



Range Plan for Woodland Caribou in Saskatchewan

DRAFT

Boreal Plain Ecozone – SK2 East Caribou Administration Unit

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Executive Summary

In 2002, boreal woodland caribou were recommended for “threatened” status by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and were listed as “threatened” under the *Species at Risk Act* (SARA) when it was proclaimed in 2003. As required under SARA, Canada developed the *Recovery Strategy for the Woodland Caribou Boreal Population in Canada* (the recovery strategy), which was released in October 2012 and amended in 2020. The document identifies 65 per cent undisturbed habitat in a range as the disturbance management threshold, which provides a measurable probability (i.e. 60 per cent) for a local population to be self-sustaining. The recovery strategy indicates that much of the Saskatchewan woodland caribou population is at risk from landscape-level disturbance. The amended federal recovery strategy identifies 40 per cent undisturbed habitat in the SK1 (Boreal Shield) conservation unit as the disturbance management threshold as well as the maintenance of total anthropogenic disturbance in the range at or below five per cent while maintaining the minimum 40 per cent undisturbed habitat (ECCC 2020).

Saskatchewan is responsible for managing woodland caribou on provincial and private lands, and as a signatory to the *Accord for the Protection of Species at Risk in Canada*, has a responsibility to prepare a provincial range plan for woodland caribou. Range plans provide a path forward for effective landscape management. They provide the federal government with clear information on the measures, tools, and targets for woodland caribou habitat management being deployed, and that they demonstrate effectively protect woodland caribou habitat.

The goal of the *Range Plan for Woodland Caribou in Saskatchewan* is to achieve and maintain a self-sustaining woodland caribou population by managing habitat availability, while allowing for continued economic activity in northern Saskatchewan. Saskatchewan considers the woodland caribou range assessment and planning processes to be part of a broader cumulative effects assessment and management strategy for provincial Crown lands, benefiting multiple species simultaneously. This approach recognizes the variation of fire regimes, ecological conditions, land use activity and human-caused disturbance across Saskatchewan’s boreal forest. This plan was uniquely and deliberately developed to consider the conditions experienced in Saskatchewan, and specifically in the SK2 East caribou administration unit.

Four fundamental principles guide the development of range plans in Saskatchewan:

- collaboration, consultation, engagement, and transparency with participants;
- incorporating a balanced approach;
- using the best available information; and
- leveraging current tools and processes, while creating new ones as required.

The province’s range planning approach has been purposefully planned with a focus on inclusiveness and participation to ensure Indigenous and Métis communities, along with stakeholders, have the opportunity to engage and be part of the planning process.

With a staged approach to range planning, initial efforts focused on the central portion of the Boreal Plain (i.e. SK2 Central), forming the framework for the planning process. The SK2 Central range plan

provided the foundation on which the SK2 East range plan is built. With each consecutive range plan, refinements are made as part of the continuous improvement process and the specific conditions of the landscapes and disturbances were reflected. This provides a solid approach to landscape level planning and development of management strategies that can be deployed in other parts of the Boreal Plain and the Boreal Shield, with the ability to refine or supplement management strategies as required.

As part of the range planning process, Saskatchewan has identified five primary management strategies that can be taken to reduce landscape disturbance:

- avoidance;
- reclamation and restoration;
- mitigation offsets for new disturbances;
- forest harvest patterns; and
- access management.

The management strategies identified in this plan are supported by existing statutes and can be implemented within the context of existing legislation, but will require development of new associated regulations and policies.

Caribou habitat management areas have been delineated and prioritized for different management objectives and actions to maintain sufficient habitat for a self-sustaining caribou population. This includes minimizing economic impacts on, and maintaining opportunities for, current and future land use. In addition, the landscape management targets have been modified depending on the local levels of fire disturbance. The management strategies identified in this plan are designed to reduce disturbance levels while allowing for continued sustainable levels of land use.

Saskatchewan's focus is on the creation of healthy forest landscapes for woodland caribou and other species. This will be achieved by managing human-caused disturbance, altering the patterns of human-caused disturbance, and maintaining adequately-sized patches of undisturbed high-value caribou habitat of various ages, with connectivity between caribou administration units. As such, and specifically within the SK2 East area, the landscape management goals are to:

- maintain a minimum of 65 per cent of the SK2 East in an undisturbed state;
- maintain a minimum of 80 per cent of high potential woodland caribou habitat in a condition unaffected by direct and/or indirect human-caused disturbance;
- maintain adequate connectivity between the SK2 East, the SK2 Central, the SK1 caribou conservation unit, and Manitoba caribou ranges;
- maintain adequate connectivity and large patches of habitat in the Pasquia-Porcupine forest management agreement area and target restoration efforts in this area to ensure and maintain connectivity;
- through forest harvesting, create natural forest patterns that more closely resemble the range of variation of natural disturbances, both in distribution and scale; and
- decrease the total amount of non-permanent legacy roads and other linear disturbances.

For the SK2 East area over a 50-year scenario period, the Saskatchewan model outputs suggest that these outcomes can be achieved while maintaining similar levels of land use activity as current.

Saskatchewan has several legislative tools and processes that offer protection in a manner that contributes to the long-term viability of woodland caribou while supporting continued economic development. This includes *The Environmental Management and Protection Act, 2010*, *The Forest Resources Management Act*, *The Provincial Lands Act, 2016* and updates to the *Saskatchewan Environmental Code*, as well as the 2017 Forest Management Planning Standard and a new chapter and standard related to linear activities and corridors that is being developed for inclusion in the *Saskatchewan Environmental Code*. These legislative tools are also applicable across woodland caribou range in both the Boreal Plain and the Boreal Shield¹.

In addition to the numerous regulatory instruments available for the protection of woodland caribou and their habitat, this plan also identifies and outlines principles, activities, programs, and management strategies that work toward the provision of recovery measures that benefit Saskatchewan's woodland caribou. The modelling conducted and illustrated within the plan and the appendices provide insight into the sensitivity associated with various disturbance factors and management strategies. While initial spatial projections of a 65 per cent undisturbed habitat are demonstrable within the SK2 East caribou administration unit, it is also recognized that habitat management strategies such as avoidance, reclamation and restoration, and access management will benefit the landscape on which the woodland caribou depend. It is also recognized that the benefits of some activities on the landscape such as reclamation and restoration cannot be immediately appreciated, but their early and continued implementation are essential to long-term landscape integrity and connectivity of woodland caribou habitat. Ultimately though, population assessment and trend data provide a more definitive measure of species sustainability.

This range plan builds upon the foundation of the previous SK2 Central and SK2 West range plans and continues to rely upon existing legislation and regulations that are in place to assure critical habitat protection. Saskatchewan is committed to ongoing assessment and research in order to support adaptive management and inform habitat indicators and targets, and will do so in collaboration with appropriate researchers, communities and agencies to deliver on these research priorities.

Saskatchewan will report on a five-year basis to Environment and Climate Change Canada (ECCC) and the public on range plan implementation, habitat condition, population trends and protection measures. Using an adaptive management framework, the Saskatchewan Ministry of Environment will be in a position to update range plans as required in response to the management strategies deployed and the outcomes attained.

¹ The *Forest Management Planning Standard* is only applicable to areas with a forest management plan.

1.0 Recovery Planning in Saskatchewan

In 2002, boreal woodland caribou were recommended for “threatened” status by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and were listed as “threatened” under the *Species at Risk Act* (SARA) when it was proclaimed in 2003. As required under SARA, the federal government developed the *Recovery Strategy for the Woodland Caribou Boreal Population in Canada* (the recovery strategy), which was released in October 2012 (Environment Canada, 2012) and amended in 2020 (ECCC, 2020). The recovery strategy identified 65 per cent undisturbed habitat in a boreal caribou range as the disturbance management threshold, which provides a measurable probability (60 per cent) for a local population to be self-sustaining. The recovery strategy indicates that Saskatchewan’s Boreal Plain (SK2) population is at risk from high levels of habitat disturbance. Range plans were identified as documents that would outline how caribou ranges will be managed to protect critical habitat from destruction or improve the condition of critical habitat. The amended federal recovery strategy identifies 40 per cent undisturbed habitat in the SK1 (Boreal Shield) conservation unit as the disturbance management threshold as well as the maintenance of total anthropogenic disturbance in the range at or below five per cent while maintaining the minimum 40 per cent undisturbed habitat (ECCC 2020).

Saskatchewan, as signatory to the *Accord for the Protection of Species at Risk in Canada*, and being responsible for managing woodland caribou on provincial and private lands, has a responsibility to prepare a provincial range plan for woodland caribou.

Woodland caribou in Saskatchewan were assessed provincially as “threatened” in 2000 (Godwin and Thorpe, 2000). In response to the assessment, the Saskatchewan Ministry of Environment worked with First Nations and Métis communities and a variety of stakeholders to develop a provincial *Conservation Strategy for Boreal Woodland Caribou* (2014). The recovery goal of the conservation strategy is:

To sustain and enhance woodland caribou populations, and maintain the ecosystems they require, throughout their current range.

The conservation strategy was developed to act as the basis for management of boreal ecosystems for other species of concern. As part of this strategy, a threat assessment was conducted and it concluded that due to relatively high levels of human-caused habitat modification and fragmentation, woodland caribou populations in the Boreal Plain were at higher risk of decline and potential extirpation compared to those in the Boreal Shield. Range plans were identified as the means by which the provincial conservation strategy would be implemented.

Following the provincial risk assessment completed as part of the caribou conservation strategy, the province prioritized the focus of recovery efforts and range planning in the Boreal Plain ecozone. Range planning for the Boreal Shield ecozone will follow as further informed by recently acquired population and habitat data. The range assessment and range planning activities that have contributed to the development of this range plan are effectively the implementation of many actions identified in *Saskatchewan’s Conservation Strategy for Boreal Woodland Caribou*.

2.0 Range Plan Development Process

This range plan will provide a path forward for effective landscape management to ensure sufficient quality habitat for a self-sustaining woodland caribou population which would allow a traditional Indigenous harvest within Saskatchewan. This includes providing the necessary information so that the federal government has a clear understanding of and confidence in, the measures, tools, and targets for management of woodland caribou habitat being deployed that effectively protect woodland caribou habitat. Additionally, as woodland caribou is a wide-ranging species, range plans developed at a landscape level will provide a foundation for addressing management of other boreal species.

The goal of the Saskatchewan Woodland Caribou Range Plan is to:

Achieve and maintain a self-sustaining woodland caribou population by managing habitat availability, while allowing for continued economic activity in northern Saskatchewan.

The Government of Saskatchewan considers the woodland caribou range assessment and planning processes to be part of a broader cumulative effects assessment and management strategy for provincial Crown lands. This approach recognizes the variation of fire regimes, ecological conditions, the dynamic nature of caribou habitat, land use activity and human-caused disturbance across Saskatchewan's boreal forest. Our focus is on reducing human-caused disturbance, altering the pattern of disturbance, maintaining adequately-sized patches of undisturbed high-value caribou habitat with connectivity across and between caribou administration units, creating healthy forest landscapes for woodland caribou and other species.

2.1 Guiding Principles of Range Planning

Four fundamental principles that guide development of range plans are:

- **Collaboration, Consultation, Engagement, and Transparency:** Range plans are developed with the participation of diverse land use interests including Indigenous communities, Métis locals, industry, northern municipalities, and other stakeholders. The participation of land users together allows for effective information sharing, helps guide range plan development, builds collaborative relationships, deepens the understanding of potential interests, concerns, and solutions of the interested parties, and a shared commitment to the outcomes.
- **Balanced Approach:** Range plans work to ensure self-sustaining caribou populations while supporting Saskatchewan's plan for growth so that needs of the present can be met without limiting future opportunities.
- **Best Available Information:** Range plans are developed using the best information available, including local and traditional Indigenous knowledge, and western science. Range plans will be refined as new information becomes available, through continued monitoring, research and analyses.
- **Leverage Current Tools and Processes/Create New as Required:** Range plans will seek to use currently available tools, policies and processes to achieve desired outcomes. There is

recognition that it will take time to meet the desired outcomes, and that new adaptive management tools will be developed and implemented as required.

2.2 Process

A two-phase process involving range assessment and range planning for woodland caribou is being used in Saskatchewan. The range assessment phase provides an understanding of the status of and the risks to, woodland caribou. It is an information gathering and evaluation process to guide planning and decision making.

The range planning phase includes the development of a range plan that guides how land use will be managed through time to optimize woodland caribou habitat and natural resource use. This includes management objectives and strategies, as well as approaches for monitoring and adaptation. Implementation of these strategies follows the range plan development.

This range plan has been developed through an iterative process of range assessment and range planning. Range assessments that characterize the level of risk have provided a path for prioritizing planning areas, as well as enabling the demonstration of a landscape planning framework concept with woodland caribou as a focus.

