. Mix of mature forest stands, mountainous terrain with forests of black spruce, tamarack and jack pine with abundant lichen.
		Travel	Connectivity between selected habitat types important given reported patterns of movement among caribou. Some animals have been reported to travel up to distances of approximately 200 km, although the majority of animals appear to move shorter distances. Females show fidelity to post-calving sites, returning to within 6.7 km of a given location in consecutive years

¹ Normalized Difference Vegetation Index (NDVI) is an index that provides a standardized method of comparing vegetation greenness between satellite images.

² Vector ruggedness is a metric used to capture variability in slope and aspect.

APPENDIX C. MAPPING OF DISTURBANCES IN BOREAL CARIBOU HABITAT

Description of the disturbance mapping method

Disturbance mapping is an exercise that was first carried out by ECCC using 2008–2010 data, then repeated with data from 2015 and more recently with data from 2020. The mapping process was established to build a nationally consistent, reliable and reproducible geospatial dataset using a common methodology. Mapping of anthropogenic disturbances, specifically, is based on visual identification of disturbances on 1:50,000 Landsat images at a scale of 30m ³⁹. A 500-m buffer is then applied around the disturbances (see Appendix 7.4 of EC [2011]). Lastly, the footprint of forest fires up to 40 years old is extracted from the Canadian Forest Fire Database (Natural Resources Canada) and combined with the footprint of anthropogenic disturbances to generate the total disturbance footprint for each range.

This document summarizes the methods used in 2020 to map the second five-year update (2020). The data acquisition process is much faster now thanks to advances in technology, but the mapping protocol is consistent with the detailed methodology described in Appendix 7.2 of EC (2011).

Highlights of the anthropogenic disturbance mapping protocol for 2020

ArcGIS version 10.8 was used for geodatabase creation and data processing. The following general steps were followed to capture disturbance features within each of the local population ranges:

1. The previous mapping database (2008–2010 and 2015) consisted of linear and polygon features, identified by a disturbance class, along with additional metadata (e.g., date of imagery used, initials of interpreter). The 2015 database was copied into a multiuser SDE database and used as a starting point. The features from 2010 that were visible in 2015 and the features added in 2015 were included.
2. In 2020, the mapping process was modified as follows: harvest polygons for 2020 were extracted from the National Terrestrial Ecosystem Monitoring System (NTEMS) of the Canadian Forest Service (Natural Resources Canada; Hermosilla *et al.*, 2016) and added to the 2015 database prior to interpretation, which accelerated the digitization process considerably. NTEMS harvest polygons that were not superimposed on polygons already mapped in 2015 were

³⁹ Landsat satellite imagery was chosen for this project, as it offers sufficient detail to identify disturbance features, as well as complete coverage of areas of interest, usually with several dates available in a given year. The spatial resolution of all Landsat images used is 30 m, and the imagery for the project came from the United States Geological Survey (USGS) archives. The first edition of anthropogenic disturbance mapping is based on Landsat-5 images captured between 2008 and 2010; the second and third (current) editions are based on Landsat-8 images from 2015 and 2020 respectively.

verified before being included, thereby eliminating some erroneously generated polygons.

3. All new linear disturbances (see Limitation b) below) and all remaining new polygonal disturbances (other than the 2020 harvest polygons extracted from NTEMS), as interpreted from Landsat 2020 imagery, were digitized.
4. A quality assurance process was implemented. This involved having a second independent interpreter review the work and add missing disturbances while ensuring the completeness and accuracy of the information in the attribute table. General checks were also carried out to verify feature classification, disturbance class consistency, and so on.

Specific limitations associated with the interpretation of disturbance mapping results

The specific limitations identified below are important to consider in the context of this assessment. This is not an exhaustive list. For example, Appendix 7.2 of EC (2011) presents additional limitations.

- a) Since anthropogenic disturbances are identified visually from Landsat 1:50,000 images, disturbance mapping does not provide an exhaustive inventory of all habitat disturbances that could be perceived by caribou and affect individual behavior or have population-level effects (e.g., affect demographic parameters such as recruitment or survival). Furthermore, the scale at which the visual identification of anthropogenic disturbance is performed implies that the representation of the different disturbance classes is not very precise.
- b) The disturbance mapping dataset was designed to provide an index of disturbance that considers the cumulative impact of all anthropogenic disturbances (along with fire as a natural disturbance). The data were not developed to examine individual disturbance classes, and it is expected that there will be overlaps, sometimes significant, between the different disturbance classes.
- c) Given the above statement, and for reasons of efficiency, portions of linear disturbances that overlapped one or more polygonal disturbances were not mapped. It is very likely that the footprint of linear disturbances was underestimated.
- d) In cases where two linear features converged and became indistinguishable on Landsat images, a single line was digitized and the disturbance class was assigned based on a hierarchy (from highest to lowest priority: roads, railroads, power lines, pipelines, seismic lines, dams, landing strips and unknown features). As a result, the footprint of certain classes of linear disturbance may have been underestimated, particularly for "lower priority" disturbance classes (according to the hierarchy mentioned above).

References⁴⁰

Hermosilla, T., M.A. Wulder, J.C. White, N.C. Coops, G.W. Hobart, and L.B. Campbell. 2016. Mass data processing of time series Landsat imagery: pixels to data products for forest monitoring. *International Journal of Digital Earth* 9(11):1035-1054.

Natural Resources Canada. Canadian National Fire Database (CNFDB) 1981-2020. <https://cwfis.cfs.nrcan.gc.ca/ha/nfdb>

Access to 2010 and 2015 data

"Boreal ecosystem anthropogenic disturbance vector data for Canada based on 2008 to 2010 Landsat imagery" can be downloaded from:

<https://open.canada.ca/data/en/dataset/afd0ce47-17c3-445c-b823-2f86409da2e0>

"Anthropogenic disturbance footprint within boreal caribou ranges across Canada - As interpreted from 2008-2010 Landsat satellite imagery Updated to 2012 range boundaries" can be downloaded from:

<https://open.canada.ca/data/en/dataset/890a5d8d-3dbb-4608-b6ce-3b6d4c3b7dce>

"2015 - Anthropogenic disturbance footprint within boreal caribou ranges across Canada - As interpreted from 2015 Landsat satellite imagery" can be downloaded from:

<https://data-donnees.az.ec.gc.ca/data/species/developplans/2015-anthropogenic-disturbance-footprint-within-boreal-caribou-ranges-across-canada-as-interpreted-from-2015-landsat-satellite-imagery/?lang=en>

⁴⁰ Only references not found in the main document are presented here.

APPENDIX D. PRESENTATION OF GEOSPATIAL INFORMATION RELATING TO FOREST MANAGEMENT PLANNING ACTIVITIES

The Government of Quebec's website entitled “Plans d’aménagement forestier régionaux et consultations (regional forest management plans and consultations)” provides information on the forest planning and the public consultation process (Gouvernement du Québec, 2022c). The website provides access to interactive map applications. Section 1 of this appendix describes in greater detail the interactive map applications that were available at the time the imminent threat assessment was prepared. Section 2 presents the information selected for integration into this assessment. Some of the information and descriptions were collected using the interactive map applications, while others required the use of a geographic information system, such as the area and length statistics presented in Tables 6 and 7 of the imminent threat assessment. Section 3 presents the elements used for this processing. Lastly, all the references used can be found in Section 4.

1. Inventory of information disseminated on interactive map applications

1.1 List of interactive map application titles and elements displayed

Table D.1 shows the titles of the interactive map applications and the elements displayed on these maps on the “regional forest management plans and consultations” website for the regions under study (period from October 15, 2023, to December 22, 2023; Gouvernement du Québec, 2022c). It was prepared by consulting the interactive map applications that are accessible via hyperlinks on the regions' web pages in the sections entitled “Programmation annuelle des activités de récolte (annual harvesting program - PRAN) and Plans d’aménagement forestier intégré opérationnels (operational integrated forest management plans - PAFIO)” or via a hyperlink in the most recent consultation follow-up report published on the same web pages⁴¹. The table includes only those items checked (and thus displayed) when the interactive map application was first opened⁴².

⁴¹ Available in the Rapports de suivi des consultations section.

⁴² For the Côte-Nord region, the *Unité d’aménagement et Villégiature* (management unit and vacation and recreational infrastructure) elements displayed when the Côte-Nord region interactive map application is opened—“*Travaux autorisés 2023-2024*” (authorized work 2023–2024) are not listed in Table D.1.

Table D.1: Interactive map application titles and elements displayed on initial opening of the interactive map applications

Region name	Information shown in the title bar of the interactive map application	Element name - Level 1	Element name - Level 2	Element name - Level 3
Saguenay–Lac-Saint-Jean	Consultation publique sur les PAFIO et les PAS de la région du Saguenay-Lac-Saint-Jean [Public consultation on PAFIOs and PASs in the Saguenay-Lac-Saint-Jean region]	Consultation PAFIO Février 2023 [PAFIO consultation, February 2023]	Plan d'aménagement spécial [Special management plan]	N/A
Saguenay–Lac-Saint-Jean	Consultation publique sur les PAFIO et les PAS de la région du Saguenay-Lac-Saint-Jean [Public consultation on PAFIOs and PASs in the Saguenay-Lac-Saint-Jean region]	Consultation PAFIO Février 2023 [PAFIO consultation, February 2023]	Infrastructures forestières [Forestry infrastructure]	Ponts et ponceaux en consultation [Bridges and culverts under consultation]
Saguenay–Lac-Saint-Jean	Consultation publique sur les PAFIO et les PAS de la région du Saguenay-Lac-Saint-Jean [Public consultation on PAFIOs and PASs in the Saguenay-Lac-Saint-Jean region]	Consultation PAFIO Février 2023 [PAFIO consultation, February 2023]	Infrastructures forestières [Forestry infrastructure]	Ponts et ponceaux déjà consultés [Bridges and culverts, consultation completed]
Saguenay–Lac-Saint-Jean	Consultation publique sur les PAFIO et les PAS de la région du Saguenay-Lac-Saint-Jean [Public consultation on PAFIOs and PASs in the Saguenay-Lac-Saint-Jean region]	Consultation PAFIO Février 2023 [PAFIO consultation, February 2023]	Infrastructures forestières [Forestry infrastructure]	Autres infrastructures en consultation [Other infrastructure under consultation]
Saguenay–Lac-Saint-Jean	Consultation publique sur les PAFIO et les PAS de la région du Saguenay-Lac-Saint-Jean [Public consultation on PAFIOs and PASs in the Saguenay-Lac-Saint-Jean region]	Consultation PAFIO Février 2023 [PAFIO consultation, February 2023]	Infrastructures forestières [Forestry infrastructure]	Autres infrastructures déjà consultées [Other infrastructure, consultation completed]
Saguenay–Lac-Saint-Jean	Consultation publique sur les PAFIO et les PAS de la région du Saguenay-Lac-Saint-Jean [Public consultation on PAFIOs and PASs in the Saguenay-Lac-Saint-Jean region]	Consultation PAFIO Février 2023 [PAFIO consultation, February 2023]	Chemins forestiers [Logging roads]	Chemins en consultation [Roads under consultation]
Saguenay–Lac-Saint-Jean	Consultation publique sur les PAFIO et les PAS de la région du Saguenay-Lac-Saint-Jean [Public consultation on PAFIOs and PASs in the Saguenay-Lac-Saint-Jean region]	Consultation PAFIO Février 2023 [PAFIO consultation, February 2023]	Chemins forestiers [Logging roads]	Chemins déjà consultés [Roads, consultation completed]
Saguenay–Lac-Saint-Jean	Consultation publique sur les PAFIO et les PAS de la région du Saguenay-Lac-Saint-Jean [Public consultation on PAFIOs and PASs in the Saguenay-Lac-Saint-Jean region]	Consultation PAFIO Février 2023 [PAFIO consultation, February 2023]	Travaux sylvicoles commerciaux [Commercial silvicultural work]	Secteurs d'intervention potentiels en consultation [Potential intervention sectors under consultation]
Saguenay–Lac-Saint-Jean	Consultation publique sur les PAFIO et les PAS de la région du Saguenay-Lac-Saint-Jean [Public consultation on PAFIOs and PASs in the Saguenay-Lac-Saint-Jean region]	Consultation PAFIO Février 2023 [PAFIO consultation, February 2023]	Travaux sylvicoles commerciaux [Commercial silvicultural work]	Potential secteurs d'intervention [Potential intervention sectors, consultation completed]
Saguenay–Lac-Saint-Jean	Consultation publique sur les PAFIO et les PAS de la région du Saguenay-Lac-Saint-Jean [Public consultation on PAFIOs and PASs in the Saguenay-Lac-Saint-Jean region]	Consultation PAFIO Février 2023 [PAFIO consultation, February 2023]	Travaux sylvicoles non commerciaux [Non-commercial silvicultural work]	Secteurs d'intervention potentiels en consultation [Potential intervention sectors under consultation]
Saguenay–Lac-Saint-Jean	Consultation publique sur les PAFIO et les PAS de la région du Saguenay-Lac-Saint-Jean [Public consultation on PAFIOs and PASs in the Saguenay-Lac-Saint-Jean region]	Consultation PAFIO Février 2023 [PAFIO consultation, February 2023]	Travaux sylvicoles non commerciaux [Non-commercial silvicultural work]	Potential secteurs d'intervention [Potential intervention sectors, consultation completed]
Saguenay–Lac-Saint-Jean	Ministère des Ressources naturelles et des Forêts - Saguenay-Lac-Saint-Jean PRAN	N/A	Programmation annuelle commerciale septembre 2023 [Annual commercial harvesting program, September 2023]	N/A
Saguenay–Lac-Saint-Jean	Ministère des Ressources naturelles et des Forêts - Saguenay-Lac-Saint-Jean PRAN	N/A	Camp de la programmation annuelle septembre 2023 [Work camps in the annual harvesting program, September 2023]	N/A