2.2.1 Caribou Conservation Units

Saskatchewan's boreal woodland caribou range is divided into two woodland caribou conservation units (Figure 1), based on the boundaries of the boreal ecozones (Acton et al., 1996). The Boreal Shield (SK1) Woodland Caribou Conservation Unit (hereafter called Boreal Shield or SK1) encompasses the rocky shield, sandy plains and many lakes of northern Saskatchewan. The Boreal Plain (SK2) Woodland Caribou Conservation Unit (hereafter called Boreal Plain or SK2) encompasses the more productive mixed-wood forests and lakes of central Saskatchewan, including large areas of low-lying peatlands. While these two units represent important differences in ecological conditions (e.g. habitat types, fire regimes, landforms) and human land use and management (e.g. overall levels and types of land use, fire management.), the boundary between SK1 and SK2 does not represent a population boundary, as caribou move freely between the two areas. The distribution of woodland caribou within the SK1 and SK2 woodland caribou conservation units are considered to be relatively continuous, without discrete ranges (Priadka et al 2018).

2.2.2 Caribou Administrative Units

The large size of the SK2 woodland caribou conservation unit (i.e. 109,717 km²) is not well suited for range assessment and range planning activities, given the large variation in ecological conditions, habitat types, land use, and natural disturbance regimes across the Boreal Plain of Saskatchewan. As a result, three smaller caribou administration units within SK2 were developed: SK2 East, SK2 Central, and SK2 West (Figure 2).

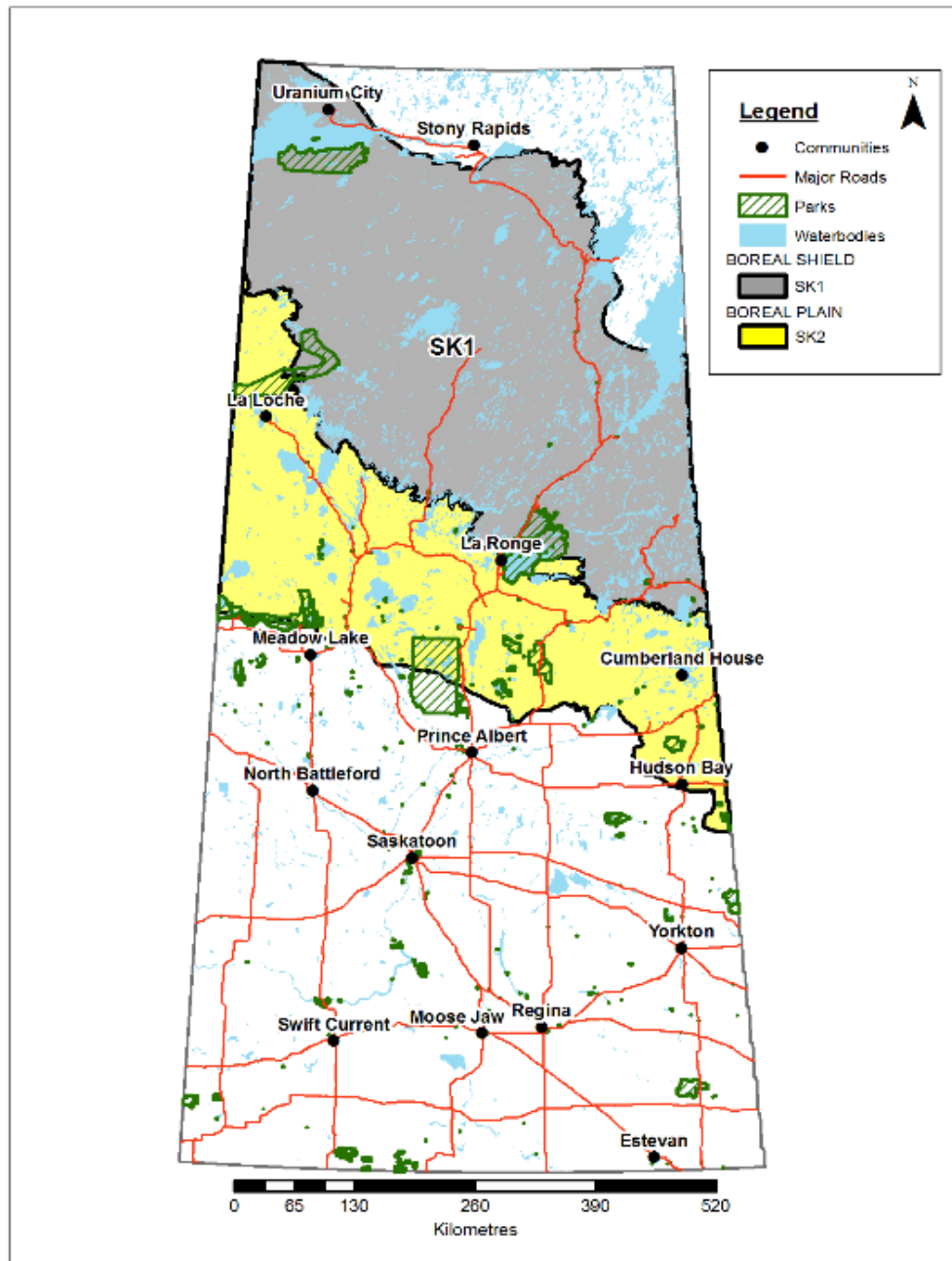


Figure 1. The caribou conservation units of Saskatchewan¹.

¹ Caribou conservation units are available for viewing on the Hunting, Angling and Biodiversity Information (HABISask) web application at: <https://gisappl.saskatchewan.ca/Html5Ext/?viewer=habisask> and for download on the Saskatchewan GeoHub: <https://geohub.saskatchewan.ca/> in raster format.

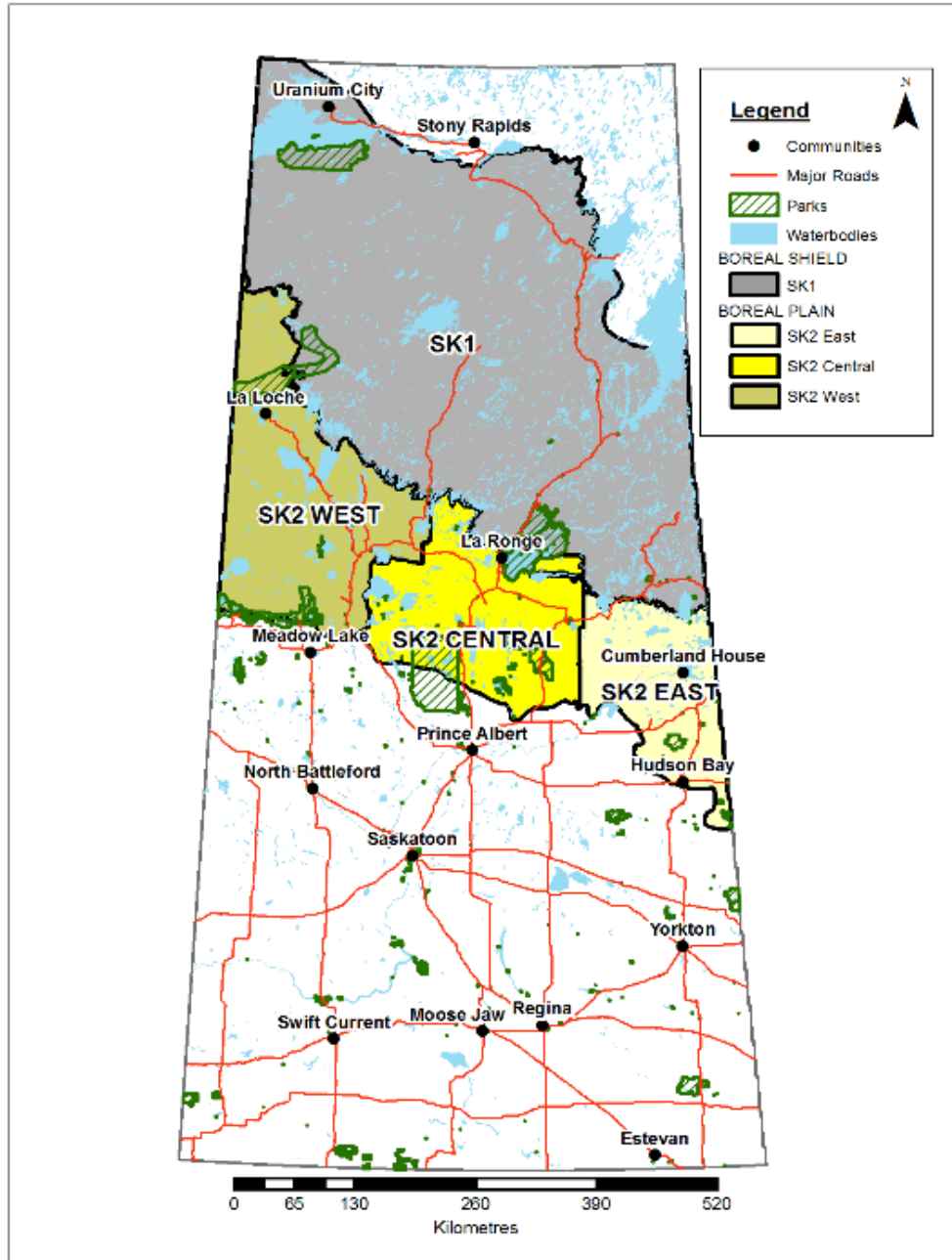


Figure 2. The caribou administration units associated with the SK2 caribou conservation unit¹.

¹ Caribou administration units are available for viewing on the Hunting, Angling and Biodiversity Information (HABISask) web application at: <https://gisappl.saskatchewan.ca/Html5Ext/?viewer=habisask> and for download on the Saskatchewan GeoHub: <https://geohub.saskatchewan.ca/> in raster format.

The caribou administration units (CAUs) should not be considered discrete caribou population boundaries, as landscape level genetic analysis has shown the population to be continuous across the range (Priadka et al., 2018). The administration units were defined based on the following considerations:

- be large enough to be meaningful for management of woodland caribou given their ecology and life history;
- represent important ecological differences from east to west;
- follow forest management agreement or term supply license area boundaries for ease of administration; and
- represent a geographical area that is manageable for the development and implementation of a range plan.

Saskatchewan has implemented a staged approach to range planning, with efforts to date focused on SK2 Central and SK2 West, forming the foundation for the planning process. This also provides a solid approach to landscape-level planning and management strategies that are being deployed in the SK2 East and possibly in the SK1, with the ability, and intent, to refine or supplement management strategies based on the unique situations within the caribou administration units.

The range planning approach has been purposefully planned with a focus on inclusiveness and participation to ensure that stakeholders and Métis, and First Nations have had the opportunity to engage and be part of the planning process. Some of the objectives met through this approach include:

- identifying industries, non-government organizations, associations, municipalities, First Nations and Métis locals that may have interests in the particular caribou administration unit;
- establishing a planning table consisting of representatives from First Nations, Métis locals, industry, non-governmental organizations, and municipalities to provide an opportunity to ensure effective and meaningful dialogue;
- engaging and consulting with planning table participants and others at locally held meetings and other forums to present and discuss the program intent, the desired outcomes, current disturbance levels, future disturbance scenarios, and possible management strategies to facilitate desired outcomes;
- engaging and consulting with participants to understand the implications of management strategies on communities, organizations, industry, and treaty and Aboriginal rights; and,
- preparing a cohesive plan that has been developed with participation of various communities and interest groups that addresses the desired outcomes, and is both feasible and practical for land users and the provincial government that provides for a Saskatchewan-based solution.

2.3 Range Plan Integration

Following the completion of the three range plans for the SK2 caribou conservation unit and the range plan for the SK1 caribou conservation unit, efforts will be made to ensure monitoring, implementation, and integration will occur. The development of the range plans to date have involved planning table participation from those responsible for shared woodland caribou populations in adjacent jurisdictions as well as from federal agencies with leases of Provincial Crown lands (i.e. Primrose Lake Air Weapons

Range) or designated federal lands (i.e. Prince Albert National Park) within Saskatchewan. Additionally, it is expected that collaboration will continue to occur with adjacent jurisdictions and with partner agencies whose shared interests include both woodland caribou populations as well as habitat.

3.0 Local Population Self-Sustainability Status

To evaluate the status of caribou populations across Canada, Environment and Climate Change Canada (2020) used an integrated risk assessment approach that incorporated three lines of evidence:

- caribou population trends;
- population size; and
- habitat condition based on total disturbance levels.

Data was not available in Saskatchewan for caribou population trends or size, so disturbance was used as an index of these parameters (Table 1). The federal recovery strategy identified Saskatchewan's Boreal Plain (SK2) woodland caribou sub-population to be "as likely as not self-sustaining," meaning that it is at the point of highest uncertainty of population status. Range retraction from the southern boundary of caribou range has been documented (Arsenault 2003) and also points to a caribou population that is not self-sustaining.