Region name	Information shown in the title bar of the interactive map application	Element name - Level 1	Element name - Level 2	Element name - Level 3
Saguenay–Lac-Saint-Jean	Ministère des Ressources naturelles et des Forêts - Saguenay-Lac-Saint-Jean PRAN	N/A	Pont de la programmation annuelle septembre 2023 [Bridges in the annual harvesting program, September 2023]	PRAN_pont_09_2023 [PRAN_bridge_09_2023]
Saguenay–Lac-Saint-Jean	Ministère des Ressources naturelles et des Forêts - Saguenay-Lac-Saint-Jean PRAN	N/A	Chemin de la programmation annuelle septembre 2023 [Roads in the annual harvesting program, September 2023]	PRAN_chemin_09_2023 [PRAN_roads_09_2023]
Capitale-Nationale	Consultation publique sur les PAFIO et le PAS de la Capitale-Nationale [Public consultation on PAFIOs and PASs in the Capitale-Nationale region]	Consultation_Publique_R03_2023 [Public consultation R03 2023]	Travaux sylvicoles commerciaux [Commercial silvicultural work]	Secteurs d'intervention potentiels en consultation [Potential intervention sectors under consultation]
Capitale-Nationale	Consultation publique sur les PAFIO et le PAS de la Capitale-Nationale [Public consultation on PAFIOs and PASs in the Capitale-Nationale region]	Consultation_Publique_R03_2023 [Public consultation R03 2023]	Travaux sylvicoles commerciaux [Commercial silvicultural work]	Potential secteurs d'intervention [Potential intervention sectors, consultation completed]
Capitale-Nationale	Consultation publique sur les PAFIO et le PAS de la Capitale-Nationale [Public consultation on PAFIOs and PASs in the Capitale-Nationale region]	Consultation_Publique_R03_2023 [Public consultation R03 2023]	Chemins forestiers [Logging roads]	Chemins en consultation [Roads under consultation]
Capitale-Nationale	Consultation publique sur les PAFIO et le PAS de la Capitale-Nationale [Public consultation on PAFIOs and PASs in the Capitale-Nationale region]	Consultation_Publique_R03_2023 [Public consultation R03 2023]	Infrastructures forestières [Forestry infrastructure]	Ponts et ponceaux en consultation [Bridges and culverts under consultation]
Capitale-Nationale	Consultation publique sur les PAFIO et le PAS de la Capitale-Nationale [Public consultation on PAFIOs and PASs in the Capitale-Nationale region]	Consultation_Publique_R03_2023 [Public consultation R03 2023]	Infrastructures forestières [Forestry infrastructure]	Autres infrastructures en consultation [Other infrastructure under consultation]
Capitale-Nationale	Consultation publique sur les PAFIO et le PAS de la Capitale-Nationale [Public consultation on PAFIOs and PASs in the Capitale-Nationale region]	Consultation_Publique_R03_2023 [Public consultation R03 2023]	Plan d'aménagement special ¹ [Special management plan ¹]	N/A
Capitale-Nationale	Diffusion des Programmation de Récolte Annuelle Autorisée de la Capitale-Nationale [Dissemination of authorized annual harvesting plans in the Capitale-Nationale region]	PRANA_2023_2024 [2023–2024 PRANA]	Plan d'aménagement special ¹ autorisés [Authorized special management plans ¹]	N/A
Capitale-Nationale	Diffusion des Programmation de Récolte Annuelle Autorisée de la Capitale-Nationale [Dissemination of authorized annual harvesting plans in the Capitale-Nationale region]	PRANA_2023_2024 [2023–2024 PRANA]	Infrastructures forestières [Forestry infrastructure]	Pont et ponceaux autorisés [Authorized bridges and culverts]
Capitale-Nationale	Diffusion des Programmation de Récolte Annuelle Autorisée de la Capitale-Nationale [Dissemination of authorized annual harvesting plans in the Capitale-Nationale region]	PRANA_2023_2024 [2023–2024 PRANA]	Infrastructures forestières [Forestry infrastructure]	Other authorized infrastructure
Capitale-Nationale	Diffusion des Programmation de Récolte Annuelle Autorisée de la Capitale-Nationale [Dissemination of authorized annual harvesting plans in the Capitale-Nationale region]	PRANA_2023_2024 [2023–2024 PRANA]	Travaux sylvicoles commerciaux [Commercial silvicultural work]	Secteurs d'intervention autorisées ¹ [Authorized intervention sectors ¹]
Capitale-Nationale	Diffusion des Programmation de Récolte Annuelle Autorisée de la Capitale-Nationale [Dissemination of authorized annual harvesting plans in the Capitale-Nationale region]	PRANA_2023_2024 [2023–2024 PRANA]	Chemins forestiers [Logging roads]	Chemins autorisés [Authorized roads]
Mauricie	Planification opérationnelle et programmation annuelle (PRAN) 2022 - Mauricie [Operational plan and annual harvesting program (PRAN) 2022 - Mauricie]	N/A	Programmation annuelle (PRAN) [Annual harvesting program (PRAN)]	N/A

Region name	Information shown in the title bar of the interactive map application	Element name - Level 1	Element name - Level 2	Element name - Level 3
Abitibi-Témiscamingue	Consultation publique sur les PAFIO et les PAS de la région Abitibi-Témiscamingue [Public consultation on PAFIOs and PASs in the Abitibi-Témiscamingue region]	ConsultationR08_E23	Travaux sylvicoles commerciaux [Commercial silvicultural work]	Secteur ¹ d'intervention potentiels en consultation [Potential intervention sectors ¹ under consultation]
Abitibi-Témiscamingue	Consultation publique sur les PAFIO et les PAS de la région Abitibi-Témiscamingue [Public consultation on PAFIOs and PASs in the Abitibi-Témiscamingue region]	ConsultationR08_E23	Travaux sylvicoles commerciaux [Commercial silvicultural work]	Secteur d'intervention potentiels déjà consultés [Potential intervention sectors, consultation completed]
Abitibi-Témiscamingue	Consultation publique sur les PAFIO et les PAS de la région Abitibi-Témiscamingue [Public consultation on PAFIOs and PASs in the Abitibi-Témiscamingue region]	ConsultationR08_E23	Travaux sylvicoles non commerciaux [Non-commercial silvicultural work]	Secteur ¹ d'intervention potentiels en consultation [Potential intervention sectors ¹ under consultation]
Abitibi-Témiscamingue	Consultation publique sur les PAFIO et les PAS de la région Abitibi-Témiscamingue [Public consultation on PAFIOs and PASs in the Abitibi-Témiscamingue region]	ConsultationR08_E23	Travaux sylvicoles non commerciaux [Non-commercial silvicultural work]	Secteur d'intervention potentiels déjà consultés [Potential intervention sectors, consultation completed]
Abitibi-Témiscamingue	Consultation publique sur les PAFIO et les PAS de la région Abitibi-Témiscamingue [Public consultation on PAFIOs and PASs in the Abitibi-Témiscamingue region]	ConsultationR08_E23	Chemins forestiers [Logging roads]	Chemins en consultation [Roads under consultation]
Abitibi-Témiscamingue	Consultation publique sur les PAFIO et les PAS de la région Abitibi-Témiscamingue [Public consultation on PAFIOs and PASs in the Abitibi-Témiscamingue region]	ConsultationR08_E23	Chemins forestiers [Logging roads]	Chemins déjà consultés [Roads, consultation completed]
Abitibi-Témiscamingue	Consultation publique sur les PAFIO et les PAS de la région Abitibi-Témiscamingue [Public consultation on PAFIOs and PASs in the Abitibi-Témiscamingue region]	ConsultationR08_E23	Infrastructures forestières [Forestry infrastructure]	Ponts et ponceaux en consultation [Bridges and culverts under consultation]
Abitibi-Témiscamingue	Consultation publique sur les PAFIO et les PAS de la région Abitibi-Témiscamingue [Public consultation on PAFIOs and PASs in the Abitibi-Témiscamingue region]	ConsultationR08_E23	Infrastructures forestières [Forestry infrastructure]	Ponts et ponceaux déjà consultés [Bridges and culverts, consultation completed]
Abitibi-Témiscamingue	Consultation publique sur les PAFIO et les PAS de la région Abitibi-Témiscamingue [Public consultation on PAFIOs and PASs in the Abitibi-Témiscamingue region]	ConsultationR08_E23	Infrastructures forestières [Forestry infrastructure]	Autres infrastructures en consultation [Other infrastructure under consultation]
Abitibi-Témiscamingue	Consultation publique sur les PAFIO et les PAS de la région Abitibi-Témiscamingue [Public consultation on PAFIOs and PASs in the Abitibi-Témiscamingue region]	ConsultationR08_E23	Infrastructures forestières [Forestry infrastructure]	Autres infrastructures déjà consultées [Other infrastructure, consultation completed]
Abitibi-Témiscamingue	Consultation publique sur les PAFIO et les PAS de la région Abitibi-Témiscamingue [Public consultation on PAFIOs and PASs in the Abitibi-Témiscamingue region]	ConsultationR08_E23	Plan d'aménagement spécial [Special management plan]	N/A
Abitibi-Témiscamingue	Programmation annuelle 2023-2024 - Abitibi-Témiscamingue (région 08) [Annual harvesting program 2023–2024 - Abitibi-Témiscamingue (region 08)]	N/A	Activités ¹ planifiées- 2023-2024 - Chemins [Planned activities ¹ - 2023–2024 - Roads]	N/A
Abitibi-Témiscamingue	Programmation annuelle 2023-2024 - Abitibi-Témiscamingue (région 08) [Annual harvesting program 2023–2024 - Abitibi-Témiscamingue (region 08)]	N/A	Activités ¹ planifiées - 2023-2024 - Chemins (Bureau de mise en marché des bois) [Planned activities ¹ - 2023–2024 - Roads (timber marketing board)]	N/A

Region name	Information shown in the title bar of the interactive map application	Element name - Level 1	Element name - Level 2	Element name - Level 3
Abitibi-Témiscamingue	Programmation annuelle 2023-2024 - Abitibi-Témiscamingue (région 08) [Annual harvesting program 2023–2024 - Abitibi-Témiscamingue (region 08)]	N/A	Activités planifiées-2023-2024-Travaux non commerciaux [Planned_activities 2023–2024 - Non-commercial work]	N/A
Abitibi-Témiscamingue	Programmation annuelle 2023-2024 - Abitibi-Témiscamingue (région 08) [Annual harvesting program 2023–2024 - Abitibi-Témiscamingue (region 08)]	N/A	Activités planifiées- 2023-2024 - Travaux commerciaux [Planned_activities 2023–2024 - Commercial work]	N/A
Abitibi-Témiscamingue	Programmation annuelle 2023-2024 - Abitibi-Témiscamingue (région 08) [Annual harvesting program 2023–2024 - Abitibi-Témiscamingue (region 08)]	N/A	Activités planifiées - 2023-2024 - Chantiers (Bureau de mise en marché des bois) [Planned activities - 2023–2024 - Work sites (timber marketing board)]	N/A
Côte-Nord	Consultation publique sur les PAFIO de la Côte-Nord [Public consultation on PAFIOs in the Côte-Nord region]	N/A	Pont planifié en consultation [Planned bridge under consultation]	N/A
Côte-Nord	Consultation publique sur les PAFIO de la Côte-Nord [Public consultation on PAFIOs in the Côte-Nord region]	N/A	Chemin planifié en consultation [Planned road under consultation]	N/A
Côte-Nord	Consultation publique sur les PAFIO de la Côte-Nord [Public consultation on PAFIOs in the Côte-Nord region]	N/A	Chemin principal déjà consulté [Main road, consultation completed]	N/A
Côte-Nord	Consultation publique sur les PAFIO de la Côte-Nord [Public consultation on PAFIOs in the Côte-Nord region]	N/A	Récolte potentielle en consultation [Potential harvest under consultation]	N/A
Côte-Nord	Consultation publique sur les PAFIO de la Côte-Nord [Public consultation on PAFIOs in the Côte-Nord region]	N/A	Travaux sylvicoles potentiels en consultation [Potential silvicultural work under consultation]	N/A
Côte-Nord	Travaux autorisés 2023-2024 (mise à jour octobre 2023) [Authorized work 2023–2024 (updated October 2023)]	N/A	Chemin [Road]	N/A
Côte-Nord	Travaux autorisés 2023-2024 (mise à jour octobre 2023) [Authorized work 2023–2024 (updated October 2023)]	N/A	Travaux sylvicoles [Silvicultural work]	N/A
Côte-Nord	Travaux autorisés 2023-2024 (mise à jour octobre 2023) [Authorized work 2023–2024 (updated October 2023)]	N/A	Récolte [Harvesting]	N/A
Côte-Nord	Travaux autorisés 2023-2024 (mise à jour octobre 2023) [Authorized work 2023–2024 (updated October 2023)]	N/A	Bureau de mise en marché des bois [Timber marketing board]	N/A
Nord-du-Québec	Consultation publique sur les PAFIO du Nord-du-Québec [Public consultation on PAFIOs in the Nord-du-Québec region]	Activités d'aménagement forestier [Forest management activities]	Travaux sylvicoles commerciaux [Commercial silvicultural work]	Secteurs d'intervention potentiels en consultation [Potential intervention sectors under consultation]
Nord-du-Québec	Consultation publique sur les PAFIO du Nord-du-Québec [Public consultation on PAFIOs in the Nord-du-Québec region]	Activités d'aménagement forestier [Forest management activities]	Travaux sylvicoles commerciaux [Commercial silvicultural work]	Secteur ¹ d'intervention potentiels déjà consultés [Potential intervention sectors ¹ , consultation completed]
Nord-du-Québec	Consultation publique sur les PAFIO du Nord-du-Québec [Public consultation on PAFIOs in the Nord-du-Québec region]	Activités d'aménagement forestier [Forest management activities]	Travaux sylvicoles non commerciaux [Non-commercial silvicultural work]	Secteurs d'intervention potentiels en consultation [Potential intervention sectors under consultation]
Nord-du-Québec	Consultation publique sur les PAFIO du Nord-du-Québec [Public consultation on PAFIOs in the Nord-du-Québec region]	Activités d'aménagement forestier [Forest management activities]	Travaux sylvicoles non commerciaux [Non-commercial silvicultural work]	Potential secteurs d'intervention [Potential intervention sectors, consultation completed]
Nord-du-Québec	Consultation publique sur les PAFIO du Nord-du-Québec [Public consultation on PAFIOs in the Nord-du-Québec region]	Activités d'aménagement forestier [Forest management activities]	Chemins forestiers [Logging roads]	Chemins en consultation [Roads under consultation]

Region name	Information shown in the title bar of the interactive map application	Element name - Level 1	Element name - Level 2	Element name - Level 3
Nord-du-Québec	Consultation publique sur les PAFIO du Nord-du-Québec [Public consultation on PAFIOs in the Nord-du-Québec region]	Activités d'aménagement forestier [Forest management activities]	Chemins forestiers [Logging roads]	Chemins déjà consultés [Roads, consultation completed]
Nord-du-Québec	Consultation publique sur les PAFIO du Nord-du-Québec [Public consultation on PAFIOs in the Nord-du-Québec region]	Activités d'aménagement forestier [Forest management activities]	Infrastructures forestières [Forestry infrastructure]	Ponts et ponceaux en consultation [Bridges and culverts under consultation]
Nord-du-Québec	Consultation publique sur les PAFIO du Nord-du-Québec [Public consultation on PAFIOs in the Nord-du-Québec region]	Activités d'aménagement forestier [Forest management activities]	Infrastructures forestières [Forestry infrastructure]	Ponts et ponceaux déjà consultés [Bridges and culverts, consultation completed]
Nord-du-Québec	Consultation publique sur les PAFIO du Nord-du-Québec [Public consultation on PAFIOs in the Nord-du-Québec region]	Activités d'aménagement forestier [Forest management activities]	Infrastructures forestières [Forestry infrastructure]	Autres infrastructures en consultation [Other infrastructure under consultation]
Nord-du-Québec	Consultation publique sur les PAFIO du Nord-du-Québec [Public consultation on PAFIOs in the Nord-du-Québec region]	Activités d'aménagement forestier [Forest management activities]	Infrastructures forestières [Forestry infrastructure]	Autres infrastructures déjà consultées [Other infrastructure, consultation completed]

¹ In general, the spelling used in the interactive map applications is reproduced here in its entirety for identification purposes.

1.2 Update schedule

When the interactive map applications for specific regions are opened, the update schedule for the information provided is indicated. Below are some details for the interactive map applications available under the Programmation annuelle des activités de récolte (annual harvesting program - PRAN) hyperlink.

For the Saguenay-Lac-Saint-Jean region, a pop-up window appears when the interactive map application is opened. This pop-up window states: "Bienvenue sur le site de diffusion de la programmation annuelle (PRAN) des travaux forestiers 2023 du ministère des Ressources naturelles et des Forêts (MRNF). La PRAN est mise à jour sur ce site les premiers jours des mois de septembre, de décembre et de février, et ce, à titre indicatif [Welcome to the website used to disseminate the Ministère des Ressources naturelles et des Forêts (MRNF)'s 2023 annual harvesting program (PRAN). On this website, the PRAN is updated in early September, December, and February for information purposes only]."⁴³ In addition, the elements consulted and used for this region are called Programmation annuelle commerciale septembre 2023, Chemin de la programmation annuelle septembre 2023 (see Table D.1).