The province initiated population monitoring in the SK2 East Administration Unit in 2020. This involves the collection of caribou fecal pellets over a three-year period to provide genetic information and estimate population size by 2021 and trend by 2023. Participants of a study in the Cumberland House area indicated a declining trend in woodland caribou numbers in the area, because of reduced sightings in recent years (PAMF n.d.).

Saskatchewan and Manitoba have two transboundary caribou populations (i.e. The Bog and the Naosap), so status information from these areas should be considered for the SK2 East area. Caribou population structure analyses show a connectivity between the southern part of SK2 East and the caribou in Manitoba's Bog population (Priadka et al., 2018).

Table 1. Environment and Climate Change Canada (2017) boreal caribou population and habitat condition assessment for the entire SK2 caribou conservation unit.

| Range Identification | Range Name | Range Type | Population Size Estimate | Population Trend | Disturbed Habitat (per cent) | | | Risk Assessment (4) |
|----------------------|--------------|-------------------|--------------------------|------------------|------------------------------|-------------------|-----------|---------------------------------------|
| | | | | | Fire (1) | Anthropogenic (2) | Total (3) | |
| SK2 | Boreal Plain | Conservation unit | Not available | Not available | 30 | 20 | 45 | Not self-sustaining / self-sustaining |

¹ Fire disturbance is any area where a fire has occurred in the past 40 years (without buffer).

² For anthropogenic disturbance, a 500 metre buffer is applied to all linear and polygonal (area) disturbances.

³ For total disturbance, anthropogenic (human-caused) and fire disturbances that overlap are counted once in the total.

⁴ Environment Canada, 2012.

4.0 Current Habitat Condition and Important Areas for Boreal Caribou

The three caribou administration units, SK2 East, SK2 Central and SK2 West were evaluated to compare population status, disturbance levels, habitat characteristics and the potential level of risk to maintaining a sustainable caribou population across different areas of the Boreal Plain. Based on these results, Saskatchewan has implemented a staged approach to range planning, beginning with SK2 Central and subsequent planning for SK2 West and East, respectively. Range planning on the Boreal Shield (SK1) will be initiated after the Boreal Plain. This section currently focuses on SK2 East and will be updated as the subsequent planning areas are completed.

4.1 Overview of SK2 East

The vast majority of the area in SK2 East falls within the Mid-Boreal Lowlands, Mid-boreal Uplands and Boreal Transition ecoregions, with a small portion occurring within the Churchill River Upland and Interlake Plain; it is the characteristic landscape of Saskatchewan’s Boreal Plain ecozone with low rolling forested hills and plains interspersed by many wetlands (e.g. fens, bogs and marshes of different classes) and lakes.

Close to half of SK2 East is considered to be in the upland forest condition, with the remaining areas represented by wetland and open water (Table 3).

The SK2 East is considered an important area for woodland caribou in Saskatchewan, because it provides the physical connection between caribou in the eastern portions of SK2, SK1, and caribou in Manitoba. SK2 East has a relatively large proportion of high-value upland (e.g. pine - lichen forest) and lowland (e.g. peatland) caribou habitat. Of the three SK2 caribou administration units, SK2 East has the lowest levels of both human-caused disturbance and wildfire.

Table 2. Summary of the SK2 East caribou administration unit land base features.

| Land Class ¹ | Area (km ²) | Area (per cent) |
|---------------------------|-------------------------|-----------------|
| Upland² | 11,750 | 46.4 |
| Wetland | 11,721 | 46.3 |
| Water | 1,866 | 7.4 |
| Total | 25,338 | 100.0 |

¹ Land class categories are based on ecosite mapping developed by the Ministry of Environment, Government of Saskatchewan.

² The Saskatchewan forest inventory identifies that the timber harvest land base covers 5,554 km² or 21.9 per cent of the SK2 East area.

The SK2 East area has a long history of industrial forest management activities, resulting in an extensive network of permanent and non-permanent roads which make up a large part of the human-caused disturbance. Forestry is one of the primary land use sectors and the SK2 East area is expected to experience slightly increasing levels of forestry activity in the future. Two forest licences have been issued within the SK2 East caribou administrative unit: the Weyerhaeuser-Dunkley forest management agreement for the Pasquia-Porcupine timber supply area (TSA) and the Mee-Toos area based term supply licence for the North East timber supply area (Figure 3). Under the *Forest Management Planning Standard* of the *Saskatchewan Environmental Code*, licensees shall develop and implement a management strategy using best available information to mitigate the negative effects of forest management activities on long-term caribou habitat supply and shall adapt their forest management plan to meet the objectives and targets of the corresponding woodland caribou range plan within the licence area (Government of Saskatchewan 2017a).

In addition to forestry, there exists significant mineral deposits in the SK2 East administration unit and there has been mineral extraction and exploration activities in this area in the past. Minerals deposits in the area include: oil shale, silica sands, coal, diamonds, gold and other base metals. Mineral resource potential in the area is generally considered to be high. Other industrial activity in SK2 East includes potential helium extraction, peat harvest and gravel extraction.

The SK2 East area represents a combination of provincial, federal and municipal land categories as shown in Table 3.

Table 3. Summary of SK2 East land categories.

| Land Category | Agency/Type | Area (km ²) | Area (per cent) |
|--|--|-------------------------|-----------------|
| Provincial Crown Lands¹ | Ministry of Environment Crown Lands | 21,301 | 84.1 |
| | Ministry of Agriculture Crown Lands | 463 | 1.8 |
| | Sub-Total | 21,764 | 85.9 |
| Provincial Parks and Conservation Areas | Provincial and Regional Parks | 383 | 1.5 |
| | Representative Area Ecological Reserves | 3,032 | 12.0 |
| | Sub-Total | 3,415 | 13.5 |
| Municipal Areas | Towns/Villages/Resort Areas/Other Private Lands ² | 33 | 0.1 |
| | Sub-Total | 33 | 0.1 |
| Federal Lands | Indian Reserves | 126 | 0.5 |
| | Sub-Total | 126 | 0.5 |
| | Total | 25,338 | 100.0 |

¹ Within the Provincial Crown Lands, there are 342 km² of Wildlife Habitat Protection land in SK2 East and 0.045 km² of Wildlife Refuge.

² Other private lands represent a very small proportion of SK2 East.

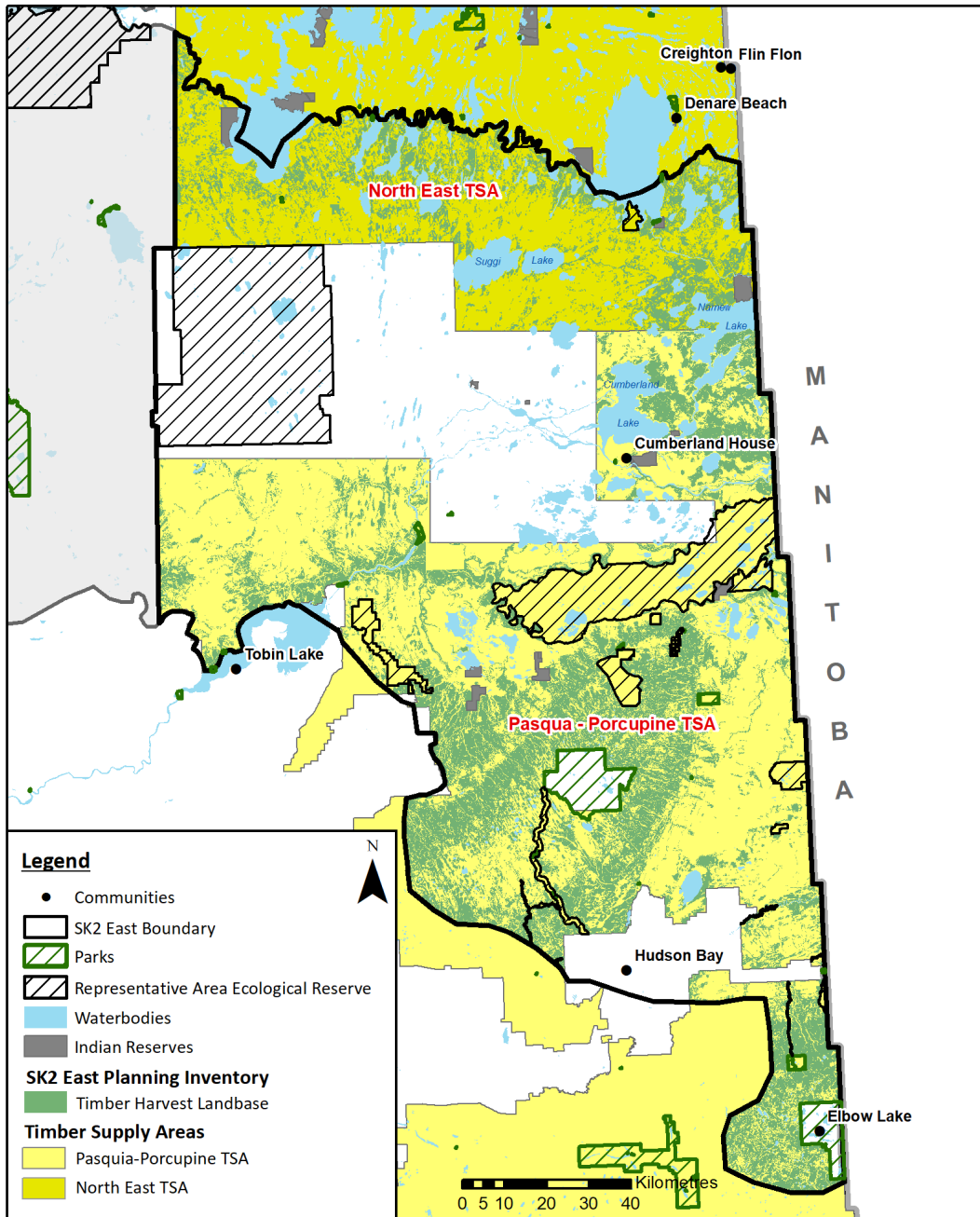


Figure 3. Forestry land tenure contained within the SK2 East caribou administration unit.

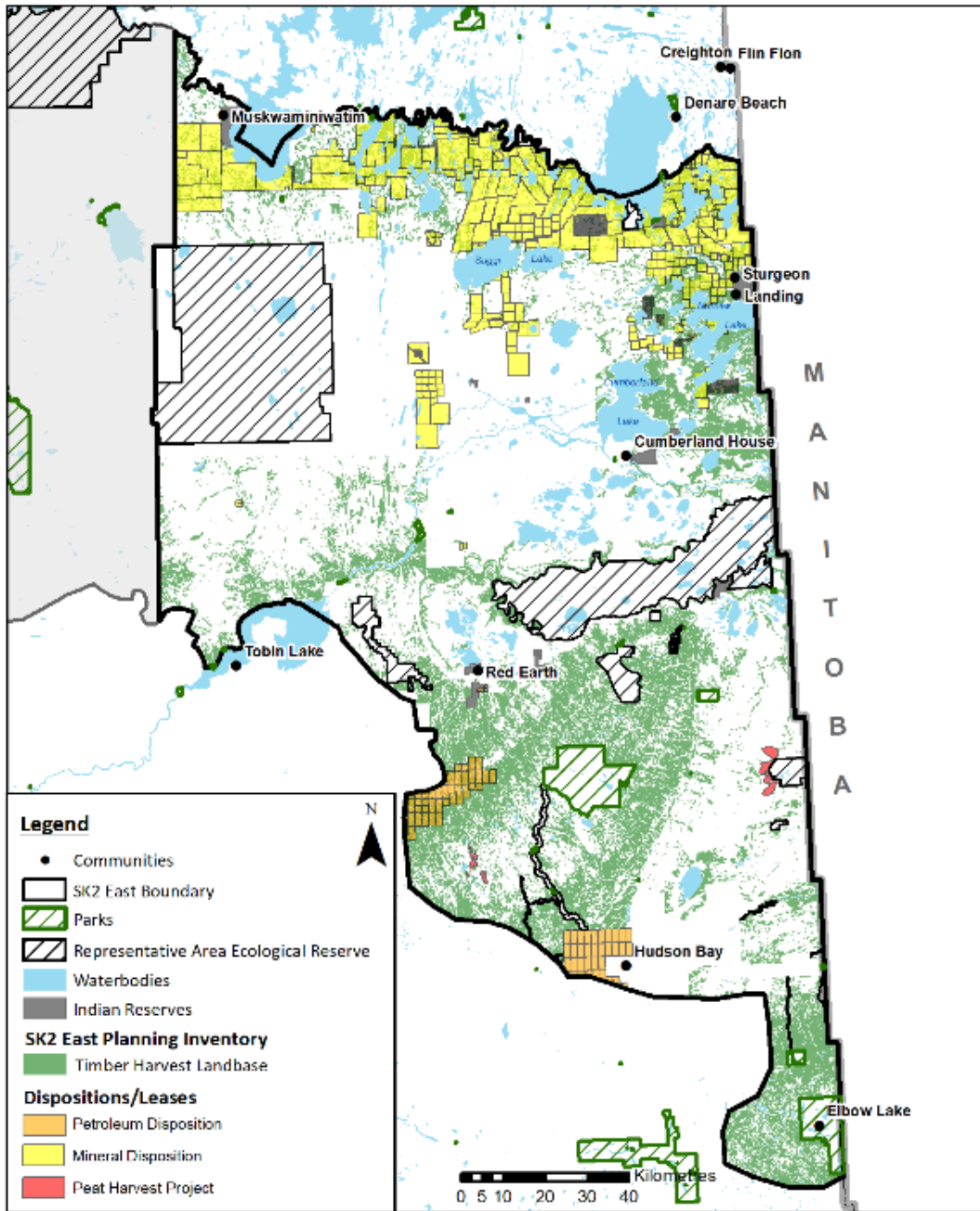


Figure 4. Overview of land use allocations and dispositions in the SK2 East.