For the Abitibi-Témiscamingue region, among the explanatory tabs available in the *About* window, the *Mise à jour des travaux prévus* tab indicates that "la Direction de la gestion des forêts de l'Abitibi-Témiscamingue mettra à jour cette programmation annuelle sur son site Web deux fois par année, soit au printemps (vers juin) et à l'automne (vers septembre) [the Direction de la gestion des forêts de l'Abitibi-Témiscamingue will update this annual program on its website twice a year, in the spring (around June) and in the fall (around September)]"⁴⁴.

For the Côte-Nord region, among the explanatory tabs available in the *About* window, the *Mise en garde* tab indicates that "L'information présentée sur ce site est mise à jour deux fois par année, soit au printemps (vers juin) et à l'automne (vers septembre) [the information presented on this site is updated twice a year, in the spring (around June) and in the fall (around September)]"⁴⁵. Also, in the title bar of the online interactive map, it says: Travaux autorisés 2023-2024 (mise à jour octobre 2023) [Authorized work 2023–2024 (update October 2023)].

⁴³ Spontaneous pop-up window [Interactive map application]: <https://mrn-dgr02.maps.arcgis.com/apps/webappviewer/index.html?id=0d4e707cde29434593bac4f5accb507b>. Accessed 2023-12-18.

⁴⁴ About: Mise à jour des travaux prévus [Interactive map application]. <https://dgr08.maps.arcgis.com/apps/webappviewer/index.html?id=7e0f6d279e34488eb0700dcf9f1505bb>. Accessed 2023-10-30.

⁴⁵ About: Mise en garde [Interactive map application]. <https://dgr09.maps.arcgis.com/apps/webappviewer/index.html?id=81cac0551aba4f29aaa75225373623f8>. Accessed 2023-11-27.

For the Mauricie region, a pop-up window appears when the interactive map application is opened. This pop-up window reads: "Bienvenue sur le site de diffusion de la Programmation annuelle (PRAN) des activités d'aménagement forestier 2023 en Mauricie, préparée par la Direction de la gestion des forêts de la Mauricie – Centre-du-Québec. Dernière mise à jour : PRAN Commerciale, Octobre 2023. PRAN Non commerciale, Octobre 2023 [Welcome to the site used to disseminate the 2023 annual harvesting program (PRAN) for the Mauricie, prepared by the Direction de la gestion des forêts de la Mauricie - Centre-du-Québec. Last update: Commercial PRAN, October 2023. Non-commercial PRAN, October 2023)]⁴⁶.

⁴⁶ Spontaneous pop-up window [Interactive map application]:
<https://dgr04.maps.arcgis.com/apps/webappviewer/index.html?id=3f51e3ee0fec427c9a2249b22d304d08>.
Accessed on 2023-11-21.

2. List of elements selected

2.1 Selected elements related to logging activities

Table 6 in the Imminent Threat Assessment for the Caribou (*Rangifer tarandus*), Boreal Population lists the area of planned cutting in square kilometres. Among the elements displayed on the interactive map applications, those selected to produce the area statistics are identified by a blue background in Table D.1. For the regions listed in Table 6, the attributes listed in the legend of the interactive map applications were used for the selected elements. Table D.2 gives details of the attributes displayed for the regions concerned:

Table D.2: Attributes as labelled in the legend of interactive map applications:

Region	Element name - Levels 2 and 3	Attributes
Saguenay–Lac-Saint-Jean	Programmation annuelle commerciale septembre 2023 [Annual commercial harvesting program, September 2023]	<ul style="list-style-type: none"> • Coupe de régénération [Regeneration cut] • Coupe par bandes [Strip cutting] • Coupe partielle [Partial harvest] • Coupe à rétention variable [Retention harvesting] • Coupe à rétention variable par bouquets [Group retention harvesting] • Récolte partielle (500 tiges résiduelles) [Partial harvesting (500 residual stems)] • Récolte partielle (700 tiges résiduelles) [Partial harvesting (700 residual stems)] • Éclaircie commerciale [Commercial thinning]
Capitale-Nationale	Travaux sylvicoles commerciaux - [Commercial silvicultural work] Secteurs d'intervention autorisées [Authorized intervention sectors]	<ul style="list-style-type: none"> • Coupe de jardinage par pied d'arbres et groupe d'arbres [Single-tree and group selection cutting] • Coupe de jardinage par pied d'arbres et groupe d'arbres phase d'amélioration [Single-tree and group selection cutting, improvement cutting phase] • Coupe avec protection de la haute régénération et des sols avec legs biologiques par bouquets [Cutting with protection of tall regeneration and soils including biological legacies (clusters)] • Coupe avec protection de la haute régénération et des sols sans legs biologiques [Cutting with protection of tall regeneration and soils with no biological legacies] • Coupe progressive irrégulière à couvert permanent phase

		<p>d'ensemencement uniforme [Uniform irregular shelterwood cutting, permanent cover, seed cutting phase]</p> <ul style="list-style-type: none"> • Coupe progressive irrégulière à couvert permanent phase d'ensemencement [Irregular shelterwood cutting, permanent cover, seed cutting phase] • Coupe progressive irrégulière à régénération lente en deux interventions phase d'ensemencement [Irregular shelterwood cutting, slow regeneration, two treatments, seed cutting phase] • Coupe progressive irrégulière à régénération lente en trois interventions phase d'ensemencement [Irregular shelterwood cutting, slow regeneration, three treatments, seed cutting phase] • Coupe avec protection des petites tiges marchandes discontinue [Harvesting with protection of small merchantable stems, discontinuously distributed] • Coupe avec protection des petites tiges marchandes discontinue avec ajout de legs biologiques par bouquets [Harvesting with protection of small merchantable stems discontinuously distributed and including biological legacies in clusters,] • Coupe avec protection de la régénération et des sols uniforme avec leg par bouquets [Uniform harvesting with protection of regeneration and soils including legacies in clusters] • Coupe avec protection de la régénération et des sols uniforme avec îlots [Uniform harvesting with protection of regeneration and soils with patches] • Coupe avec protection de la régénération et des sols uniforme sans legs biologiques [Uniform harvesting with protection of regeneration and soils with no biological legacies] • Coupe progressive régulière uniforme - coupe d'ensemencement [Uniform regular shelterwood system - seed cutting] • Coupe progressive régulière uniforme phase finale sans legs biologiques
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		<p>[Uniform regular shelterwood system, final cutting with no biological legacies]</p> <ul style="list-style-type: none"> • Coupe progressive régulière uniforme phase secondaire [Uniform regular shelterwood system, secondary phase] • Coupe avec réserve de semenciers sans legs biologiques [Seed-tree method with no biological legacies] • Coupe de succession sans legs [Succession cutting with no legacies] • Coupe totale sans protection uniforme sans legs biologiques [Uniform clearcutting with no protection and no biological legacies] • Éclaircie commerciale mixte par le haut et par le bas [Mixed commercial thinning from above and below] • Récolte partielle dans une lisière boisée (700 tiges de 10 cm et +) [Partial harvesting in a buffer strip (700 stems of 10+ cm)]
Abitibi-Témiscamingue	<p>Activités planifiées- 2023-2024 - Travaux commerciaux [Planned_activities - 2023–2024 - Commercial work]</p> <p>Activités planifiées- 2023-2024 - Chantiers (Bureau de mise en marché des bois) [Planned activities- 2023–2024 - Work sites (timber marketing board)]</p>	<ul style="list-style-type: none"> • Coupe de régénération [Regeneration cut] (CPHRS-CPPTM-CPRS-CRS-CTSP) • Coupe partielle [Partial harvest] (CPI-EC-RPLB) • <i>No attributes</i>
Côte-Nord	<p>Récolte [Harvesting]</p> <p>Bureau de mise en marché des bois [Timber marketing board]</p>	<ul style="list-style-type: none"> • Récolte [Harvesting] • Récolte partielle [Partial harvesting] • Secteur vendu [Sold area]

All polygons present in the elements covering the study area were included in the production of the statistics.

2.2 Selected elements related to road network activities

Table 7 of the Imminent Threat Assessment for the Caribou (*Rangifer tarandus*), Boreal Population lists the lengths of road to be built (in kilometers). Among the elements displayed on interactive map applications, those selected to produce the length statistics are identified by a brown background in Table D.1. For the regions documented in Table 7, the attributes listed in the legend of the interactive map applications were used for the selected elements. Table D.3 gives details of the attributes displayed for the regions concerned.

Table D.3: Attributes as labelled in the legend of interactive map applications:

Region	Element name - Levels 2 and 3	Attributes
Saguenay–Lac-Saint-Jean	Chemin de la programmation annuelle septembre 2023 [Roads in the annual harvesting program, September 2023] PRAN_chemin_09_2023 [PRAN_roads_09_2023]	<ul style="list-style-type: none"> • Amélioration [Improvement] • Implantation [Building] • Réfection [Repairs]
Capitale-Nationale	Chemins forestiers - [Logging roads] Chemins autorisés [Authorized roads]	<ul style="list-style-type: none"> • Amélioration [Improvement] • Implantation [Building] • Réfection [Repairs]
Abitibi-Témiscamingue	Activités planifiées - 2023-2024 – Chemins [Planned_activities - 2023–2024 – Roads] Activités planifiées - 2023-2024 - Chemins (Bureau de mise en marché des bois) [Planned activities - 2023–2024 - Roads (timber marketing board)]	<ul style="list-style-type: none"> • Amélioration (AM-EN-RE) [Improvement] • Implantation (IM) [Building] • Amélioration (AM-EN-RE) [Improvement] • Implantation (IM) [Building]
Côte-Nord	Chemin [Road]	<ul style="list-style-type: none"> • Implantation [Building] • Amélioration [Improvement] • Réfection [Repairs] • Entretien [Maintenance] • Implantation suivie d'une fermeture [Building following a closure] • Fermeture définitive [Permanent closure]

To generate the lengths of roads to be built, the *Implantation* (Building) attribute was selected for each element (shown in **bold** in the table above).

3. Source of elements used

For each of the elements selected, statistics were produced and presented in Tables 6 and 7 of the imminent threat assessment. Complete references for the elements used to produce these statistics can be found in Section 4. For each element used, information on the terms of use was consulted and archived.

4. References

Gouvernement du Québec. 2022. Plans d'aménagement forestier régionaux et consultations. Accessed multiple times between 2023-10-15 and 2023-12-22 at <https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/forets/planification-forestiere/plans-regionaux-consultations>.

Saguenay-Lac-Saint-Jean region:

Gouvernement du Québec. 2023. Aménagement forestier au Saguenay–Lac-Saint-Jean - Plans d'aménagement forestiers régionaux et consultations. Accessed multiple times between 2023-10-15 and 2023-12-22 at <https://www.quebec.ca/agriculture-environnement-et-ressources-naturelles/forets/planification-forestiere/plans-regionaux-consultations/saguenay-lac-st-jean>.

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APPENDIX E. EVOLUTION OF THE SCOPE OF CUTBLOCKS (LOGGING) AND ROADS (ROAD NETWORK) BETWEEN 2010 AND 2020 IN PROVINCIAL RANGES (MFFP, 2021A) WHERE THE DISTURBANCE LEVEL IS GREATER THAN 35%⁴⁷.

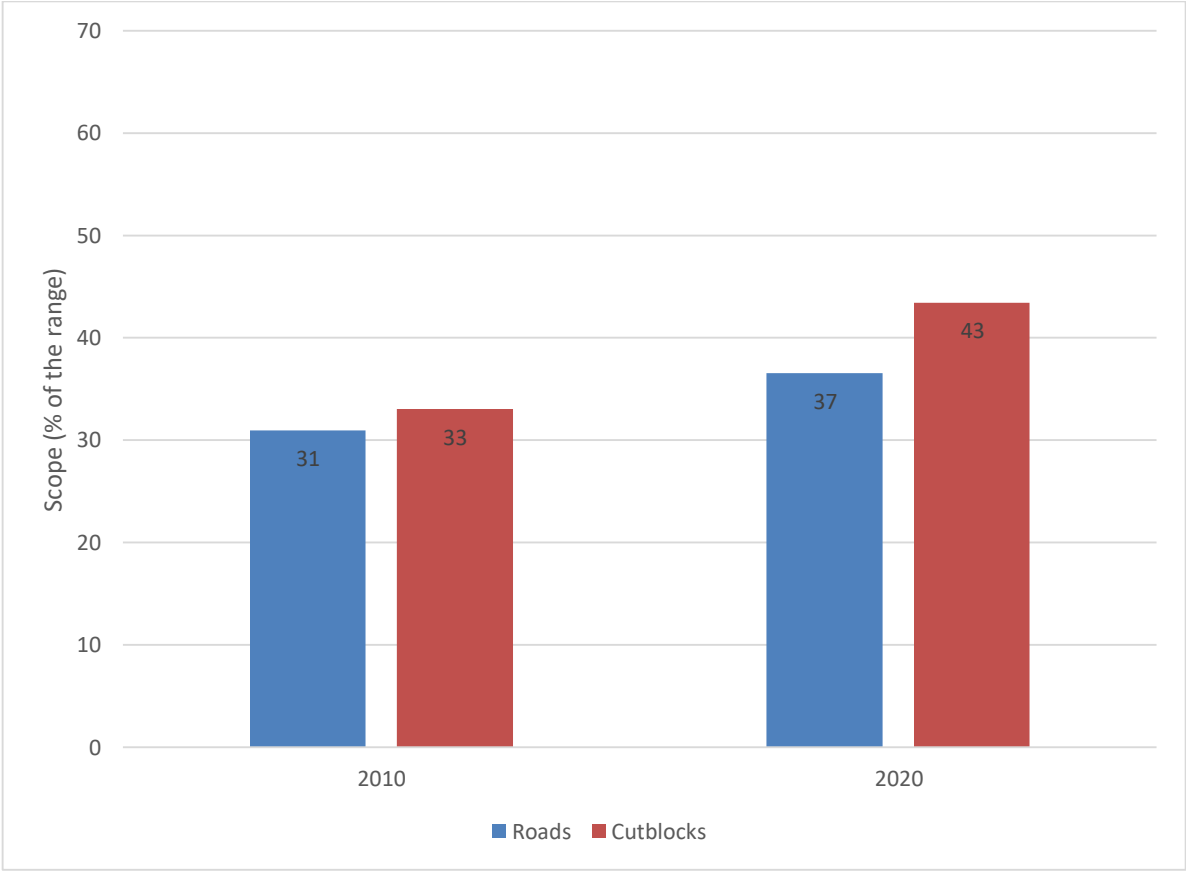


Figure E.1. Evolution of the scope of cutblocks (logging) and roads (road network) between 2010 and 2020 in the Val-d'Or range (as identified by MFFP [2021a]).

⁴⁷ Even though its disturbance level is 36%, the Baie-James knowledge acquisition area was not included because it is not directly linked to the range of a local population, and because the anthropogenic disturbance level is only 4%.

Table E.1. Evolution of the scope of cutblocks (logging) and roads (road network) between 2010 and 2020 in the Val-d'Or range (as identified by MFFP [2021a]).

Disturbance class ¹	2010		2020		Increase in area between 2010 and 2020 (km ²)	Increase in scope between 2010 and 2020 (%)
	Area ² (km ²)	Scope ³ (%)	Area ² (km ²)	Scope ³ (%)		
Cutblocks	2,709	33	3,560	43	851	10
Roads ⁴	2,539	31	2,996	37	457	6

¹ See methodology described in EC (2011). The results do not take into account other disturbance classes present in the range.