4.2 SK2 East Habitat Condition and Disturbance Levels

4.2.1 Effects of Disturbance on Caribou

Natural and human-caused disturbances affect habitat in the short and medium term because of the alteration of mature forests that are used by caribou. New growth that follows wildfires or forest harvesting is often of limited value to woodland caribou because it is lacking lichens, the primary food source of caribou, and may increase predation risk by providing habitat for other ungulates and their predators. Skatter et al. (2014) found that suitable lichen coverage was high 21-30 years post fire, but that thickness and biomass may limit the value to caribou in the Boreal Shield of Saskatchewan. This is in agreement with the findings by Gruel (2018). When human-caused changes occur over a large scale and encroach upon the southern-most provincial range boundary, they can lead to caribou range retraction as evidenced over the last century (Trottier, 1988; Arsenault, 2003; Schmid, n.d.). In the longer term, regeneration after wildfire or forest harvesting can renew habitats which are of importance to woodland caribou.

Fragmentation of the landscape by roads, geophysical lines, cut lines and other linear developments discourages or impedes the ability of caribou to make optimum use of the available resources within their range. Roads which do not allow sufficient flow of water through wetland complexes can impact wetland function. Disturbances reduce connectivity between important habitats, making the behaviour of the animals more predictable and increasing risk of predation. Disturbances may reduce the size of important habitat patches, thereby concentrating animals and making it easier for predators to find them. Linear features also provide humans and predators with access to areas of formerly inaccessible habitat.

Small populations of caribou can become isolated if the landscape is divided by barriers that they will not cross. Such populations are likely to become genetically homogeneous and lack the diversity necessary for long-term survival, eventually leading to local extinctions. Caribou in the Pasquia Hills have become somewhat isolated due to disturbance levels between the Pasquia Hills and Pasquia Bog, although some movement is still known to occur.

4.2.2 Types of Disturbance

The federal recovery strategy identified that the total disturbance level (i.e. burn over areas less than 40 years old and human-caused disturbance buffered by 500 metres) provides the best link to caribou population status from studies of 24 caribou populations across Canada (Environment Canada, 2012). The link between population status and disturbance was re-confirmed with subsequent analysis of 46 caribou populations (Johnson et al., 2019). Disturbance reported in this range plan follows the ECCC methodology using datasets developed by the Ministry of Environment. The disturbance buffer approach will continue to be followed until new science comes available which demonstrates a more appropriate alternative.

Human-caused disturbance can be considered as either linear or area-based. Linear features include roads, trails, power lines, geophysical lines and railways. Area-based disturbance features include forest harvest blocks, well pads, gravel pits, mine sites or settlements. Area-based disturbance can also include

wetlands affected as a byproduct of road construction and interference with natural drainage systems and area hydrology. Human-caused disturbances can be further classified as permanent or non-permanent. Permanent disturbances include municipal and industrial infrastructure, graded and paved roads, and long-term forest and mineral resource roads. Non-permanent disturbances include forest harvest blocks, geophysical lines, and short-term access roads. To align disturbance mapping with ECCC methodology, reclamation and restoration of non-permanent features were forecast to take 40 years to be considered undisturbed. Wildfire was also considered as a disturbance in the Environment and Climate Change Canada assessment and will contribute to disturbance mapping in the Saskatchewan disturbance assessment.

4.2.3 SK2 East Disturbance Levels

The Saskatchewan Ministry of Environment has updated the disturbance mapping in SK2 East and is consistent with Environment and Climate Change Canada human disturbance mapping (Appendix A: SK2 East Disturbance Mapping). The ministry estimates that the current disturbance level in the SK2 East is 30.5 per cent. Approximately 25.6 per cent of SK2 East is affected by human-caused disturbance and the associated 500 m buffer (Table 4). The footprint of forest harvest blocks (less than 40 years old) in SK2 East, not including the 500-m buffer, is 1,219 km². There are approximately 5,524 km of non-permanent forestry, recreational and resource-related roads in SK2 East. Forest harvesting, transportation and agriculture activities have resulted in concentrations of human-caused disturbance in the southern portion of SK2 East, and created a landscape with relatively small undisturbed patches existing within the matrix of roads, forest harvest blocks, and cropland. To a lesser extent, mineral extraction and exploration and forest harvest and associated road networks have lead to a concentration of human disturbance in the northeastern portion of SK2 East. Large patches of undisturbed habitat still remain in the central and northwestern parts of SK2 East (Figure 5)

Table 4. Disturbance levels in the SK2 East caribou administration unit as assessed by Saskatchewan Ministry of Environment (2016).

| Disturbance | Area (km ²) | Area (per cent) |
|---|-------------------------|-----------------|
| Human-caused Disturbance¹ | | |
| Permanent | 1,495 | 5.9 |
| Non-Permanent | 4,990 | 19.7 |
| Total | 6,485 | 25.6 |
| Wildfire² | | |
| Total | 1,254 | 4.9 |
| Disturbance Summary | | |
| Total Disturbed | 7,739 | 30.5 |
| Total Undisturbed | 17,599 | 69.5 |

¹ Human-caused disturbance includes 500 metre buffer.

² Wildfire disturbance is based on 1978 to 2017 fire records. Human-caused and wildfire disturbance are based on the non-overlapping area of each, with human-caused disturbance taking priority over wildfire disturbance. Waterbodies (as identified in the CanVec 1:50,000 dataset) were removed from the wildfire polygons and do not contribute to the total wildfire disturbance.

There is large variation in the location and extent of area burned across the Boreal Plain, reflecting spatial differences in fire regimes. The total area burned from 1978 to 2017 is 1,824km² or 7.2 per cent of the SK2 East area (Figure 6).

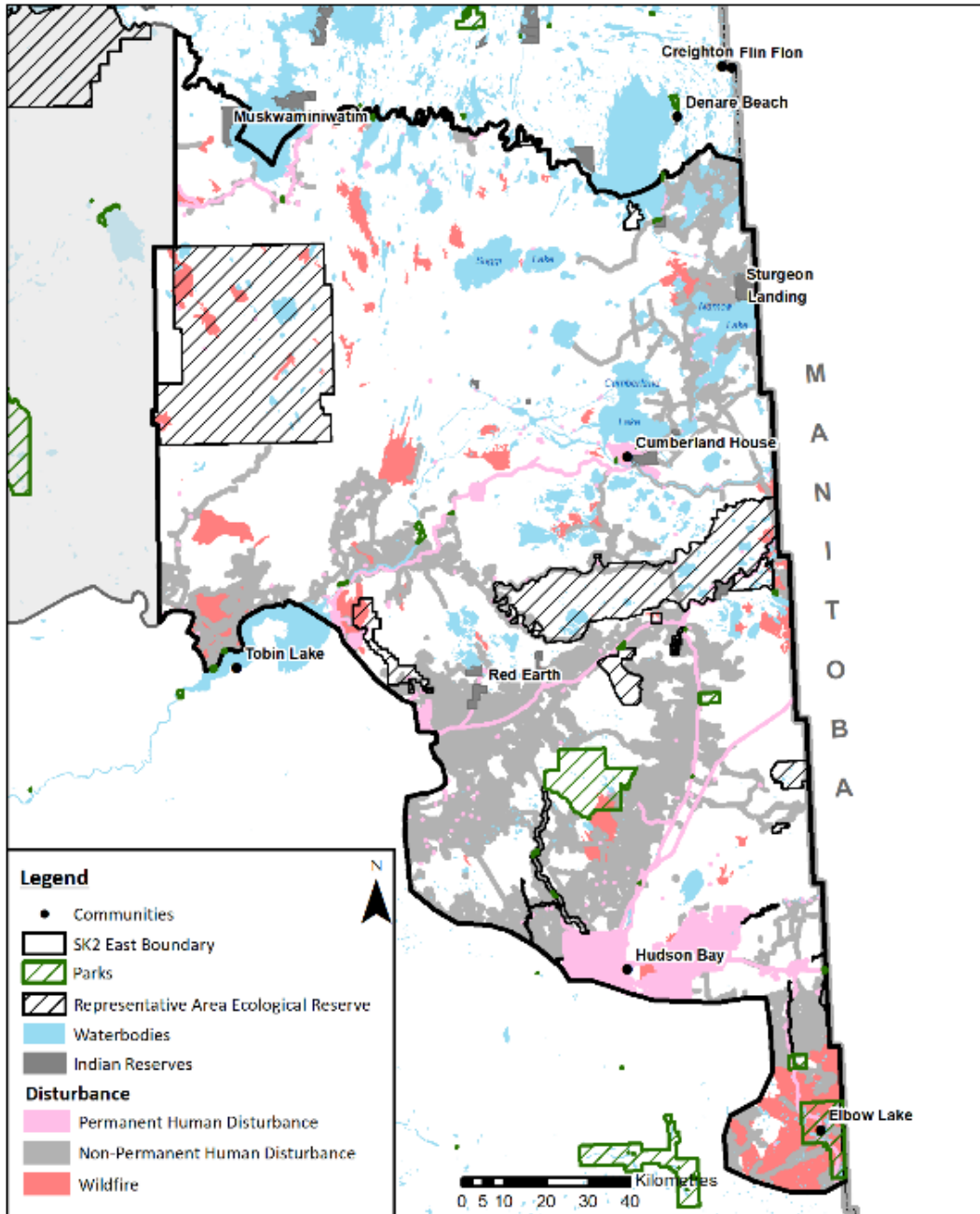


Figure 5. The extent of human-caused disturbance and wildfire in the SK2 East area based on the 2017 Saskatchewan Ministry of Environment updated disturbance mapping assessment.

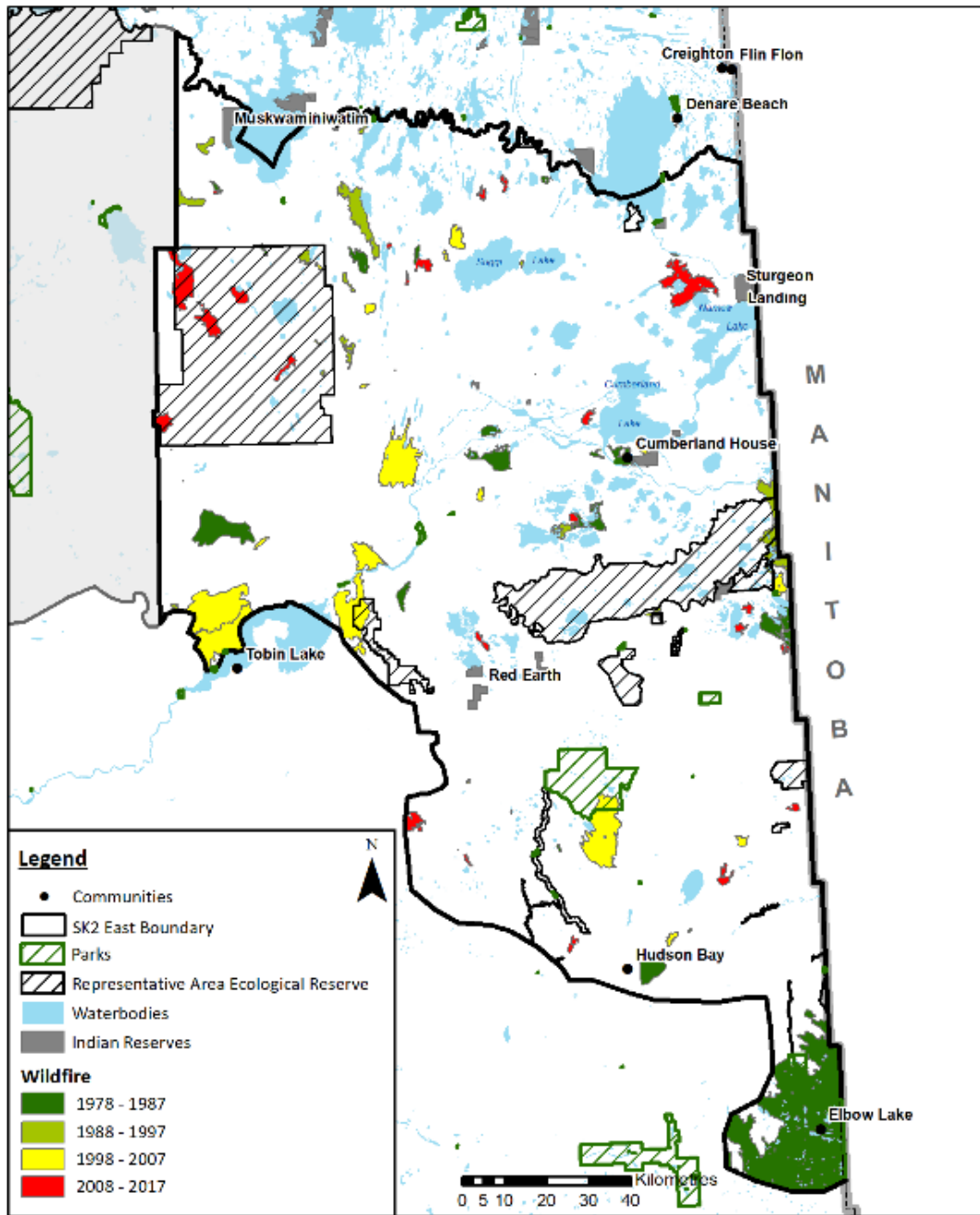


Figure 6. Wildfire history from 1978 to 2017 in the SK2 East caribou administration unit.

4.3 Important Areas for Caribou

The quality of woodland caribou habitat was evaluated using three approaches:

- i. ranking ecosites and mapping habitat potential;
- ii. considering the current suitability of potential habitats; and
- iii. habitat modelling based on Indigenous traditional knowledge.

Woodland caribou habitat potential within the provincial forest of central and northern Saskatchewan has been identified using a forest ecosite geographic information system layer which has been mapped for the SK2 East area. Forest ecosites represent information about a site's tree species, plant-abundance and soil and site characteristics (McLaughlan et al., 2010). Forest ecosite habitat potential ranks were assigned by individually evaluating the ecosite's potential to provide forage, refuge and calving habitat. Forage value was rated based on the availability of lichen and other plant species, which are palatable to caribou (Thomas and Armbruster, 1996). Refuge value was rated based on the availability of plant species which provide food value for other ungulates (e.g. moose, deer, elk). This was used as a surrogate for the probability of predation. If these food sources are not present, the ecosite has potential to provide refuge for caribou from predators.

Calving and post-calving ratings were made in consideration of both the time of calving and the following two to four-week period. The primary consideration was safety from predation. The related factors considered were the ability to hide a calf and the lack of spring black bear forage. A secondary consideration was whether there was caribou forage available on the site. The ecosite rankings were completed for the Boreal Shield and Taiga Shield, and the Boreal Plain by a panel of biologists with expertise on woodland caribou habitat use in Saskatchewan (see Appendix C). Forest ecosites were mapped with the assigned habitat potential value (Figure 7). This approach to defining habitat potential provides similar results to outcomes of habitat modeling based on Indigenous traditional knowledge done by Mamun and Brook (2017) as seen in Figure 8. Both methods correspond in defining a landscape with the potential to provide contiguous, high quality caribou habitat.

For further comparison and validation, the approximate location of woodland caribou habitat types as classified and identified by Indigenous and local knowledge in the Cumberland House region is illustrated in Figure 9 (PAMF, n.d.).

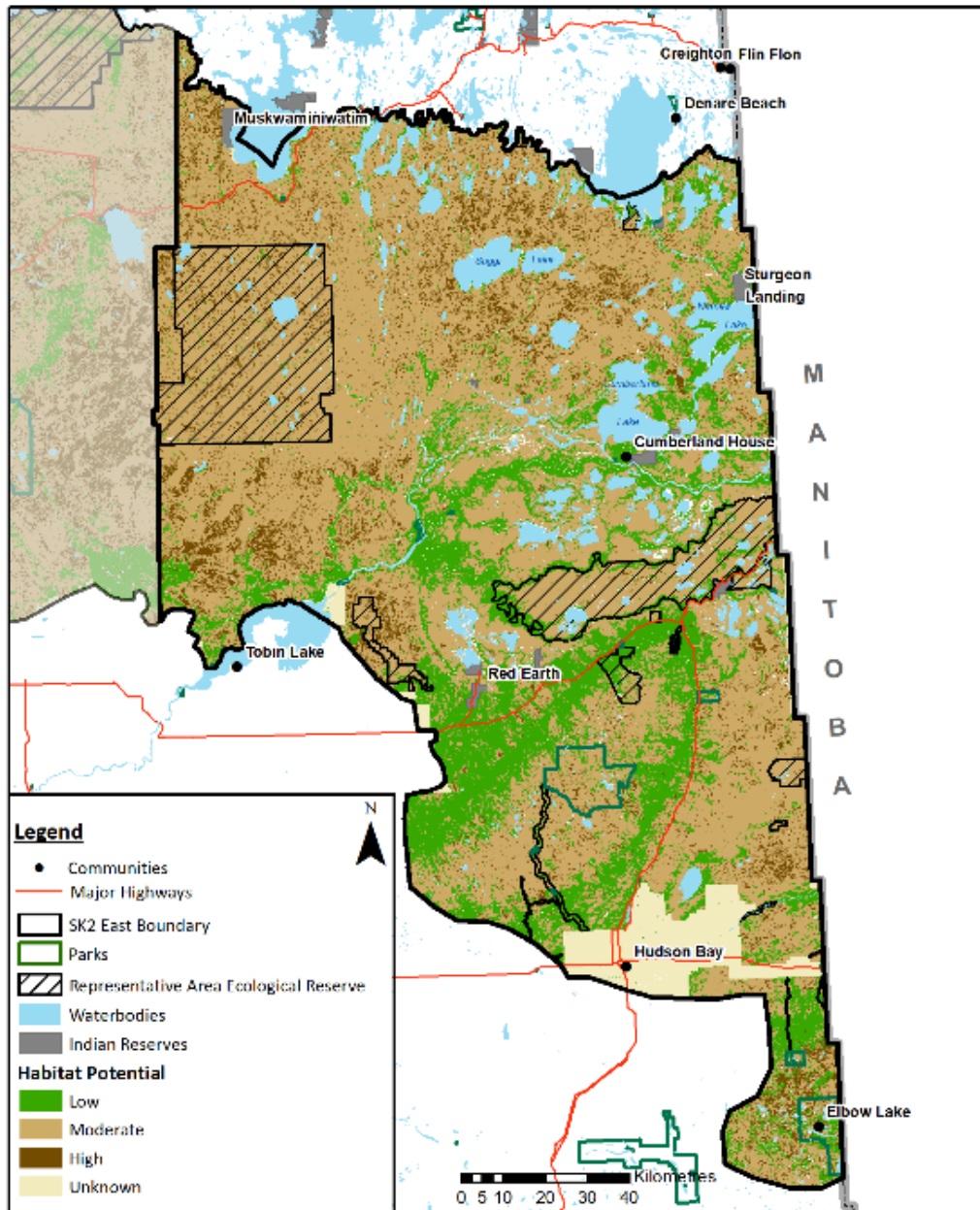


Figure 7. Caribou habitat potential in the SK2 East caribou administration unit ¹.

¹ The caribou habitat potential spatial layer is available for viewing by detailed users on the Hunting, Angling and Biodiversity Information (HABISask) web application: <https://gisappl.saskatchewan.ca/html5ext/?viewer=habisask> and for download on the Saskatchewan GeoHub: <https://geohub.saskatchewan.ca/> in raster format.

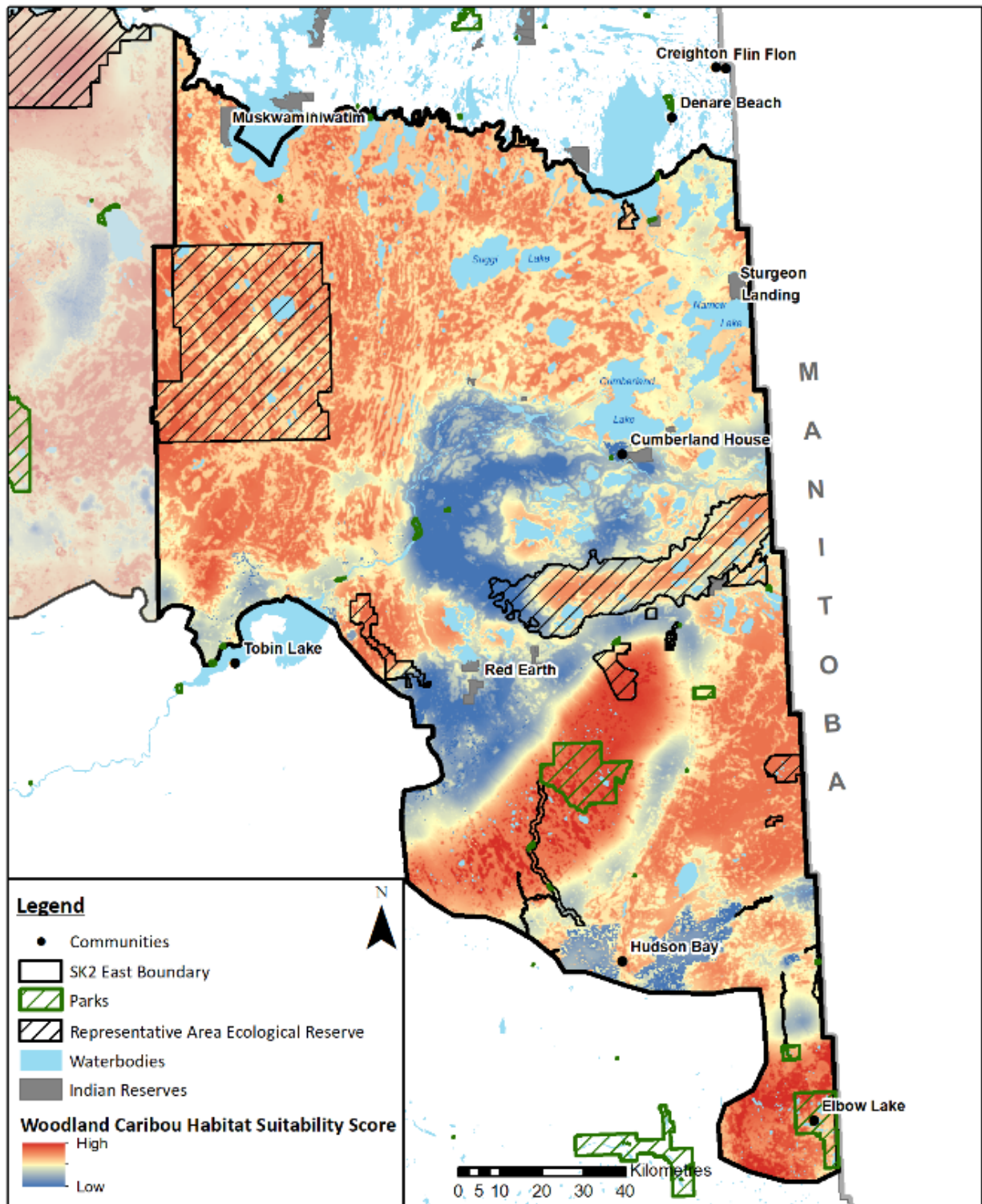


Figure 8. Suitability score of woodland caribou habitat for the SK2 East area based on Indigenous traditional knowledge (Mamun and Brook, 2017).