² Areas include a 500-m buffer (non-overlapping; see methodology described in EC [2011] and Appendix C).

³ The scope corresponds to the proportion of the area of the range (8,202 km²) that is affected by the disturbance class.

⁴ This disturbance class is most likely underestimated, as explained in Appendix C.

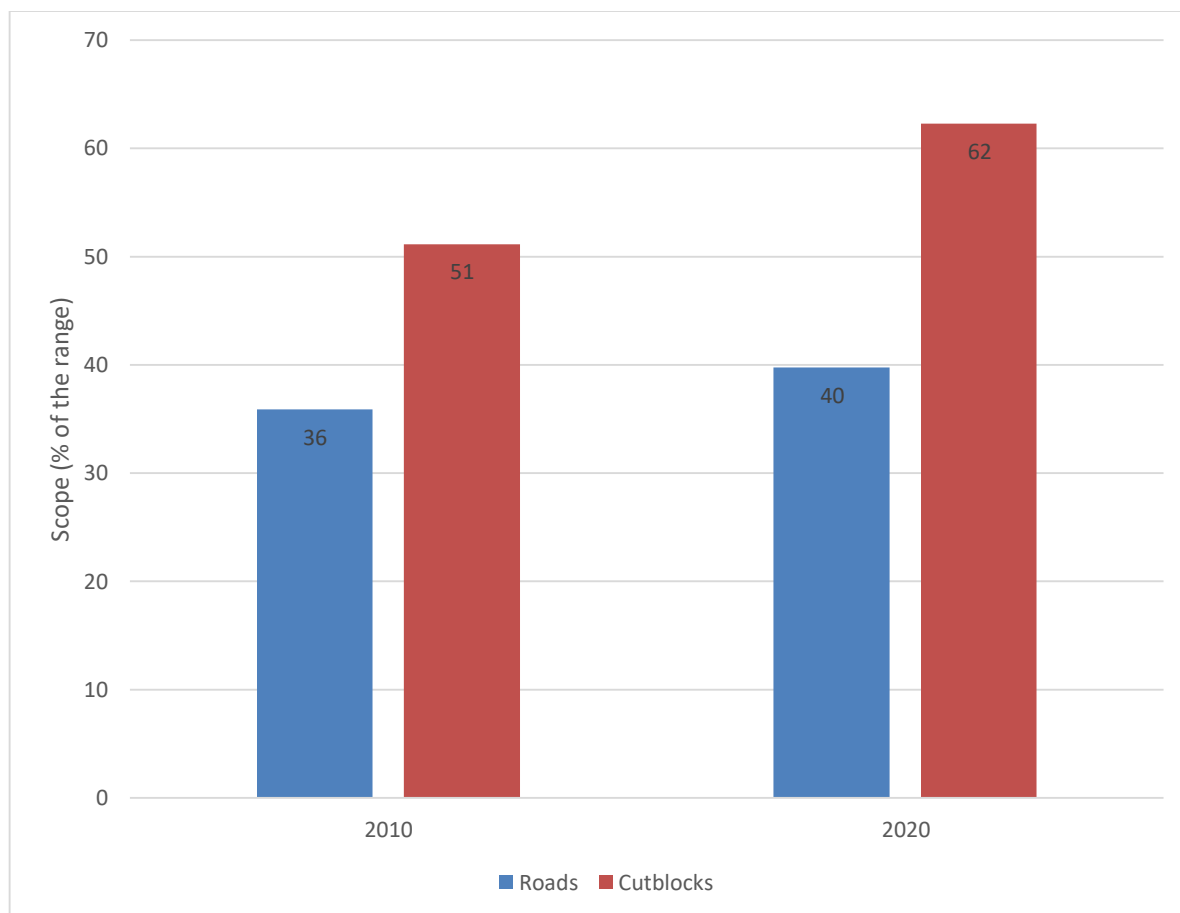


Figure E.2. Evolution of the scope of cutblocks (logging) and roads (road network) between 2010 and 2020 in the Charlevoix range (as identified by MFFP [2021a]).

Table E.2. Evolution of the scope of cutblocks (logging) and roads (road network) between 2010 and 2020 in the Charlevoix range (as identified by MFFP [2021a]).

Disturbance class ¹	2010		2020		Increase in area between 2010 and 2020 (km ²)	Increase in scope between 2010 and 2020 (%)
	Area ² (km ²)	Scope ³ (%)	Area ² (km ²)	Scope ³ (%)		
Cutblocks	3,706	51	4,514	62	808	11
Roads ⁴	2,601	36	2,881	40	280	4

¹ See methodology described in EC (2011). The results do not take into account other disturbance classes present in the range.

² Areas include a 500-m buffer (non-overlapping; see methodology described in EC [2011] and Appendix C).

³ The scope corresponds to the proportion of the area of the range (7,248 km²) that is affected by the disturbance class.

⁴ This disturbance class is most likely underestimated, as explained in Appendix C.

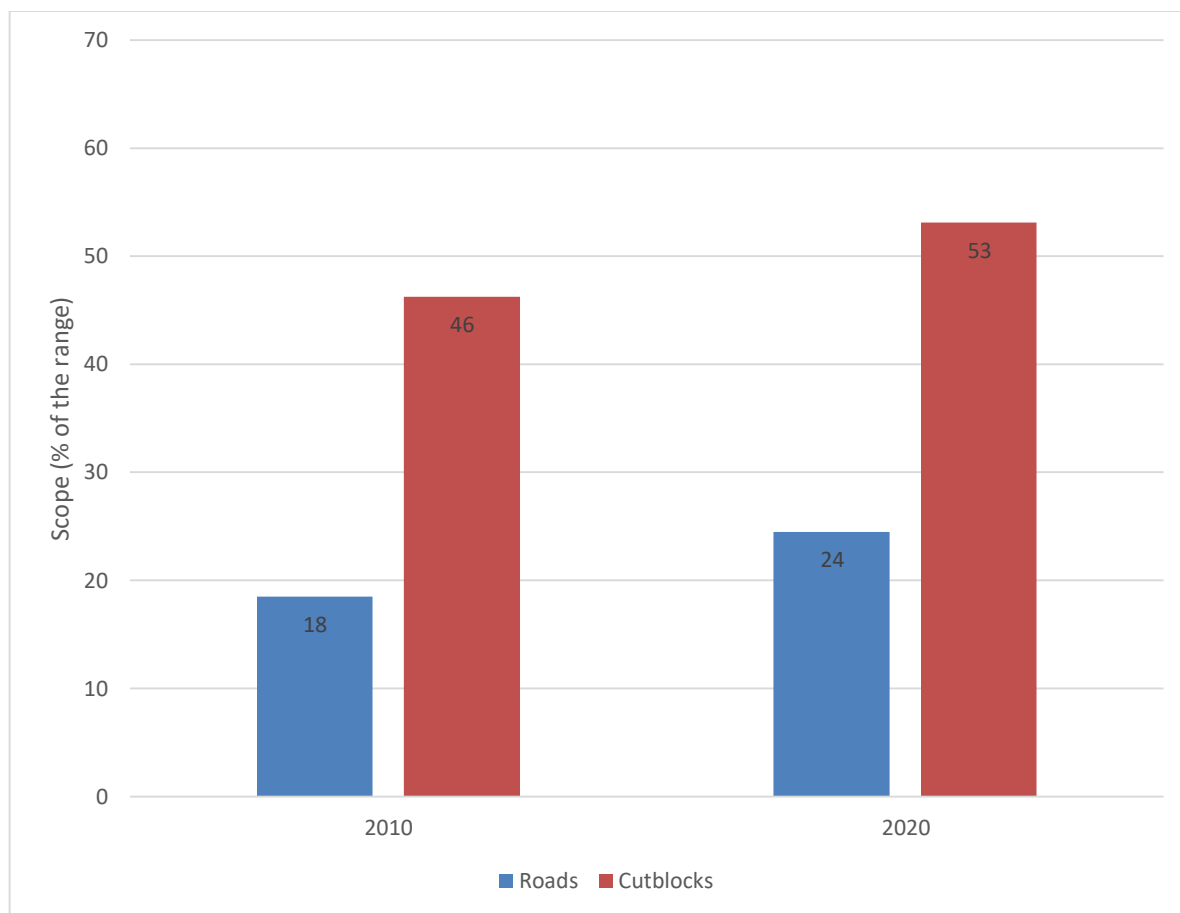


Figure E.3. Evolution of the scope of cutblocks (logging) and roads (road network) between 2010 and 2020 in the Pipmuacan range (as identified by MFFP [2021a]).

Table E.3. Evolution of the scope of cutblocks (logging) and roads (road network) between 2010 and 2020 in the Pipmuacan range (as identified by the MFFP [2021a]).

Disturbance class ¹	2010		2020		Increase in area between 2010 and 2020 (km ²)	Increase in scope between 2010 and 2020 (%)
	Area ² (km ²)	Scope ³ (%)	Area ² (km ²)	Scope ³ (%)		
Cutblocks	8,523	46	9,791	53	1,268	7
Roads ⁴	3,407	18	4,513	24	1,106	6

¹ See methodology described in EC (2011). The results do not take into account the other disturbance classes present in the range.

² Areas include a 500-m buffer (non-overlapping; see methodology described in EC [2011] and Appendix C).

³ The scope corresponds to the proportion of the area of the range (18,432 km²) that is affected by the disturbance class.

⁴ This disturbance class is most likely underestimated, as explained in Appendix C.

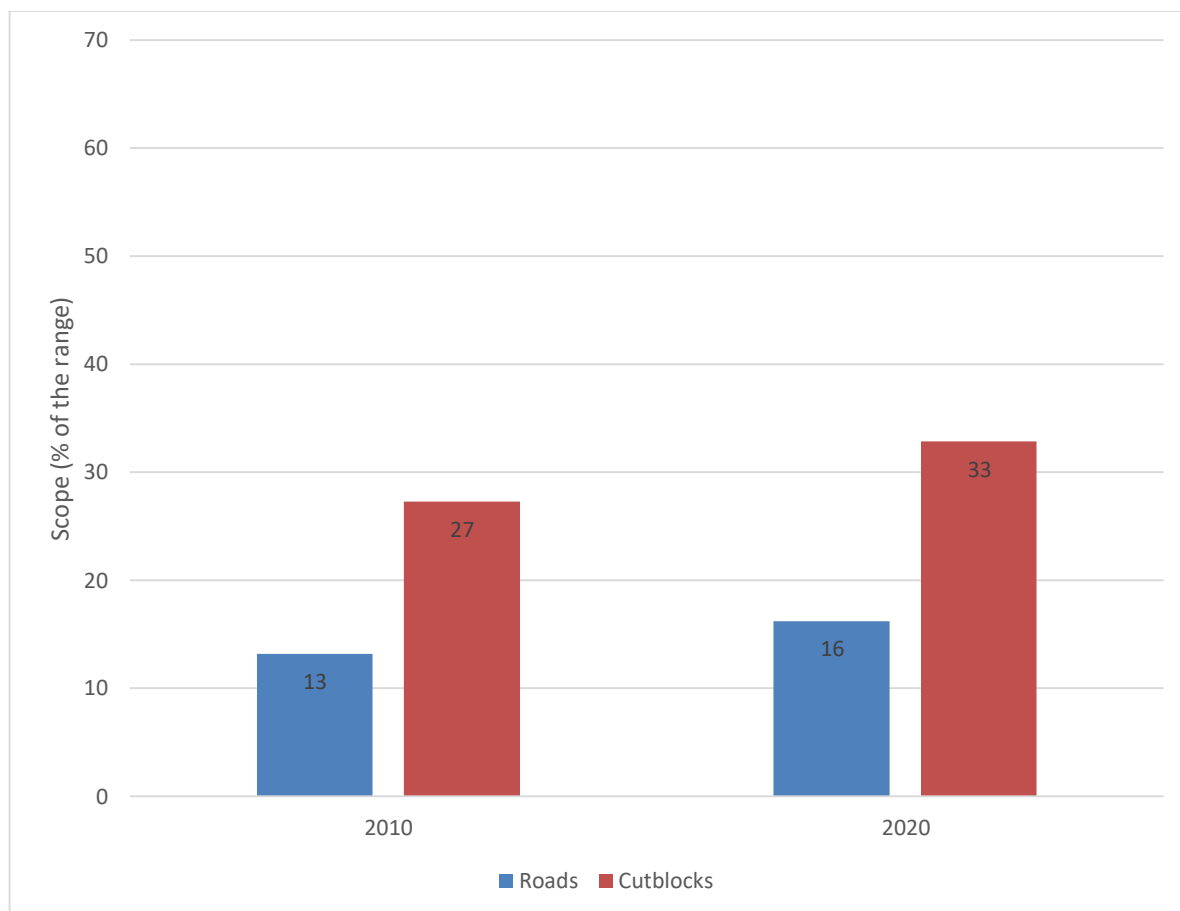


Figure E.4. Evolution of the scope of cutblocks (logging) and roads (road network) between 2010 and 2020 in the Assinica range (as identified by the MFFP [2021a]).

Table E.4. Evolution of the scope of cutblocks (logging) and roads (road network) between 2010 and 2020 in the Assinica range (as identified by the MFFP [2021a]).

Disturbance class ¹	2010		2020		Increase in area between 2010 and 2020 (km ²)	Increase in scope between 2010 and 2020 (%)
	Area ² (km ²)	Scope ³ (%)	Area ² (km ²)	Scope ³ (%)		
Cutblocks	19,323	27	23,281	33	3,959	6
Roads ^d	9,346	13	11,484	16	2,138	3

¹ See methodology described in EC (2011). The results do not take into account other disturbance classes present in the range.

² Areas include a 500 m buffer (non-overlapping; see methodology described in EC [2011] and Appendix C).

³ The scope corresponds to the proportion of the area of the range (70,875 km²) that is affected by the disturbance class.

⁴ This disturbance class is most likely underestimated, as explained in Appendix C.

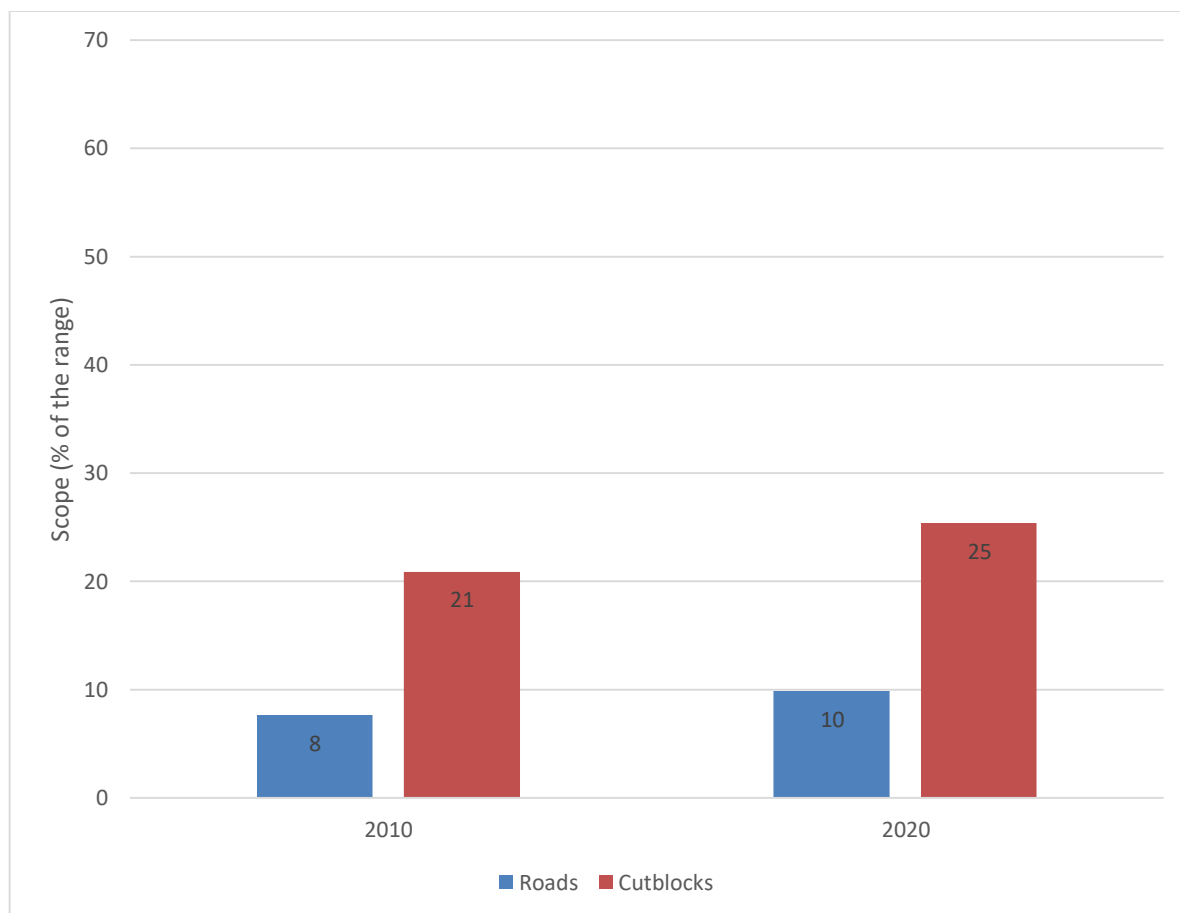


Figure E.5. Evolution of the scope of cutblocks (logging) and roads (road network) between 2010 and 2020 in the Témiscamie range (as identified by the MFFP [2021a]).

Table E.5. Evolution of the scope of cutblocks (logging) and roads (road network) between 2010 and 2020 in the Témiscamie range (as identified by the MFFP [2021a]).

Disturbance class ¹	2010		2020		Increase in area between 2010 and 2020 (km ²)	Increase in scope between 2010 and 2020 (%)
	Area ² (km ²)	Scope ³ (%)	Area ² (km ²)	Scope ³ (%)		
Cutblocks	21,985	21	26,723	25	4,738	4
Roads ⁴	8,054	8	10,395	10	2,341	2

¹ See methodology described in EC (2011). The results do not take into account other disturbance classes present in the range.

² Areas include a 500-m buffer (non-overlapping; see methodology described in EC [2011] and Appendix C).

³ The scope corresponds to the proportion of the area of the range (105,332 km²) that is affected by the disturbance class.

⁴ This disturbance class is most likely underestimated, as explained in Appendix C.

APPENDIX F. HABITAT CATEGORIES AFFECTED BY WORK PLANNED UNDER THE 2023-2024 PRANS IN THE VAL-D'OR, CHARLEVOIX AND PIPMUACAN RANGES

To determine how the activities planned in the 2023-2024 PRANs (logging and road construction) were likely to affect the biophysical attributes of critical habitat for boreal caribou, ECCC examined which habitat categories would be affected by the work. The Updated Ecoforestry Map (MFFP, 2023b) is a public dataset produced by the Quebec government that contains information on the different forest and ecological characteristics of Quebec's forest land, as well as on some relatively recent disturbances (e.g., logging). Some of these characteristics can be grouped into categories that are representative of the different types of habitats used, or not used, by boreal caribou within the ranges located in Quebec (Table F.1). Leblond *et al.* (2014a) carried out such an exercise by drawing on the knowledge of several experts on the species in Eastern Canada. According to them, mature forests (young and old), wetlands and lichen-rich environments represent quality habitats for the species. For the purposes of this analysis, polygons from the Updated Ecoforestry Map that matched the query criteria defining each of the habitat categories presented in Table F.1 were selected and grouped, following the methodology developed by Leblond *et al.* (2014a, b) and updated by Martin, Leblond and Trus (ECCC, unpublished data). The “Definitions” section provides a description of each⁴⁸ attribute code and value used in this table. For some habitat categories, several query strings were used to process the ecoforestry data, and the results were then merged to produce a single geographic information layer (for each habitat category). To ensure that only one habitat category was assigned to each polygon in the Updated Ecoforestry Map, the geographic information layers were created sequentially (see methodology detailed in Leblond *et al.*, 2014a, b).

Table F.1. Martin, Leblond and Trus (ECCC, unpublished data) queries used to select polygons from the Updated Ecoforestry Map (MFFP, 2023b) corresponding to the different habitat categories identified by Leblond *et al.* (2014a, b).

Habitat category ¹	Query (ATTRIBUTE CODE, value code)
Old mature forest	AN_ORIGINE = N/A ² & CL_AGE = (120, 12010, 12012, 12030, 12050, 12070, 12090, 90, 9010, 90120, 9030, 9050, 9070, 9090, VIN, VIR, VIN10, VIN30, VIN50, 110, 120JI, 120VI, 12JIN, 12VIN, 130, 90JIN, 90VIN, VIN12, VIN70, VIN90, VINJI, or VINVI) & TYPE_COUV = (M or R)
	CO_TER = (ILE or IL)
	AN_ORIGINE < (reference year ³ – 70) & TYPE_COUV = (M or R)
	AN_ORIGINE < (reference year – 70) & TYPE_COUV = N/A & CO_TER = N/A & TYPE_ECO = (ME13, ME16, MS12, MS20, MS20E, MS20P, MS21, MS22, MS22E, MS23, MS24, MS25, MS25E, MS26, MS40, MS42, MS61, MS62, MS71, RE10, RE11, RE11P, RE12, RE12P, RE13, RE14, RE15, RE16, RE20, RE20P, RE21, RE21P, RE22, RE22M, RE22P, RE23, RE24, RE24P, RE25, RE25P, RE25S, RE26, RE42, RS20, RS20P, RS20S, RS21, RS21P, RS22, RS22M, RS22P, RS23, RS24, RS25, RS25P, RS25S, RS26, RS37, RS38, RS39, RS40, or RS42)

⁴⁸ An attribute corresponds to a field in a database.

Habitat category ¹	Query (ATTRIBUTE CODE, value code)
	AN_ORIGINE = N/A & CL_AGE = (120, 12010, 12012, 12030, 12050, 12070, 12090, 90, 9010, 90120, 9030, 9050, 9070, 9090, VIN, VIR, VIN10, VIN30, VIN50, 110, 120JI, 120VI, 12JIN, 12VIN, 130, 90JIN, 90VIN, VIN12, VIN70, VIN90, VINJI, or VINVI) & TYPE_COUV = N/A & CO_TER = N/A & TYPE_ECO = (ME13, ME16, MS12, MS20, MS20E, MS20P, MS21, MS22, MS22E, MS23, MS24, MS25, MS25E, MS26, MS40, MS42, MS61, MS62, MS71, RE10, RE11, RE11P, RE12, RE12P, RE13, RE14, RE15, RE16, RE20, RE20P, RE21, RE21P, RE22, RE22M, RE22P, RE23, RE24, RE24P, RE25, RE25P, RE25S, RE26, RE42, RS20, RS20P, RS20S, RS21, RS21P, RS22, RS22M, RS22P, RS23, RS24, RS25, RS25P, RS25S, RS26, RS37, RS38, RS39, RS40, or RS42)
Young mature forest	AN_ORIGINE = N/A & CL_AGE = (50, 5010, 50120, 5030, 5050, 5070, 5090, 70, 7010, 70120, 7030, 7050, 7070, 7090, JIN, JIR, JIN10, JIN30, 50JIN, 50VIN, 70JIN, 70VIN, JIN12, JIN50, JIN70, JIN90, JINJI, or JINVI) & TYPE_COUV = (M or R)
	AN_ORIGINE < (reference year – 50) & AN_ORIGINE ≥ (reference year – 70) & TYPE_COUV = (M or R)
	AN_ORIGINE < (reference year – 50) & AN_ORIGINE ≥ (reference year – 70) & TYPE_COUV = N/A & CO_TER = N/A & TYPE_ECO = (ME13, ME16, MS12, MS20, MS20E, MS20P, MS21, MS22, MS22E, MS23, MS24, MS25, MS25E, MS26, MS40, MS42, MS61, MS62, MS71, RE10, RE11, RE11P, RE12, RE12P, RE13, RE14, RE15, RE16, RE20, RE20P, RE21, RE21P, RE22, RE22M, RE22P, RE23, RE24, RE24P, RE25, RE25P, RE25S, RE26, RE42, RS20, RS20P, RS20S, RS21, RS21P, RS22, RS22M, RS22P, RS23, RS24, RS25, RS25P, RS25S, RS26, RS37, RS38, RS39, RS40, or RS42)
	AN_ORIGINE = N/A & CL_AGE = (50, 5010, 50120, 5030, 5050, 5070, 5090, 70, 7010, 70120, 7030, 7050, 7070, 7090, JIN, JIR, JIN10, JIN30, 50JIN, 50VIN, 70JIN, 70VIN, JIN12, JIN50, JIN70, JIN90, JINJI, or JINVI) & TYPE_COUV = N/A & CO_TER = N/A & TYPE_ECO = (ME13, ME16, MS12, MS20, MS20E, MS20P, MS21, MS22, MS22E, MS23, MS24, MS25, MS25E, MS26, MS40, MS42, MS61, MS62, MS71, RE10, RE11, RE11P, RE12, RE12P, RE13, RE14, RE15, RE16, RE20, RE20P, RE21, RE21P, RE22, RE22M, RE22P, RE23, RE24, RE24P, RE25, RE25P, RE25S, RE26, RE42, RS20, RS20P, RS20S, RS21, RS21P, RS22, RS22M, RS22P, RS23, RS24, RS25, RS25P, RS25S, RS26, RS37, RS38, RS39, RS40, or RS42)
Wetlands	CO_TER = (AL, DH, or INO)
	AN_ORIGINE = N/A & CL_AGE = (120, 12012, 12030, 12050, 12070, 12090, 30, 30120, 3030, 3050, 3070, 3090, 50, 50120, 5030, 5050, 5070, 5090, 70, 70120, 7030, 7050, 7070, 7090, 90, 90120, 9030, 9050, 9070, 9090, JIN, JIR, VIN, VIR, JIN30, VIN30, VIN50, 110, 120JI, 120VI, 12JIN, 12VIN, 130, 30JIN, 30VIN, 50JIN, 50VIN, 70JIN, 70VIN, 90JIN, 90VIN, JIN12, JIN50, JIN70, JINJI, JINVI, VIN12, VIN70, VIN90, VINJI, or VINVI) & TYPE_COUV = N/A & CO_TER = N/A & TYPE_ECO = (MA18R, RE37, RE38, RE39, TO18, TOB9D, TOB9U, or TOF8U)
	AN_ORIGINE < (reference year – 20) & TYPE_COUV = N/A & CO_TER = N/A & TYPE_ECO = (MA18R, RE37, RE38, RE39, RS42, TO18, TOB9D, TOB9U, or TOF8U)
	AN_ORIGINE = N/A & CL_AGE = N/A & TYPE_COUV = N/A & CO_TER = N/A & TYPE_ECO = (MA18R, RE37, RE38, RE39, TO18, TOB9D, TOB9U, or TOF8U)
Lichen-rich environment	CO_TER = DS
	AN_ORIGINE < (reference year – 20) & TYPE_COUV = N/A & CO_TER = N/A & TYPE_ECO = (LA12C, LA20, LA20C, LA20P, LA22, LA40, LL20, or TA12)
	AN_ORIGINE = N/A & CL_AGE = (120, 12012, 12030, 12050, 12070, 12090, 30, 30120, 3030, 3050, 3070, 3090, 50, 50120, 5030, 5050, 5070, 5090, 70, 70120, 7030, 7050, 7070, 7090, 90, 90120, 9030, 9050, 9070, 9090, JIN, JIR, VIN, VIR, JIN30, VIN30, VIN50, 110, 120JI, 120VI, 12JIN, 12VIN, 130, 30JIN, 30VIN, 50JIN, 50VIN, 70JIN, 70VIN, 90JIN, 90VIN, JIN12, JIN50, JIN70, JINJI, JINVI, VIN12, VIN70, VIN90, VINJI, or VINVI) & TYPE_COUV = N/A & CO_TER = N/A & TYPE_ECO = (LA12C, LA20, LA20C, LA20P, LA22, LA40, LL20, or TA12)
	AN_ORIGINE = N/A & CL_AGE = N/A & TYPE_COUV = N/A & CO_TER = N/A & TYPE_ECO = (LA12C, LA20, LA20C, LA20P, LA22, LA40, LL20, or TA12)
Natural disturbance	AN_ORIGINE ≥ (reference year – 20) & ORIGINE = (BR, CHT, DT, ES, FR, or VER)