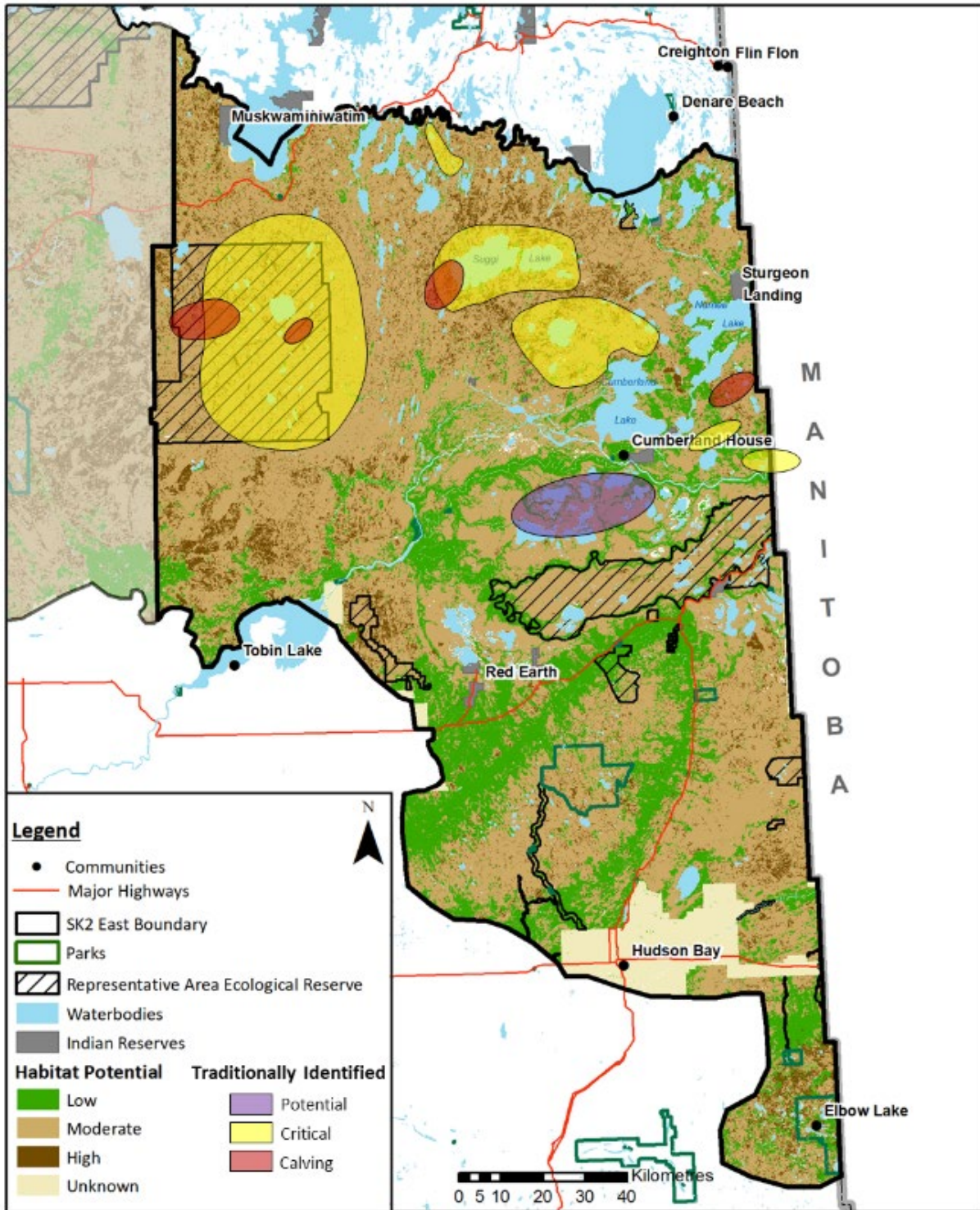


Figure 9. Approximate location of woodland caribou habitat types as identified by Indigenous and local knowledge in the Cumberland House region (adapted from PAMF, n.d).

Habitat potential refers to the ability or capability of a habitat type to support a wildlife species for its various life cycle requirements. Potential does not consider the current state of the habitat (e.g. recently burned, harvested or industrial development), but its optimal state. In comparison, habitat suitability reflects the current status of the habitat and incorporates the effects of fire or forest harvesting on seral stage (i.e. sequence of vegetation development over time), habitat loss, reduced use of a habitat by caribou resulting from sensory disturbance adjacent to human land use features, increased risk of mortality, and other factors.

Over 60 per cent of the SK2 East (i.e. 15,526 km²) falls into the moderate habitat potential class, while the high habitat potential class makes up approximately 7 per cent of SK2 East (i.e. 1,866 km²). The low habitat potential class accounts for 20 per cent of the SK2 East (i.e. 5,110 km²), and unclassified areas (i.e. 3.9 per cent or 987 km²), and water (i.e. 7.4 per cent or 1,866 km²) make up the remaining area in SK2 East (Table 5).

Current suitability shows a fragmented landscape of suitable habitat patches, somewhat isolated from others (Figure 10). The high level of fragmentation also requires the careful management of the remaining large patches of suitable habitat, while other disturbed areas are restored or mature into suitable habitat in the future.

Recent work from the Boreal Shield in Saskatchewan has shown use by caribou of unburned residuals within fire boundaries as calving habitat, especially those dominated by bogs and fens (Skatter et al., 2017). Further research will be necessary to better understand how these results apply to the southern parts of the Boreal Plain where human caused disturbance levels are much higher and often overlap with wildfires.

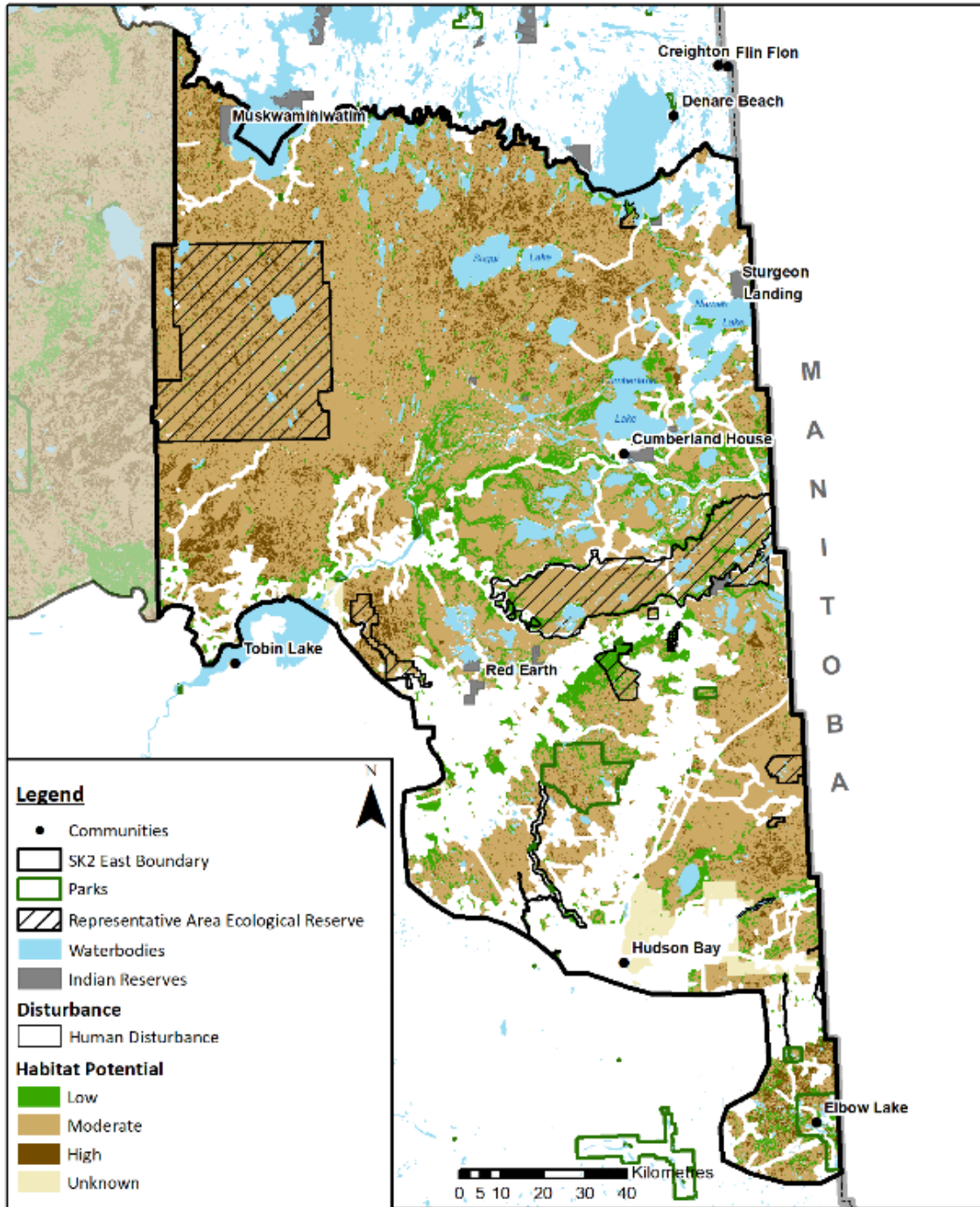


Figure 10. The distribution of undisturbed habitat and habitat potential class across SK2 East¹.

¹ Undisturbed habitat are areas not disturbed by wildfire human-caused disturbance plus a 500 m buffer.

4.3.1 Disturbance Levels by Habitat Potential Class

Over 60 per cent of SK2 East falls in the moderate habitat potential class, while the high potential habitat class makes up approximately 7.4 per cent of SK2 East (Table 5). The low habitat potential class, unclassified areas, and water make up the remaining area in SK2 East. Disturbance levels within the various habitat potential classes provide an indication of the human impacts associated with specific habitat types for caribou, but these numbers should not be confused with the overall range planning target of achieving 65 per cent of the SK2 East in an undisturbed state.

Figure 11 shows the overlay of the human-caused disturbance with habitat potential. Over 50 per cent of the low potential category has experienced human-caused disturbance; approximately 15 per cent of the moderate habitat potential category has experienced human-caused disturbance, and 12 per cent of the high habitat potential category is affected by human-caused disturbance. The relatively high proportion (i.e. 79 per cent) of undisturbed habitat in the moderate and high potential classes is expected to remain so as these classes contain a greater proportion of wetland and forest classes that are considered non-timber productive. In addition, permanent human-caused disturbance such as permanent roads and settlements overlaps 8.7 per cent of low, 2.0 per cent of moderate, and 1.9 per cent of the high habitat potential classes.

Table 5. Area summary of caribou habitat potential classes in SK2 East.

| Habitat Potential Class | Area (km ²) | Area (per cent) |
|---------------------------|-------------------------|-----------------|
| Low | 5,110 | 20.2 |
| Moderate | 15,526 | 61.3 |
| High | 1,866 | 7.4 |
| Unsuitable ¹ | 987 | 3.9 |
| Total ² | 23,488 | 92.7 |

¹ The unsuitable habitat potential class is primarily composed of agricultural lands at the southern boundary of the caribou administration unit around Hudson Bay.

² The total SK2 East area covers 25,338 km². The remaining SK2 East area is composed of water (i.e. 1,866 km² or approximately 7.4 per cent).

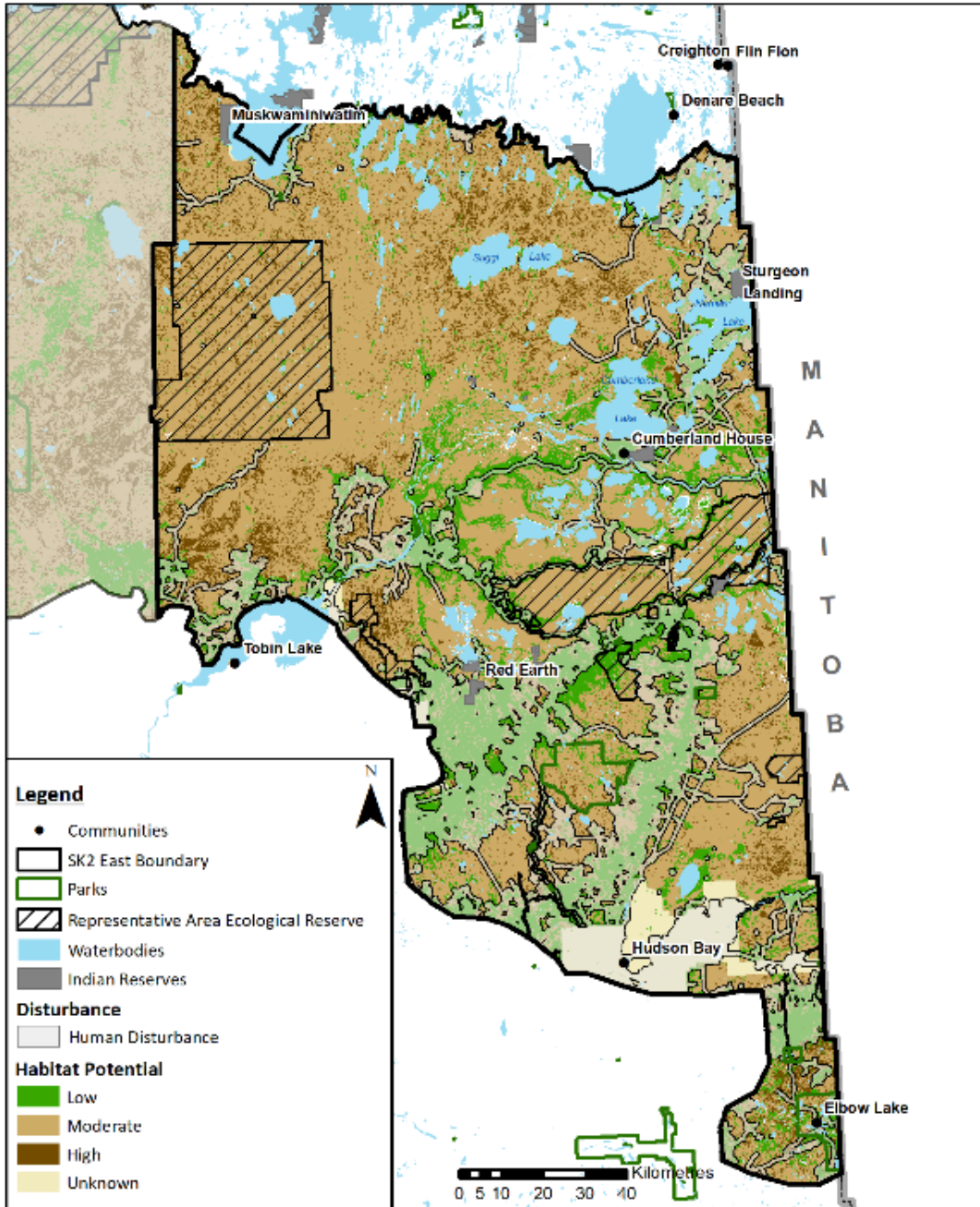


Figure 11. Habitat potential classes in the SK2 East caribou administration unit overlaid with the current human-caused disturbance.