Habitat category ¹	Query (ATTRIBUTE CODE, value code)
	AN_ORIGINE = N/A & CL_AGE = (10, 10120, 1030, 1050, 1070, 1090, 12010, 3010, 5010, 7010, 9010, 1010, JIN10, VIN10, 10JIN, 10VIN, or JIN90) & ORIGINE = (BR, CHT, DT, ES, FR, or VER)
Young cutblock	AN_ORIGINE ≥ (reference year – 5) & ORIGINE = (CBA, CBT, CDV, CEF, CIF, CPE, CPH, CPR, CPT, CRB, CRR, CRS, CS, CT, ENS, ETR, P, PLN, PLR, PRR, REA, RPS, CPHRS, CPI_RL_F, CPPTM_DIS, CPPTM_U, CPRS_BA, CPRS_DA, CPRS_PA, CPRS_T, CPRS_U, CPR_U-F, CTSP_BA, CTSP_DA, CTSP_PA, CTSP_T, CTSP_U, PL, RECUP_C-T, RECUP_F-T, RECUP_I-T, or RECUP_M-T)
Old cutblock	AN_ORIGINE < (reference year – 5) & AN_ORIGINE ≥ (reference year – 20) & ORIGINE = (CBA, CBT, CDV, CEF, CIF, CPE, CPH, CPR, CPT, CRB, CRR, CRS, CS, CT, ENS, ETR, P, PLN, PLR, PRR, REA, RPS, CPHRS, CPI_RL_F, CPPTM_DIS, CPPTM_U, CPRS_BA, CPRS_DA, CPRS_PA, CPRS_T, CPRS_U, CPR_U-F, CTSP_BA, CTSP_DA, CTSP_PA, CTSP_T, CTSP_U, PL, RECUP_C-T, RECUP_F-T, RECUP_I-T, or RECUP_M-T)
Regenerating stand	AN_ORIGINE = N/A & CL_AGE = (1030, 12030, 30, 3010, 30120, 3030, 3050, 3070, 3090, 5030, 7030, 9030, JIN30, VIN30, 30JIN, or 30VIN) & TYPE_COUV = F
	AN_ORIGINE < (reference year – 20) & AN_ORIGINE ≥ (reference year – 50) & TYPE_COUV = F
	AN_ORIGINE < (reference year – 20) & AN_ORIGINE ≥ (reference year – 50) & TYPE_COUV = (M or R)
	AN_ORIGINE = N/A & CL_AGE = N/A & ORIGINE = (ENM, ENS, P, PLB, PLN, PLR, or PL) & TYPE_COUV = (F, M, or R)
	AN_ORIGINE = N/A & CL_AGE = N/A & ORIGINE = N/A & PERTURB = (RR, RRG, or RRR) & TYPE_COUV = (F, M, or R)
	AN_ORIGINE = N/A & CL_AGE = (10, 10120, 1030, 1050, 1070, 1090, 1010, 10JIN, or 10VIN) & ORIGINE = N/A & TYPE_COUV = (F, M, or R)
	AN_ORIGINE = N/A & CL_AGE = (10, 10120, 1030, 1050, 1070, 1090, 1010, 10JIN, or 10VIN) & ORIGINE = (CBA, ENS, or PRR) & TYPE_COUV = (F, M, or R)
AN_ORIGINE = N/A & CL_AGE = (30, 3010, 30120, 3030, 3050, 3070, 3090, 30JIN, or 30VIN) & TYPE_COUV = N/A & CO_TER = N/A & TYPE_ECO = (ME13, ME16, MS12, MS20, MS20E, MS20P, MS21, MS22, MS22E, MS23, MS24, MS25, MS25E, MS26, MS40, MS42, MS61, MS62, MS71, RE10, RE11, RE11P, RE12, RE12P, RE13, RE14, RE15, RE16, RE20, RE20P, RE21, RE21P, RE22, RE22M, RE22P, RE23, RE24, RE24P, RE25, RE25P, RE25S, RE26, RE42, RS20, RS20P, RS20S, RS21, RS21P, RS22, RS22M, RS22P, RS23, RS24, RS25, RS25P, RS25S, RS26, RS37, RS38, RS39, RS40, or RS42)	
AN_ORIGINE < (reference year – 20) & AN_ORIGINE ≥ (reference year – 50) & TYPE_COUV = N/A & CO_TER = N/A & TYPE_ECO = (ME13, ME16, MS12, MS20, MS20E, MS20P, MS21, MS22, MS22E, MS23, MS24, MS25, MS25E, MS26, MS40, MS42, MS61, MS62, MS71, RE10, RE11, RE11P, RE12, RE12P, RE13, RE14, RE15, RE16, RE20, RE20P, RE21, RE21P, RE22, RE22M, RE22P, RE23, RE24, RE24P, RE25, RE25P, RE25S, RE26, RE42, RS20, RS20P, RS20S, RS21, RS21P, RS22, RS22M, RS22P, RS23, RS24, RS25, RS25P, RS25S, RS26, RS37, RS38, RS39, RS40, or RS42)	

¹ The eight categories in the table do not include 100% of the area covered by the Updated Ecoforestry Map. The area not covered has been divided into two sub-categories: hydrography (CO_TER = WATER) and "other terrestrial environments", which include all the remaining area.

² "N/A" means that a polygon should not contain a value for a given attribute (equivalent to NULL).

³ The reference year has been set at 2021 (Martin, Leblond and Trus; ECCC; unpublished data).

Tables F.2, F.3 and F.4 show the proportion of the different habitat categories found within the ranges and within the areas targeted by planned work (logging and road

construction) under the 2023–2024 PRANs for the Val-d'Or, Charlevoix and Pipmuacan ranges, respectively. For the purposes of this analysis, the Assinica and Témiscamie ranges were not considered since only partial data from the 2023–2024 PRANs for these two ranges was available (see Question 1 in Part 3), and since data from the Updated Ecoforestry Mapping only covers the portion of territory south of the northern limit for commercial timber allocation. These tables show that areas of mature forest (young or old) account for the majority of habitats in which work is planned (without including a buffer). The other two suitable habitat categories for caribou, namely wetlands and lichen-rich environments, are not directly affected by the work planned under the 2023–2024 PRANs.

Mature forest stands (young and old) are habitats that possess the biophysical attributes of critical habitat for boreal caribou (see Appendix B). ECCC recognizes that some stands may have certain characteristics (e.g., old forest) sought by the species without having *all* the characteristics necessary to make them high-quality habitat for the species (e.g., the stands may be too small to allow caribou to spatially separate themselves from alternate prey and predators). In the herds covered by this analysis, these habitat patches nevertheless constitute critical habitat (see Part 1.7), and their destruction would further reduce the likelihood of the species' recovery. Before the work planned under the 2023–2024 PRANs was considered, the probability of stable or increasing growth (over a 20-year period) was assessed in 2020 as “Unlikely” for the Val-d'Or and Pipmuacan populations and “Very unlikely” for the Charlevoix population (see Table 2).

Table F.2. Representation of the different habitat categories in the Val-d'Or range, as well as in the areas targeted by the work planned under the 2023–2024 PRANs.

Habitat category	Representation within the range (8,202 km ²)		Representation in the areas targeted by logging and roads to be built under the 2023–2024 PRANs, without including a buffer (11 km ²) ¹	
	Area (km ²) ²	Proportion of reference area (see above; %)	Area (km ²) ²	Proportion of reference area (see above; %)
Old mature forest (> 70 years)	1,929	24	5	45
Young mature forest (50–70 years)	1,563	19	4	36
Wetlands	941	11	0	0
Lichen-rich environments	30	0	0	0
Natural disturbance	24	0	0	0
Young cutblock (< 5 years)	187	2	0	0
Old cutblock (5–20 years)	414	5	0	0
Regenerating stand (20–50 years)	1,729	21	0	0
Other terrestrial environments	432 ³	5	2	18
Hydrography	952	12	0	0

¹ For the purposes of this analysis, a width of 20 m was assigned to the roads (normally treated as linear features) so that their area could be calculated when a buffer was not applied. This width corresponds to the right-of-way of a class 5 multi-purpose road (MFFP, 2023c). Logging and roads to be built under the 2023–2024 PRANs have been combined to avoid double-counting of overlapping areas.

² The areas shown in this table have been rounded to the nearest unit. As a result, the sum of these areas may differ slightly from the actual total area. Similarly, the sum of the proportions may differ slightly from 100%.

³ The majority of this area (82%) is made up of hardwood stands.

Table F.3. Representation of the different habitat categories in the *Charlevoix* range (as identified by MFFP [2021a]), as well as in the areas targeted by the work planned under the 2023–2024 PRANs.

Habitat category	Representation within the range (7,248 km ²)		Representation in the areas targeted by logging and roads to be built under the 2023–2024 PRANs (56 km ²) ¹	
	Area (km ²) ²	Proportion of reference area (see above; %)	Area (km ²) ²	Proportion of reference area (see above; %)
Old mature forest (> 70 years)	1,451	20	16	29
Young mature forest (50–70 years)	2,450	34	35	63
Wetlands	183	3	0	0
Lichen-rich environments	31	0	0	0
Natural disturbance	5	0	0	0
Young cutblock (< 5 years)	172	2	0	0
Old cutblock (5–20 years)	530	7	0	0
Regenerating stand (20–50 years)	1,969	27	4	7
Other terrestrial environments	147 ³	2	1	2
Hydrography	309	4	0	0

¹ For the purposes of this analysis, a width of 20 m was assigned to the roads (normally treated as linear features) so that their area could be calculated when a buffer was not applied. This width corresponds to the right-of-way of a class 5 multi-purpose road (MFFP, 2023c). Logging and roads to be built under the 2023–2024 PRANs have been combined to avoid double-counting of overlapping areas.

² The areas shown in each of the entries in this table have been rounded to the nearest unit. As a result, the sum of these areas may differ slightly from the actual total area. Similarly, the sum of the proportions may differ slightly from 100%.

³ The majority of this area (64%) is made up of hardwood stands.

Table F.4. Representation of the different habitat categories in the *Pipmuacan* range, as well as in the areas targeted by the work planned under the 2023–2024 PRANs.

Habitat category	Representation within the range (18,432 km ²)		Representation in the areas targeted by logging and roads to be established under the 2023–2024 PRANs, without including a buffer (175 km ²) ¹	
	Area (km ²) ²	Proportion of reference area (see above; %)	Area (km ²) ²	Proportion of reference area (see above; %)
Old mature forest (> 70 years)	4,632	25	55	31
Young mature forest (50-70 years)	2,692	15	72	41
Wetlands	442	2	0	0
Lichen-rich environments	308	2	0	0
Natural disturbance	156	1	0	0
Young cutblock (< 5 years)	321	2	0	0
Old cutblock (5-20 years)	1,204	7	0	0
Regenerating stand (20-50 years)	5920	32	47	27
Other terrestrial environments	239 ³	1	1	1
Hydrography	2,516	14	0	0

¹ For the purposes of this analysis, a width of 20 m was assigned to the roads (normally treated as linear features) so that their area could be calculated when a buffer was not applied. This width corresponds to the right-of-way of a class 5 multi-purpose road (MFFP, 2023c). Logging and roads to be built under the 2023–2024 PRANs have been combined to avoid double-counting of overlapping areas.

² The areas shown in this table have been rounded to the nearest unit. As a result, the sum of these areas may differ slightly from the actual total area. Similarly, the sum of the proportions may differ slightly from 100%.

³ The majority of this area (75%) is made up of hardwood stands.

Definitions

The tables below⁴⁹ contain the value code definitions for each attribute used in this analysis. The information is taken from the *Fiche descriptive des attributs et de leurs domaines de valeurs* (MFFP, 2023d). The only attribute not considered in the following tables is “AN_ORIGINE”. This attribute has no predefined value. It is described as the year of the original disturbance.

Table F.5. Description of the value codes used in this analysis for the attribute ORIGINE (which identifies the original disturbance), according to the Updated Ecoforestry Map.

Code	Description
BR	Brûlis total [Total burn]
BRD	[Brûlage dirigé] Prescribed burn
BRU	[Brûlage dirigé] Prescribed burn
CBA	Coupe par bandes [Strip cutting]
CBT	Coupe par bandes finale [Final strip cutting]
CDV	Coupe avec protection des tiges à diamètre variable [Harvesting with protection of variable diameter stems]
CEF	Coupe d'ensemencement finale [Final seed cutting]
CHT	Chablis total [Total windfall]
CIF	Coupe progressive irrégulière phase finale [Irregular shelterwood system, final cutting]
CPE	Coupe progressive d'ensemencement (coupe finale) [Shelterwood seed cutting (final cutting)]
CPH	Coupe avec protection de la haute régénération et des sols [Harvesting with protection of tall regeneration and soils]
CPHRS	Coupe avec protection de la haute régénération et des sols [Harvesting with protection of tall regeneration and soils]
CPI_RL_F	Coupe progressive irrégulière à régénération lente phase finale [Irregular shelterwood system, slow regeneration, final cutting]
CPPTM_DIS	Coupe avec protection des petites tiges marchandes discontinue [Harvesting with protection of small merchantable stems, discontinuously distributed]
CPPTM_U	Coupe avec protection des petites tiges marchandes uniforme [Uniform harvesting with protection of small merchantable stems]
CPR	Coupe avec protection de la régénération [Cutting with protection of regeneration]
CPR_U-F	Coupe progressive régulière uniforme finale [Uniform regular shelterwood system, final cutting]
CPRS_BA	Coupe avec protection de la régénération et des sols par bandes [Strip cutting with protection of regeneration and soils]

⁴⁹ The tables are in French so that the information matches that in the *Fiche descriptive des attributs et de leurs domaines de valeurs* (MFFP, 2023d).

Code	Description
CPRS_DA	Coupe avec protection de la régénération et des sols en damier [Checkerboard cutting with protection of regeneration and soils]
CPRS_PA	Coupe avec protection de la régénération et des sols en parquets [Block cutting with protection of regeneration and soils]
CPRS_T	Coupe avec protection de la régénération et des sols par trouées [Patch cutting with protection of regeneration and soils]
CPRS_U	Coupe avec protection de la régénération et des sols uniforme [Uniform harvesting with protection of regeneration and soils]
CPT	Coupe avec protection des petites tiges marchandes et des sols [Harvesting with protection of small merchantable stems and soils]
CRB	Coupe de récupération dans un brûlis [Salvage cutting in a burned area]
CRR	Récolte des tiges résiduelles et des rebuts [Harvesting of residual stems and slash]
CRS	Coupe avec réserve de semencier [Seed-tree method]
CS	Coupe de succession [Succession cutting]
CT	Coupe totale [Clearcutting]
CTSP_BA	Coupe totale sans protection par bandes [Strip clearcutting without protection]
CTSP_DA	Coupe totale sans protection en damier [Checkerboard clearcutting without protection]
CTSP_PA	Coupe totale sans protection en parquets [Block clearcutting without protection]
CTSP_T	Coupe totale sans protection par trouées [Patch clearcutting without protection]
CTSP_U	Coupe totale sans protection uniforme [Uniform clearcutting without protection]
CTX	Ancienne coupe totale sans référence cartographique, dont l'année de réalisation [Past clearcut with no map reference, including year carried out]
DT	Dépérissement total [Complete dieback]
ENM	Ensemencement avec mini-serres [Seeding in mini-greenhouses]
ENS	Ensemencement [Seeding]
ES	Épidémie grave [Severe disease outbreak]
ETR	Élimination des tiges résiduelles [Removal of residual stems]
FR	Friche [Wildland]
P	Plantation [Plantation]
PL	Plantation [Plantation]
PLB	Plantation de boutures [Plantation of cuttings]
PLN	Plantation à racines nues [Bareroot plantation]
PLR	Plantation avec semis en récipients [Plantation of container seedlings]
PRR	Regarni de régénération pour constituer l'équivalent d'une plantation [Fill planting in areas of regeneration to establish the equivalent of a plantation]
REA	Régénération d'aire d'ébranchage [Regeneration of a lopping site]

Code	Description
RECUP_C-T	Coupe de récupération totale après chablis [Salvage clearcutting after windfall]
RECUP_F-T	Coupe de récupération totale après feu [Salvage clearcutting after fire]
RECUP_I-T	Coupe de récupération totale après épidémie d'insectes [Salvage clearcutting after an insect outbreak]
RECUP_M-T	Coupe de récupération totale après maladie [Salvage clearcutting after disease]
RIA	Régénération de site d'infrastructure abandonnée [Regeneration of an abandoned infrastructure site]
RPS	Récupération en vertu d'un plan spécial d'aménagement [Salvage operations under a special management plan]
VER	Verglas grave [Severe ice damage]

Table F.6. Description of the value codes used in this analysis for the CL_AGE attribute (which identifies the age class), according to the Updated Ecoforestry Map.