4.3.2 Biophysical Attributes of Habitat

In the SK2 conservation unit, high value woodland caribou habitat potential is characterized by open jack pine sites with very high (i.e. greater than or equal to 20 per cent) lichen coverage and black spruce treed bogs. Most wetland types, and other jack pine dominated and black spruce dominated sites, provide moderate value habitat potential. These ecosites meet the biophysical attributes as outlined in the federal recovery strategy (Environment Canada, 2012).

Sites classed as low value habitat potential for caribou are hardwood, hardwood dominated mixedwoods, or white spruce dominated forest stands. These high nutrient, moist ecosites tend to provide forage and additional habitat values for other ungulates (e.g. deer, moose, and elk) and are typically used less frequently by caribou, but may be required to maintain connectivity between patches of high and moderate habitat potential. Suitable caribou habitat exists in areas where high and moderate value habitat potential is found intermixed in large, contiguous patches with little fragmentation.

4.3.3 Patterns of Habitat Use

Data from radio collared caribou from the early 1990s indicated that caribou in the SK2 Central area preferred peatlands and black spruce dominated stands compared to all other habitat types (Rettie and Messier, 2000). An additional telemetry-based study in the mid-2000s showed that caribou selected treed muskegs and mature jack pine and avoided hardwoods, young conifer, recent cut blocks and linear features (Arlt, 2009). Late winter habitat use assessments done on the Mistik Forest Management Agreement area showed that caribou used tamarack and black spruce dominated wetlands in the south (Proulx, 2013) and also used jack pine dominated habitats further north (Proulx and Gillis, 2017).

To understand geographic patterns of caribou habitat use in the SK2 East, caribou location information has been compiled from a combination of data sources since 1970. Woodland caribou location information has come from incidental sightings (e.g. report a caribou database; Saskatchewan Conservation Data Centre), industrial, First Nation and provincial government surveys, telemetry data (Manitoba Hydro), and fecal pellet collections. Because caribou have large home ranges, a grid consisting of 15 km x 15 km squares, the approximate size of a caribou home range (Rettie and Messier, 2001; Dyke, 2009) was constructed across SK2 East. If a caribou observation occurred within a grid square, it was assumed that caribou used all or part of the square. The caribou observation map (Figure 12) represents knowledge to date on caribou locations and habitat use in SK2 East. Without having long-term and systematic surveys, the absence of caribou observations in Figure 12 should not be interpreted necessarily as an absence of caribou, but rather a lack of survey information to detect caribou. Resource users and outdoor enthusiasts are encouraged to submit their sightings of woodland caribou on the report a caribou sighting webpage (<http://www.biodiversity.sk.ca/ReportaCaribou.php>). Reporting of caribou sightings are also available on the Cooperative Wildlife Management Survey (CWMS) app.

For comparison and validation, the approximate location of woodland caribou sighting density as identified by Indigenous traditional and local knowledge in the Cumberland House region is illustrated in Figure 13 (PAMF, n.d.).

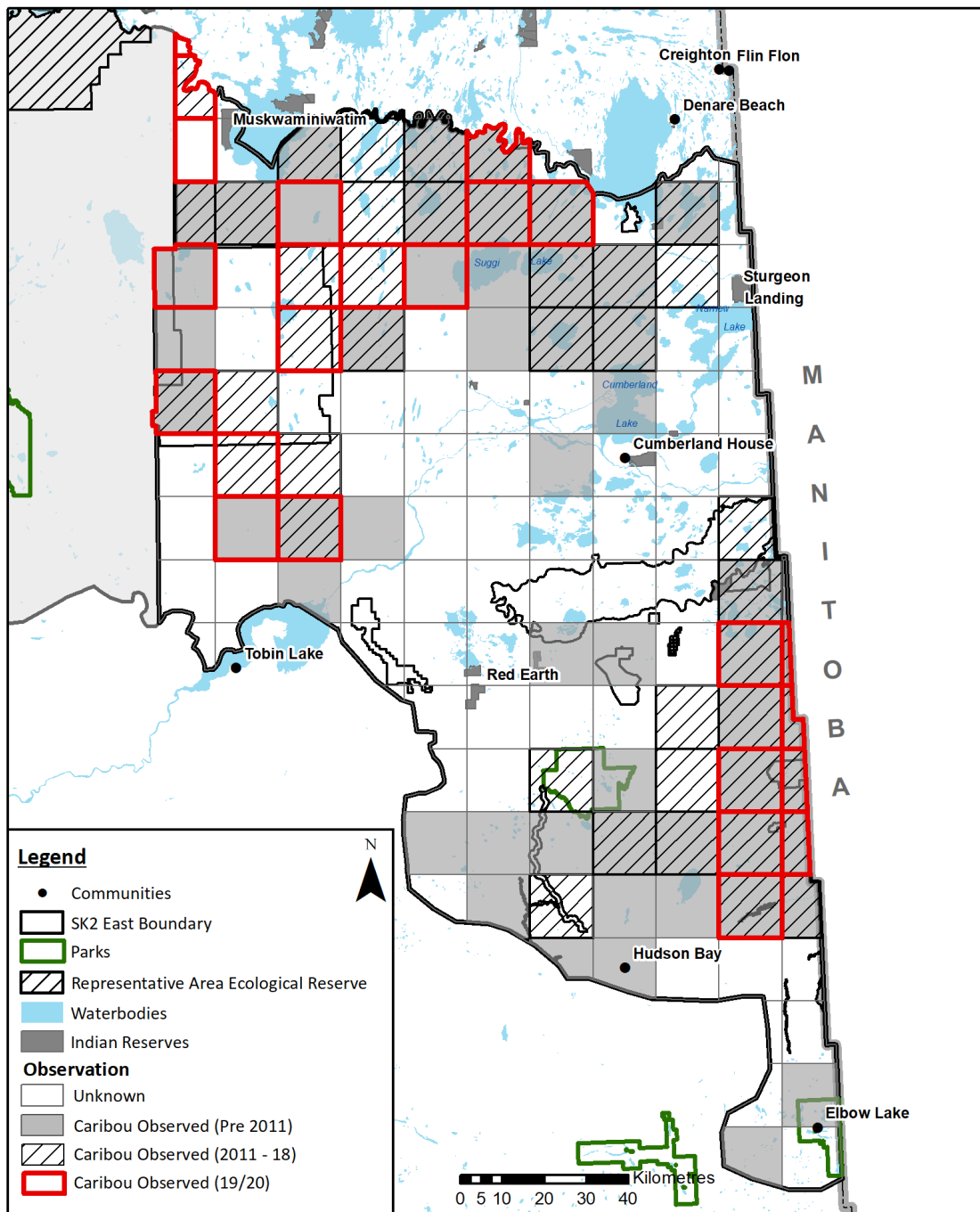


Figure 12. Areas with woodland caribou observations in the SK2 East from 1966 to 2020¹.

¹ Fifteen square kilometre grid squares that are marked as unknown reflect a lack of survey information to detect caribou and not necessarily absence of caribou use of the square.

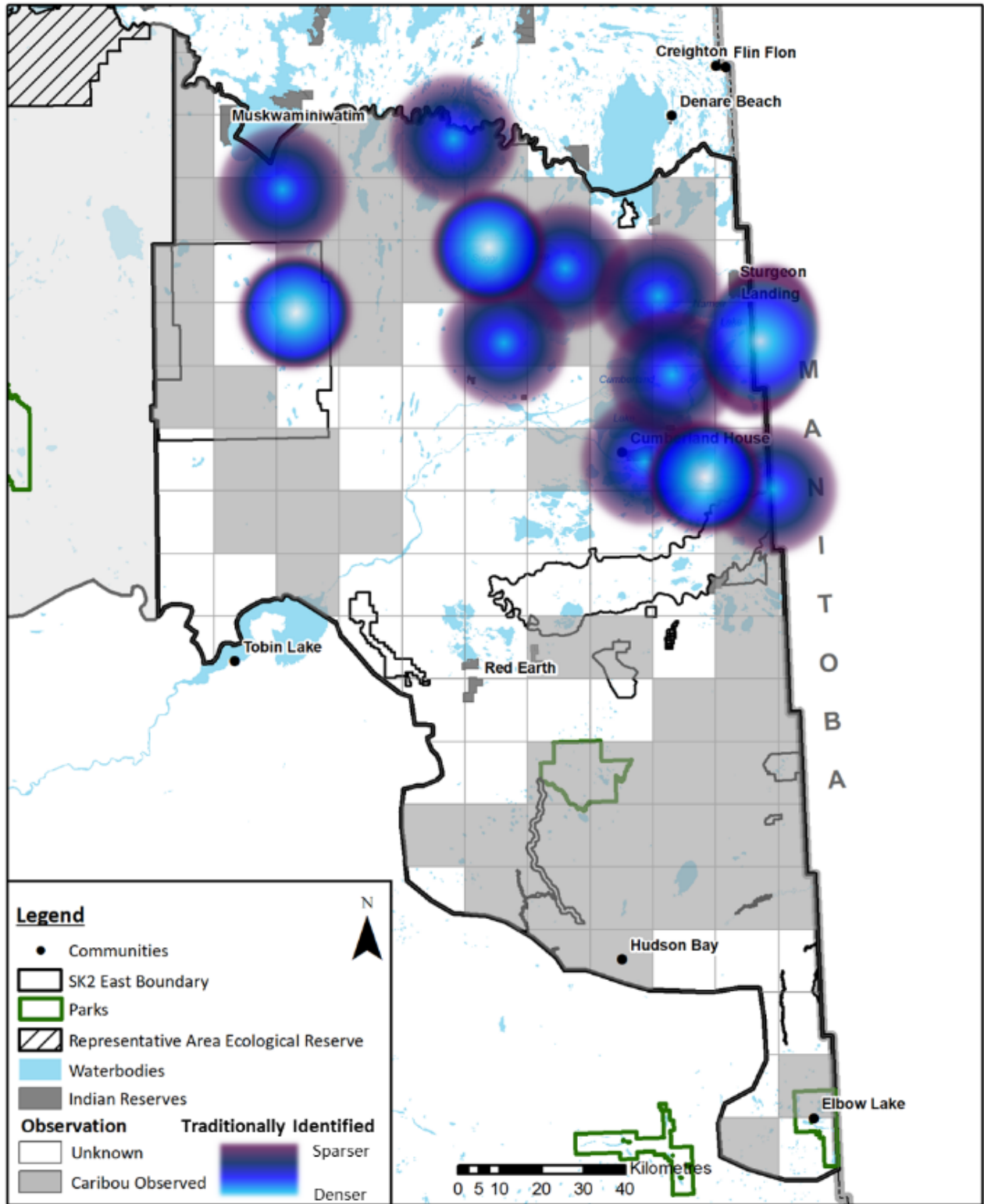


Figure 13. Approximate woodland caribou sighting density as identified by Indigenous traditional and local knowledge in the Cumberland House region (adapted from PAMF, n.d).

5.0 Habitat Management

The Government of Saskatchewan considers the woodland caribou range assessment and planning processes to be part of a broader cumulative effects assessment and management strategy for provincial Crown lands. Our approach recognizes the variation of fire regimes, ecological conditions, land use activity and human-caused disturbance across Saskatchewan's boreal forest.