Code	Description
10	Peuplement équiennne : classe d'âge de 10 ans [Even-aged stand: 10-year age class]
30	Peuplement équiennne : classe d'âge de 30 ans [Even-aged stand: 30-year age class]
50	Peuplement équiennne : classe d'âge de 50 ans [Even-aged stand: 50-year age class]
70	Peuplement équiennne : classe d'âge de 70 ans [Even-aged stand: 70-year age class]
90	Peuplement équiennne : classe d'âge de 90 ans [Even-aged stand: 90-year age class]
110	Peuplement équiennne : classe d'âge de 110 ans [Even-aged stand: 110-year age class]
120	Peuplement équiennne : classe d'âge de 120 ans [Even-aged stand: 120-year age class]
130	Peuplement équiennne : classe d'âge de 130 ans [Even-aged stand: 130-year age class]
1010	Peuplement étagé : classes d'âge de 10 ans et 10 ans [Multi-layered stand: 10-year and 10-year age classes]
1030	Peuplement étagé : classes d'âge de 10 ans et 30 ans [Multi-layered stand: 10-year and 30-year age classes]
1050	Peuplement étagé : classes d'âge de 10 ans et 50 ans [Multi-layered stand: 10-year and 50-year age classes]
1070	Peuplement étagé : classes d'âge de 10 ans et 70 ans [Multi-layered stand: 10-year and 70-year age classes]
1090	Peuplement étagé : classes d'âge de 10 ans et 90 ans [Multi-layered stand: 10-year and 90-year age classes]
3010	Peuplement étagé : classes d'âge de 30 ans et 10 ans [Multi-layered stand: 30-year and 10-year age classes]
3030	Peuplement étagé : classes d'âge de 30 ans et 30 ans [Multi-layered stand: 30-year and 30-year age classes]
3050	Peuplement étagé : classes d'âge de 30 ans et 50 ans [Multi-layered stand: 30-year and 50-year age classes]
3070	Peuplement étagé : classes d'âge de 30 ans et 70 ans [Multi-layered stand: 30-year and 70-year age classes]
3090	Peuplement étagé : classes d'âge de 30 ans et 90 ans [Multi-layered stand: 30-year and 90-year age classes]
5010	Peuplement étagé : classes d'âge de 50 ans et 10 ans [Multi-layered stand: 50-year and 10-year age classes]
5030	Peuplement étagé : classes d'âge de 50 ans et 30 ans [Multi-layered stand: 50-year and 30-year age classes]
5050	Peuplement étagé : classes d'âge de 50 ans et 50 ans [Multi-layered stand: 50-year and 50-year age classes]
5070	Peuplement étagé : classes d'âge de 50 ans et 70 ans [Multi-layered stand: 50-year and 70-year age classes]

Code	Description
5090	Peuplement étagé : classes d'âge de 50 ans et 90 ans [Multi-layered stand: 50-year and 90-year age classes]
7010	Peuplement étagé : classes d'âge de 70 ans et 10 ans [Multi-layered stand: 70-year and 10-year age classes]
7030	Peuplement étagé : classes d'âge de 70 ans et 30 ans [Multi-layered stand: 70-year and 30-year age classes]
7050	Peuplement étagé : classes d'âge de 70 ans et 50 ans [Multi-layered stand: 70-year and 50-year age classes]
7070	Peuplement étagé : classes d'âge de 70 ans et 70 ans [Multi-layered stand: 70-year and 70-year age classes]
7090	Peuplement étagé : classes d'âge de 70 ans et 90 ans [Multi-layered stand: 70-year and 90-year age classes]
9010	Peuplement étagé : classes d'âge de 90 ans et 10 ans [Multi-layered stand: 90-year and 10-year age classes]
9030	Peuplement étagé : classes d'âge de 90 ans et 30 ans [Multi-layered stand: 90-year and 30-year age classes]
9050	Peuplement étagé : classes d'âge de 90 ans et 50 ans [Multi-layered stand: 90-year and 50-year age classes]
9070	Peuplement étagé : classes d'âge de 90 ans et 70 ans [Multi-layered stand: 90-year and 70-year age classes]
9090	Peuplement étagé : classes d'âge de 90 ans et 90 ans [Multi-layered stand: 90-year and 90-year age classes]
10120	Peuplement étagé : classes d'âge de 10 ans et 120 ans [Multi-layered stand: 10-year and 120-year age classes]
12010	Peuplement étagé : classes d'âge de 120 ans et 10 ans [Multi-layered stand: 120-year and 10-year age classes]
12012	Peuplement étagé : classes d'âge de 120 ans et 120 ans [Multi-layered stand: 120-year and 120-year age classes]
12030	Peuplement étagé : classes d'âge de 120 ans et 30 ans [Multi-layered stand: 120-year and 30-year age classes]
12050	Peuplement étagé : classes d'âge de 120 ans et 50 ans [Multi-layered stand: 120-year and 50-year age classes]
12070	Peuplement étagé : classes d'âge de 120 ans et 70 ans [Multi-layered stand: 120-year and 70-year age classes]
12090	Peuplement étagé : classes d'âge de 120 ans et 90 ans [Multi-layered stand: 120-year and 90-year age classes]
30120	Peuplement étagé : classes d'âge de 30 ans et 120 ans [Multi-layered stand: 30-year and 120-year age classes]
50120	Peuplement étagé : classes d'âge de 50 ans et 120 ans [Multi-layered stand: 50-year and 120-year age classes]
70120	Peuplement étagé : classes d'âge de 70 ans et 120 ans [Multi-layered stand: 70-year and 120-year age classes]

Code	Description
90120	Peuplement étagé : classes d'âge de 90 ans et 120 ans [Multi-layered stand: 90-year and 120-year age classes]
10JIN	Peuplement biétagé : Classes d'âge de 10 ans et jeune peuplement inéquienne [Two-layered stand: 10-year age class and young, uneven-aged stand]
10VIN	Peuplement biétagé : Classes d'âge de 10 ans et vieux peuplement inéquienne [Two-layered stand: 10-year age class and old-growth, uneven-aged stand]
120JI	Peuplement étagé : Classe d'âge de 120 ans et jeune peuplement inéquienne [Multi-layered stand: 120-year age class and young, uneven-aged stand]
120VI	Peuplement étagé : Classe d'âge de 120 ans et vieux peuplement inéquienne [Multi-layered stand: 120-year age class and old-growth, uneven-aged stand]
12JIN	Peuplement étagé : Classe d'âge de 120 ans et jeune peuplement inéquienne [Multi-layered stand: 120-year age class and young, uneven-aged stand]
12VIN	Peuplement étagé : Classe d'âge de 120 ans et vieux peuplement inéquienne [Multi-layered stand: 120-year age class and old-growth, uneven-aged stand]
30JIN	Peuplement biétagé : Classes d'âge de 30 ans et jeune peuplement inéquienne [Two-layered stand: 30-year age class and young, uneven-aged stand]
30VIN	Peuplement biétagé : Classes d'âge de 30 ans et vieux peuplement inéquienne [Two-layered stand: 30-year age class and old-growth, uneven-aged stand]
50JIN	Peuplement biétagé : Classes d'âge de 50 ans et jeune peuplement inéquienne [Two-layered stand: 50-year age class and young, uneven-aged stand]
50VIN	Peuplement biétagé : Classes d'âge de 50 ans et vieux peuplement inéquienne [Two-layered stand: 50-year age class and old-growth, uneven-aged stand]
70JIN	Peuplement étagé : Classe d'âge de 70 ans et jeune peuplement inéquienne [Multi-layered stand: 70-year age class and young, uneven-aged stand]
70VIN	Peuplement biétagé : Classes d'âge de 70 ans et vieux peuplement inéquienne [Two-layered stand: 70-year age class and old-growth, uneven-aged stand]
90JIN	Peuplement étagé : Classe d'âge de 90 ans et jeune peuplement inéquienne [Multi-layered stand: 90-year age class and young, uneven-aged stand]
90VIN	Peuplement biétagé : Classes d'âge de 90 ans et vieux peuplement inéquienne [Two-layered stand: 90-year age class and old-growth, uneven-aged stand]
JIN	Jeune peuplement inéquienne [Young, uneven-aged stand]
JIN10	Peuplement étagé : Jeune peuplement inéquienne et 10 ans [Multi-layered stand: Young, uneven-aged stand and 10-year age class]
JIN12	Peuplement biétagé : Jeune peuplement inéquienne et 120 ans [Two-layered stand: Young, uneven-aged stand and 120-year age class]
JIN30	Peuplement étagé : Jeune peuplement inéquienne et 30 ans [Multi-layered stand: Young, uneven-aged stand and 30-year age class]
JIN50	Peuplement étagé : Jeune peuplement inéquienne et 50 ans [Multi-layered stand: Young, even-aged stand and 50-year age class]
JIN70	Peuplement biétagé : Jeune peuplement inéquienne et 70 ans [Two-layered stand: Young, uneven-aged stand and 70-year age class]

Code	Description
JIN90	Peuplement biétagé : Jeune peuplement inéquienne et 10 ans [Two-layered stand: Young, uneven-aged stand and 10-year age class]
JINJI	Peuplement étagé : Jeune peuplement équienne et jeune peuplement équienne [Multi-layered stand: Young, even-aged stand and young, even-aged stand]
JINVI	Peuplement étagé : Jeune peuplement inéquienne et jeune peuplement inéquienne [Two-layered stand: Young, uneven-aged stand and young, uneven-aged stand]
JIR	Jeune peuplement irrégulier dont l'origine remonte à moins de 80 ans [Young irregular stand less than 80 years old]
VIN	Vieux peuplement inéquienne [Old-growth, uneven-aged stand]
VIN10	Peuplement étagé : Vieux peuplement inéquienne et 10 ans [Multi-layered stand: Old-growth, uneven-aged stand and 10-year age class]
VIN12	Peuplement étagé : Vieux peuplement inéquienne et 120 ans [Multi-layered stand: Old-growth, uneven-aged stand and 120-year age class]
VIN30	Peuplement étagé : Vieux peuplement inéquienne et 30 ans [Multi-layered stand: Old-growth, uneven-aged stand and 30-year age class]
VIN50	Peuplement étagé : Vieux peuplement inéquienne et 50 ans [Multi-layered stand: Old-growth, uneven-aged stand and 50-year age class]
VIN70	Peuplement étagé : Vieux peuplement équienne et classe d'âge de 70 ans [Multi-layered stand: Old-growth, even-aged stand and 70-year age class]
VIN90	Peuplement étagé : Vieux peuplement équienne et classe d'âge de 90 ans [Multi-layered stand: Old-growth, even-aged stand and 90-year age class]
VINJI	Peuplement étagé : Vieux peuplement équienne et jeune peuplement équienne [Multi-layered stand: Old-growth, even-aged stand and young, even-aged stand]
VINVI	Peuplement biétagé : Vieux peuplement inéquienne et vieux peuplement inéquienne [Two-layered stand: Old-growth, uneven-aged stand and young, uneven-aged stand]
VIR	Vieux peuplement irrégulier dont l'origine remonte à plus de 80 ans [Old-growth irregular stand more than 80 years old]

Table F.7. Description of the value codes used in this analysis for the TYPE_COUV attribute (which identifies the major cover type), according to the Updated Ecoforestry Map.

Code	Description
F	Feuillu [Hardwood]
M	Mixte [Mixed]
R	Résineux [Softwood]

Table F.8. Description of the value codes used in this analysis for the CO_TER attribute (which identifies the terrain code), according to the Updated Ecoforestry Map.

Code	Description
AL	Aulnaie [Alder thicket]
DH	Dénudé humide [Wet barren area]
DS	Dénudé sec [Dry barren area]
IL	Ile boisée de 2 ha et moins [Treed island of 2 h or less]
ILE	Ile superficie < 1 ha [Island less than 1 ha]
INO	Site inondé, site exondé non régénéré [Flooded site, exposed site, non-regenerated]
EAU	Étendue d'eau [Water body]

Table F.9. Description of the value codes used in this analysis for the TYPE_ECO attribute (which identifies the ecological type), according to the Updated Ecoforestry Map.

Code	Description
LA12C	Lande à lichens (ou à mousses) sur dépôt minéral de mince à épais, de texture moyenne, de drainage mésique, arboré (espèces arborescentes (> 4 m) entre 1 à 10 % de couvert) [Lichen (or moss) barren, thin to thick mineral deposits, medium soil texture, mesic drainage, treed (tree species > 4 m, between 1% and 10% cover)]
LA20	Lande arbustive sur dépôt très mince, de texture variée, de drainage de xérique à hydrique [Shrub barren, very thin deposits, variable soil texture, xeric to hydric drainage]
LA20C	Lande arbustive sur dépôt très mince, de texture variée, de drainage de xérique à hydrique, arboré (espèces arborescentes (> 4 m) entre 1 à 10 % de couvert) [Shrub barren, very thin deposits, variable soil texture, xeric to hydric drainage, treed (tree species > 4 m, between 1% and 10% cover)]
LA20P	Lande arbustive sur dépôt minéral de mince à épais, de drainage de xérique à hydrique, terrain très pierreux (plus de 80 % de pierrosité) [Shrub barren, thin to thick mineral deposits, xeric to hydric drainage, very stony land (stoniness of over 80%)]
LA22	Lande arbustive sur dépôt minéral de mince à épais, de texture moyenne, de drainage mésique [Shrub barren, thin to thick mineral deposits, medium soil texture, mesic drainage]

Code	Description
LA40	Lande rocheuse sur dépôt très mince, de texture variée, de drainage de xérique à hydrique [Rock barren, very thin deposits, variable soil texture, xeric to hydric drainage]
LL20	Lande alpine arbustive sur dépôt très mince, de texture variée, de drainage de xérique à hydrique [Alpine shrub barren, very thin deposits, variable soil texture, xeric to hydric drainage]
MA18R	Marais ou marécage arbustif, d'eau douce, sur dépôt organique ou minéral de mince à épais, de drainage hydrique, minérotrophe, riverain (en bordure d'un cours d'eau ou d'un lac) [Marsh or shrub swamp, freshwater, thin to thick organic or mineral deposits, hydric drainage, minerotrophic, riparian (located at the edge of a water body or lake)]
ME13	Pessière noire à peuplier faux-tremble sur dépôt de mince à épais, de texture fine et de drainage mésique [Black spruce–trembling aspen stand, thin to thick deposits, fine soil texture, mesic drainage]
ME16	Pessière noire à peuplier faux-tremble sur dépôt de mince à épais, de texture fine et de drainage subhydrique [Black spruce–trembling aspen stand, thin to thick deposits, fine soil texture, sub-hydric drainage]
MS12	Sapinière à bouleau jaune sur dépôt de mince à épais, de texture moyenne et de drainage mésique [Balsam fir–yellow birch stand, thin to thick deposits, medium soil texture, mesic drainage]
MS20	Sapinière à bouleau blanc sur dépôt très mince, de texture variée et au drainage de xérique à hydrique [Balsam fir–white birch stand, very thin deposits, variable soil texture, xeric to hydric drainage]
MS20E	Sapinière à bouleau blanc sur dépôt très mince, de texture variée et au drainage de xérique à hydrique, d'altitude élevée [Balsam fir–white birch stand, very thin deposits, variable soil texture, xeric to hydric drainage, high elevation]
MS20P	Sapinière à bouleau blanc sur dépôt très mince, de texture variée et de drainage de xérique à hydrique, terrain très pierreux (plus de 80 % de pierrosité) [Balsam fir–white birch stand, very thin deposits, variable soil texture, xeric to hydric drainage, very stony land (stoniness over 80%)]
MS21	Sapinière à bouleau blanc sur dépôt de mince à épais, de texture grossière et de drainage xérique ou mésique [Balsam fir–white birch stand, thin to thick deposits, coarse soil texture, xeric or mesic drainage]
MS22	Sapinière à bouleau blanc sur dépôt de mince à épais, de texture moyenne et de drainage mésique [Balsam fir–white birch stand, thin to thick deposits, medium soil texture, mesic drainage]
MS22E	Sapinière à bouleau blanc sur dépôt minéral de mince à épais, de texture moyenne, de drainage mésique, d'altitude élevée [Balsam fir–white birch stand, thin to thick mineral deposits, medium soil texture, mesic drainage, high elevation]
MS23	Sapinière à bouleau blanc sur dépôt de mince à épais, de texture fine et de drainage mésique [Balsam fir–white birch stand, thin to thick deposits, fine soil texture, mesic drainage]
MS24	Sapinière à bouleau blanc sur dépôt de mince à épais, de texture grossière et de drainage subhydrique [Balsam fir–white birch stand, thin to thick deposits, coarse soil texture, sub-hydric drainage]

Code	Description
MS25	Sapinière à bouleau blanc sur dépôt de mince à épais, de texture moyenne et de drainage subhydrique [Balsam fir–white birch stand, thin to thick deposits, medium soil texture, sub-hydric drainage]
MS25E	Sapinière à bouleau blanc sur dépôt minéral de mince à épais, de texture moyenne, de drainage subhydrique, d'altitude élevée [Balsam fir–white birch stand, thin to thick mineral deposits, medium soil texture, sub-hydric drainage, high elevation]
MS26	Sapinière à bouleau blanc sur dépôt de mince à épais, de texture fine et de drainage subhydrique [Balsam fir–white birch stand, thin to thick deposits, fine soil texture, sub-hydric drainage]
MS40	Sapinière à bouleau blanc montagnarde sur dépôt très mince, de texture variée et au drainage de xérique à hydrique [Montane balsam fir–white birch stand, very thin deposits, variable soil texture, xeric to hydric drainage]
MS42	Sapinière à bouleau blanc montagnarde sur dépôt de mince à épais, de texture moyenne et de drainage mésique [Montane balsam fir–white birch stand, thin to thick deposits, medium soil texture, mesic drainage]
MS61	Sapinière à érable rouge sur dépôt de mince à épais, de texture grossière et de drainage xérique ou mésique [Balsam fir–red maple stand, thin to thick deposits, coarse soil texture, xeric or mesic drainage]
MS62	Sapinière à érable rouge sur dépôt de mince à épais, de texture moyenne et de drainage mésique [Balsam fir–red maple stand, thin to thick deposits, medium soil texture, mesic drainage]
MS71	Sapinière à bouleau blanc maritime sur dépôt de mince à épais, de texture grossière et de drainage xérique ou mésique [Maritime balsam fir–white birch stand, thin to thick deposits, coarse soil texture, xeric or mesic drainage]
RE10	Pessière noire à lichens sur dépôt très mince, de texture variée, de drainage de xérique à hydrique [Black spruce–lichen stand, very thin deposits, variable soil texture, xeric to hydric drainage]
RE11	Pessière noire à lichens sur dépôt minéral de mince à épais, de texture grossière, de drainage xérique ou mésique [Black spruce–lichen stand, thin to thick mineral deposits, coarse soil texture, xeric or mesic drainage]
RE11P	Pessière noire à lichens sur dépôt de mince à épais, de texture grossière et de drainage xérique ou mésique, terrain très pierreux (plus de 80 % de pierrosité) [Black spruce–lichen stand, thin to thick deposits, coarse soil texture, xeric or mesic drainage, very stony land (stoniness over 80%)]
RE12	Pessière noire à lichens sur dépôt minéral de mince à épais, de texture moyenne, de drainage mésique [Black spruce–lichen stand, thin to thick mineral deposits, medium soil texture, mesic drainage]
RE12P	Pessière noire à lichens sur dépôt minéral de mince à épais, de texture moyenne, de drainage mésique, terrain très pierreux (plus de 80 % de pierrosité) [Black spruce–lichen stand, thin to thick mineral deposits, medium soil texture, mesic drainage, very stony land (stoniness over 80%)]
RE13	Pessière noire à lichens sur dépôt minéral de mince à épais, de texture fine, de drainage mésique [Black spruce–lichen stand, thin to thick mineral deposits, fine soil texture, mesic drainage]

Code	Description
RE14	Pessière noire à lichens sur dépôt minéral de mince à épais, de texture grossière, de drainage subhydrique [Black spruce–lichen stand, thin to thick mineral deposits, coarse soil texture, sub-hydric drainage]
RE15	Pessière noire à lichens sur dépôt minéral de mince à épais, de texture moyenne, de drainage subhydrique [Black spruce–lichen stand, thin to thick mineral deposits, medium soil texture, sub-hydric drainage]
RE16	Pessière noire à lichens sur dépôt minéral de mince à épais, de texture fine, de drainage subhydrique [Black spruce–lichen stand, thin to thick mineral deposits, fine soil texture, sub-hydric drainage]
RE20	Pessière noire à mousses ou à éricacées sur dépôt très mince, de texture variée, de drainage de xérique à hydrique [Black spruce–moss or black spruce–heath stand, very thin deposits, variable soil texture, xeric to hydric drainage]
RE20P	Pessière noire à mousses ou à éricacées sur dépôt minéral de mince à épais, de drainage de xérique à hydrique, très pierreux sans matrice [Black spruce–moss or black spruce–heath stand, thin to thick mineral deposits, xeric to hydric drainage, very stony without matrix]
RE21	Pessière noire à mousses ou à éricacées sur dépôt minéral de mince à épais, de texture grossière, de drainage xérique ou mésique [Black spruce–moss or black spruce–heath stand, thin to thick mineral deposits, coarse soil texture, xeric or mesic drainage]
RE21P	Pessière noire à mousses ou à éricacées sur dépôt de mince à épais, de texture grossière et de drainage xérique ou mésique, terrain très pierreux (plus de 80 % de pierrosité) [Black spruce–moss or black spruce–heath stand, thin to thick deposits, coarse soil texture, xeric or mesic drainage, very stony land (stoniness over 80%)]
RE22	Pessière noire à mousses ou à éricacées sur dépôt minéral de mince à épais, de texture moyenne, de drainage mésique [Black spruce–moss or black spruce–heath stand, thin to thick mineral deposits, medium soil texture, mesic drainage]
RE22M	Pessière noire à mousses ou à éricacées sur dépôt de mince à épais, de texture moyenne et de drainage mésique, situation topographique de mi-pente [Black spruce–moss or black spruce–heath stand, thin to thick deposits, medium soil texture, mesic drainage, mid-slope topographic position]
RE22P	Pessière noire à mousses ou à éricacées sur dépôt de mince à épais, de texture moyenne et de drainage mésique, terrain très pierreux (plus de 80 % de pierrosité) [Black spruce–moss or black spruce–heath stand, thin to thick deposits, medium soil texture, mesic drainage, very stony land (stoniness over 80%)]
RE23	Pessière noire à mousses ou à éricacées sur dépôt minéral de mince à épais, de texture fine, de drainage mésique [Black spruce–moss or black spruce–heath stand, thin to thick mineral deposits, fine soil texture, mesic drainage]
RE24	Pessière noire à mousses ou à éricacées sur dépôt minéral de mince à épais, de texture grossière, de drainage subhydrique [Black spruce–moss or black spruce–heath stand, thin to thick mineral deposits, coarse soil texture, sub-hydric drainage]
RE24P	Pessière noire à mousses ou à éricacées sur dépôt de mince à épais, de texture grossière et de drainage subhydrique, terrain très pierreux (plus de 80 % de pierrosité) [Black spruce–moss or black spruce–heath stand, thin to thick deposits, coarse soil texture, sub-hydric drainage, very stony land (stoniness over 80%)]

Code	Description
RE25	Pessière noire à mousses ou à éricacées sur dépôt minéral de mince à épais, de texture moyenne, de drainage subhydrique [Black spruce–moss or black spruce–heath stand, thin to thick mineral deposits, medium soil texture, sub-hydric drainage]
RE25P	Pessière noire à mousses ou à éricacées sur dépôt de mince à épais, de texture moyenne et de drainage subhydrique, terrain très pierreux (plus de 80 % de pierrosité) [Black spruce–moss or black spruce–heath stand, thin to thick deposits, medium soil texture, sub-hydric drainage, very stony land (stoniness over 80%)]
RE25S	Pessière noire à mousses ou à éricacées sur dépôt de mince à épais, de texture moyenne et de drainage subhydrique, situation topographique favorisant la présence de drainage latéral (seepage) [Black spruce–moss or black spruce–heath stand, thin to thick deposits, medium soil texture, sub-hydric drainage, topographic position that favours lateral drainage (seepage)]
RE26	Pessière noire à mousses ou à éricacées sur dépôt de mince à épais, de texture fine et de drainage subhydrique [Black spruce–moss or black spruce–heath stand, thin to thick deposits, fine soil texture, sub-hydric drainage]
RE37	Pessière noire à sphaignes sur dépôt minéral de mince à épais, de drainage hydrique, ombrotrophe [Black spruce–sphagnum moss stand, thin to thick mineral deposits, hydric drainage, ombrotrophic]
RE38	Pessière noire à sphaignes sur dépôt organique ou minéral, de mince à épais, de drainage hydrique, minérotrophe [Black spruce–sphagnum moss stand, thin to thick organic or mineral deposits, hydric drainage, minerotrophic]
RE39	Pessière noire à sphaignes sur dépôt organique de mince à épais, de drainage hydrique, ombrotrophe [Black spruce–sphagnum moss stand, thin to thick organic deposits, hydric drainage, ombrotrophic]
RE42	Pessière noire à mousses ou à éricacées montagnarde sur dépôt minéral de mince à épais, de texture moyenne, de drainage mésique [Montane black spruce–moss or black spruce–heath stand, thin to thick mineral deposits, medium soil texture, mesic drainage]
RI14	Rive sur dépôt minéral de mince à épais, de texture grossière, de drainage subhydrique [Shoreline, thin to thick mineral deposits, coarse soil texture, sub-hydric drainage]
RS20	Sapinière à épinette noire sur dépôt très mince, de texture variée, de drainage de xérique à hydrique [Balsam fir–black spruce stand, very thin deposits, variable soil texture, xeric to hydric drainage]
RS20P	Sapinière à épinette noire sur dépôt très mince, de texture variée et au drainage de xérique à hydrique, terrain très pierreux (plus de 80 % de pierrosité) [Balsam fir–black spruce stand, very thin deposits, variable soil texture, xeric to hydric drainage, very stony land (stoniness over 80%)]
RS20S	Sapinière à épinette noire sur dépôt très mince, de texture variée et au drainage de xérique à hydrique, situation topographique favorisant la présence de drainage latéral (seepage) [Balsam fir–black spruce stand, very thin deposits, variable soil texture, xeric to hydric drainage, topographic position that favours lateral drainage (seepage)]
RS21	Sapinière à épinette noire sur dépôt minéral de mince à épais, de texture grossière, de drainage xérique ou mésique [Balsam fir–black spruce stand, thin to thick mineral deposits, coarse soil texture, xeric or mesic drainage]

Code	Description
RS21P	Sapinière à épinette noire sur dépôt de mince à épais, de texture grossière et de drainage xérique ou mésique, terrain très pierreux (plus de 80 % de pierrosité) [Balsam fir–black spruce stand, thin to thick deposits, coarse soil texture, xeric or mesic drainage, very stony land (stoniness over 80%)]
RS22	Sapinière à épinette noire sur dépôt minéral de mince à épais, de texture moyenne, de drainage mésique [Balsam fir–black spruce stand, thin to thick mineral deposits, medium soil texture, mesic drainage]
RS22M	Sapinière à épinette noire sur dépôt minéral de mince à épais, de texture moyenne, de drainage mésique, situation topographique de mi-pente [Balsam fir–black spruce stand, thin to thick mineral deposits, medium soil texture, mesic drainage, mid-slope topographic position]
RS22P	Sapinière à épinette noire sur dépôt de mince à épais, de texture moyenne et de drainage mésique, terrain très pierreux (plus de 80 % de pierrosité) [Balsam fir–black spruce stand, thin to thick deposits, medium soil texture, mesic drainage, very stony land (stoniness over 80%)]
RS23	Sapinière à épinette noire sur dépôt minéral de mince à épais, de texture fine, de drainage mésique [Balsam fir–black spruce stand, thin to thick mineral deposits, fine soil texture, mesic drainage]
RS24	Sapinière à épinette noire sur dépôt minéral de mince à épais, de texture grossière, de drainage subhydrique [Balsam fir–black spruce stand, thin to thick mineral deposits, coarse soil texture, sub-hydric drainage]
RS25	Sapinière à épinette noire sur dépôt minéral de mince à épais, de texture moyenne, de drainage subhydrique [Balsam fir–black spruce stand, thin to thick mineral deposits, medium soil texture, sub-hydric drainage]
RS25P	Sapinière à épinette noire sur dépôt de mince à épais, de texture moyenne et de drainage subhydrique, terrain très pierreux (plus de 80 % de pierrosité) [Balsam fir–black spruce stand, thin to thick deposits, medium soil texture, sub-hydric drainage, very stony land (stoniness over 80%)]
RS25S	Sapinière à épinette noire sur dépôt minéral de mince à épais, de texture moyenne, de drainage subhydrique, situation topographique favorisant la présence de drainage latéral (seepage) [Balsam fir–black spruce stand, thin to thick mineral deposits, medium soil texture, sub-hydric drainage, topographic position that favours lateral drainage (seepage)]
RS26	Sapinière à épinette noire sur dépôt minéral de mince à épais, de texture fine, de drainage subhydrique [Balsam fir–black spruce stand, thin to thick mineral deposits, fine soil texture, sub-hydric drainage]
RS37	Sapinière à épinette noire et sphaignes sur dépôt minéral de mince à épais, de drainage hydrique, ombrotrophe [Balsam fir stand with black spruce and sphagnum moss, thin to thick mineral deposits, hydric drainage, ombrotrophic]
RS38	Sapinière à épinette noire et sphaignes sur dépôt organique ou minéral, de mince à épais, de drainage hydrique, minerotrophe [Balsam fir stand with black spruce and sphagnum moss, thin to thick organic or mineral deposits, hydric drainage, minerotrophic]
RS39	Sapinière à épinette noire et sphaignes sur dépôt organique de mince à épais, de drainage hydrique, ombrotrophe [Balsam fir stand with black spruce and sphagnum moss, thin to thick organic deposits, hydric drainage, ombrotrophic]

Code	Description
RS40	Sapinière à épinette noire montagnarde sur dépôt très mince, de texture variée, de drainage de xérique à hydrique [Montane balsam fir–black spruce stand, very thin deposits, variable soil texture, xeric to hydric drainage]
RS42	Sapinière à épinette noire montagnarde sur dépôt minéral de mince à épais, de texture moyenne, de drainage mésique [Montane balsam fir–black spruce stand, thin to thick mineral deposits, medium soil texture, mesic drainage]
TA12	Toundra alpine à lichens sur dépôt de mince à épais, de texture moyenne et de drainage mésique [Alpine tundra with lichens, thin to thick deposits, medium soil texture, mesic drainage]
TO18	Tourbière non boisée sur dépôt minéral ou organique, de drainage hydrique, minérotrophe [Non-forested peatland, mineral or organic deposits, hydric drainage, minerotrophic]
TOB9D	Tourbière ombrotrophe, station au dépôt organique de mince à épais, de drainage hydrique, ombrotrophe, ridé (alternance de buttes arbustives et de dépressions herbacées que l'on observe dans les tourbières) [Bog, thin to thick organic or mineral deposits, hydric drainage, ombrotrophic, ridges (shrub-covered hummocks alternating with depressions containing herbaceous vegetation characteristic of peatlands)]
TOB9U	Tourbière ombrotrophe, station au dépôt organique de mince à épais, de drainage hydrique, ombrotrophe, surface uniforme (absence de lanières et de mares) que l'on observe dans les tourbières [Bog, thin to thick mineral deposits, hydric drainage, ombrotrophic, flat surface (lacking strings and pools characteristic of peatlands)]
TOF8U	Tourbière minérotrophe, station au dépôt organique ou minéral de mince à épais, de drainage hydrique, minérotrophe, surface uniforme (absence de lanières et de mares) que l'on observe dans les tourbières [Fen, thin to thick organic or mineral deposits, hydric drainage, minerotrophic, flat surface (lacking strings and pools characteristic of peatlands)]

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⁵⁰ Only references not found in the main document are presented here.