5.1 Landscape Management Goals

Landscape level genetic analysis has shown the woodland caribou population to be relatively continuous across the province with weak population structure mostly caused by distance between animals but also affected by landscape features which cause resistance to movement (e.g. large water bodies, roads, and harvest blocks). The province is incorporating the landscape level approach to management, which can provide suitable habitat conditions to support the recovery and long-term sustainability of the woodland caribou population across the provincial range. Ultimately, the measured population size and trend of the woodland caribou within SK2 East will provide the best indication of the effectiveness of Saskatchewan's landscape management goals. An adaptive management approach, including annual disturbance monitoring and longer-term population monitoring, will allow Saskatchewan to respond to changes in caribou population status and assess the effectiveness of current management options.

Our focus will be on managing human-caused disturbance, altering the pattern of human-caused disturbance, and maintaining adequately-sized and well-connected patches of undisturbed caribou habitat across, and between, caribou administration units and jurisdictions. This approach should provide sufficient habitat availability on the Saskatchewan landscape in which the natural fire regime, if unchecked, would result in a highly disturbed land base. It will also create healthy forest landscapes for other boreal species.

Specific areas of the landscape have been prioritized for different management objectives and actions in order to maintain sufficient habitat for a self-sustaining caribou population while minimizing economic impacts on, and maintaining opportunities for, current and future land use. To assist with gaining a better appreciation of habitat value and use by woodland caribou, the landscape will be stratified into 3 different tier. Tier 1 represents areas of high importance where caribou habitat retention is the primary objective. Tier 2 areas are of importance to caribou, but have higher levels of habitat disturbance and have an objective of habitat restoration. Tier 3 areas represent general matrix caribou habitat where maintaining connectivity is an important objective.

While tier 1 areas do contain the highest amount of high habitat potential (i.e. 13 per cent), high habitat potential can also be found in lower amounts in tier2 (i.e. 10 per cent) and tier3 (i.e. 3.3 per cent). High habitat potential is identified at the site or stand level and distributed across the landscape, so all high habitat potential sites will not be found in tier 1 areas.

Additional fire suppression efforts are not currently considered a viable option to maintain or reduce disturbance levels in the SK2 East. The province identifies values at risk from wildfire with the following priority: human life, communities, public infrastructure, primary timber and important habitat.

Therefore, caribou habitat would likely fall within the primary timber value. Increasing fire suppression resources and preventing the natural fire return interval from occurring would contribute to the buildup of fuels over time and would ultimately make fire suppression in these areas more difficult.

Additionally, a comparative analysis of costs was completed for additional protection measures in the SK1 caribou conservation unit. The number of suppression staff, supervisors and support staff would need to be doubled with an estimated annual fixed cost increase of \$ 2,581,445. Additional infrastructure required is estimated as a one-time capital cost, estimated at \$ 8,600,000. Enhanced fire response would require a one-third increase in aerial fleet coverage which would include one additional 580 aircraft, two additional 250 skimmer aircraft, and two bird dog aircraft with a minimum cost of \$110,000,000, if the same aircraft are available. These estimates do not include the costs associated with air operations such as staffing, infrastructure, training, and other factors. Not included in the cost estimates are needs for increased crew vehicles, fire engines, crew equipment and personal protective equipment, fire camp needs (for large fires), training needs, increased detection capabilities and program support costs. Increasing crew numbers requires a proportional increase in equipment, facilities, and resources to support them.

Saskatchewan has identified five landscape management goals for the SK2 East:

Landscape Management Goal 1:

Maintain the total amount of disturbance in SK2 East below 35 per cent.

Based on the Saskatchewan Ministry of Environment disturbance assessment¹, the current level of human-caused disturbance in SK2 East is approximately 6,485 km² or 25.6 per cent of SK2 East and the total disturbance (including wildfire) is 30.5 per cent. Saskatchewan aims to maintain the total disturbance level below the 35 per cent threshold through enhanced reclamation that targets legacy mineral linear features and forestry-related linear features, the application of minimization practices and mitigation for new infrastructure access management, avoidance of important caribou habitat, and by using a natural forest pattern-based harvesting approach to reduce the dispersion of forest harvesting areas and the associated amount of road access infrastructure. Other human-caused disturbances may cause localized and cumulative negative effects on caribou and their habitat, but are not the focus of these future projections.

¹ The Saskatchewan Ministry of Environment disturbance assessment was based on Environment Canada (2011) methodology where: a) all mapped human-caused direct footprints are buffered by 500 m, and b) human-caused and wildfire disturbances have a 40-year restoration time after which they become undisturbed habitat. See Appendix A for detailed methods and data sources.

Landscape Management Goal 2:

Increase the amount of high potential woodland caribou habitat that is unaffected by human-caused disturbance above current levels.

The location and amount of high potential habitat is broader in geographic scope than tier 1 areas and occurs throughout SK2 East within tier 1, tier 2 and tier 3 areas although in higher proportions in tier 1 and tier 2 areas. High potential habitat provides necessary forage and refuge and is used during the sensitive late-winter, calving, and post-calving periods. Therefore, high potential habitat locations need to remain in relatively large undisturbed patches throughout the SK2 East landscape to ensure that vital processes can continue. Based on Saskatchewan Ministry of Environment's habitat potential mapping, the amount of high potential woodland caribou habitat in the SK2 East area is approximately 1,866 km² or 7.4 per cent of SK2 East. These areas are largely comprised of treed wetlands, but also include upland jack pine-lichen ecosites. Currently, less than 15 per cent of high potential habitats are affected by direct and/or indirect human-caused disturbance. The Saskatchewan Ministry of Environment aims to increase the amount of high potential habitat in a condition unaffected by human-caused disturbance in the SK2 East. Achieving this objective will ensure that nodes of important caribou habitat remain in a largely undisturbed condition (from human activities) across the SK2 East caribou administration unit. To be effective, this habitat objective should be used in conjunction with other landscape objectives for connectivity, forest harvest patterns, and reclamation of legacy non-permanent roads.

Landscape Management Goal 3:

Landscape Management Goal 3a: Target reclamation efforts within CHMA 6 to reduce human-caused disturbance below current levels and ensure connectivity between tier 1 areas.

CHMA 6 (tier 2 - Figure 17) is currently highly disturbed (80 per cent disturbed), but is an essential movement corridor for caribou between CHMAs 2 and 3 (tier 1 areas). There will likely continue to be forestry operations in much of the northern half of CHMA 6; however, the southern portion of CHMA 6 (despite some continued forestry operations) is to be targeted first for reclamation and restoration efforts on linear features to maintain an undisturbed movement corridor between CHMAs 2 and 3. This southern area currently has 490 km of non-permanent linear features. Once harvesting is reduced in the northern portion of CHMA 6 then this area could be targeted for reclamation and restoration efforts.

Landscape Management Goal 3b: Maintain adequate connectivity between SK2 East and adjacent caribou administration units and jurisdictions.

Recent population genetic research has demonstrated that a relatively continuous population of woodland caribou exists across the Boreal Plain and Boreal Shield of Saskatchewan and that caribou in the eastern and western areas remain connected to woodland caribou populations in Manitoba and Alberta (Priadka et al., 2018). However, this research also suggests there is weak population structure, which is affected by landscape features that create resistance to movement such as large

lakes, roads and harvest blocks. Weak structure within the woodland caribou population suggests that there are still relatively few connective barriers across the landscape and that gene flow is still possible and occurring (COSEWIC, 2014).

In order to maintain a relatively continuous woodland caribou population across eastern and northern Saskatchewan, maintaining adequate landscape-level connectivity within the SK2 East area and adjacent caribou administration units and jurisdictions is required. The Saskatchewan Ministry of Environment is working to develop a decision-support tool using currently available habitat connectivity mapping software to provide spatial information on likely movement corridors for caribou. This finer scale indicator of caribou habitat connectivity will be used to support planning in all tiers, but will have important implications for management of caribou habitat in tier 3 areas.

Landscape Management Goal 4:

Increase forest harvest event sizes to more closely emulate natural forest patterns.

Similar to other jurisdictions, historical forest harvesting patterns generally utilized a traditional two-pass harvest system with relatively small (ranging from 40 ha to 100 ha in size) harvest blocks with adjacent leave areas. This harvesting pattern resulted in a fragmented landscape with relatively small forest openings and a large legacy network of roads.

Through the *Saskatchewan Environmental Code – Forest Management Planning Standard*, the Saskatchewan Ministry of Environment has adopted a natural disturbance-based approach to forest management. Based on the concepts of the natural range of variation, Saskatchewan is implementing natural forest pattern harvest requirements that more closely emulate natural disturbances in scale and pattern. Natural forest pattern harvest methods will result in increased harvest patch and harvest event sizes that more closely emulate natural disturbance patterns, and as importantly, should contribute to a reduction in the amount of forestry associated roads. Individual natural forest pattern harvest events can be further coordinated through forest management planning that in the long-term will create future large patches of undisturbed habitat. Emulating natural forest patterns is anticipated to have many other benefits for multiple boreal wildlife species, including woodland caribou.

Landscape Management Goal 5:

Human-caused disturbance in the SK2 East is spatially aggregated (i.e. clumped) and generally located in the southern portion of the unit. Conversely, large areas of relatively undisturbed patches occur in the northern portion of the unit. Landscape management goals 5a and 5b acknowledge that we are currently, and will likely remain, under the 65 per cent undisturbed habitat threshold, but that there remains concern for caribou in areas with high levels of human-caused disturbance.

Landscape Management Goal 5a: Maintain and or reduce disturbance levels in CHMA 1 and 4.

Caribou habitat management areas #1 and #4 (Figure 17) together provide one of the largest patches of undisturbed habitat in the boreal plain (8,046 km²) and there are a significant number of woodland

caribou observations in these areas. In light of the current status and value of this area from a habitat connectivity and undisturbed habitat perspective, this landscape management goal will focus on keeping disturbance levels in this area at or below current levels.

Landscape Management Goal 5b: Reduce the total amount of non-permanent linear features in CHMAs 2,3,5, and 6.

SK2 East has a large network of non-permanent legacy roads. Depending on the type and status of the feature, responsibility for reclamation may rest either with industry or the Crown. This landscape management goal is directly tied to Landscape Management Goal 3a.

The re-vegetation status and level of human activity associated with many legacy roads is currently uncertain. However, based on available information¹ the total length of non-permanent linear features in SK2 East is estimated to be approximately 5,524 km. In-block roads which are within harvest blocks are currently required to be reclaimed at the time of block reforestation. Saskatchewan plans to decrease the total amount of non-permanent legacy roads through access management planning, and enhanced reclamation, especially focused on legacy forestry-related linear features. The tier 1 and tier 2 caribou habitat management areas will be initially prioritized for these activities. Through future detailed access management planning, road reclamation plans and targets will be created for different areas of the SK2 East area.

5.2 Management Strategies

As part of the range planning process, Saskatchewan has identified several management strategies that will be combined to reduce landscape disturbance. Five primary strategies (e.g. Table 6) have been identified:

- i. avoidance;
- ii. reclamation and restoration;
- iii. mitigation offsets;
- iv. forest harvest patterns; and
- v. access management.

Each management strategy is supported by existing provincial legislation. Management strategies will be deployed strategically across the landscape to maintain or improve the amount and connectivity of suitable caribou habitat, over the 50-year period of this plan. These management strategies not only benefit woodland caribou, but many other species including migratory birds that share the same habitat requirements (Environment Canada, 2012). However, it is possible that negative impacts could occur to other species and the province will be watchful of unintended outcomes. These management strategies were developed for the SK2 Central and SK2 West, but are also suitable for use in the SK2 East caribou administration unit.

¹ Non-permanent roads are considered to be Class 2, 3, and 4. Public roads and non-permanent seismic lines are from Ministry of Environment mapping initiatives. See Appendix A for detailed disturbance mapping methods.

The five management strategies, their application, and potential considerations, are described in Table 6. Steps or actions required to implement each strategy are identified in Section 6.

Table 6. Summary of SK2 East area range plan management strategies.

| Management Strategy | Purpose/Intent | Actions |
|------------------------------------|--|--|
| Avoidance | Limiting or reducing human access in areas with characteristics or features that make them uniquely important to the maintenance of caribou, their movement, or other habitat requirements. The intention is to avoid preventable human-caused impacts on caribou and caribou habitat. | <p><u>All Activities</u></p> <ul style="list-style-type: none"> • Evaluate the risks associated with activities and develop viable alternatives to creating new disturbance. • Areas to be avoided are anticipated to be dynamic in nature and the relevancy of these areas may change over time. • New disturbance in tier 1 habitat is strongly discouraged and should only be considered in exceptional circumstances. |
| Reclamation and Restoration | Return disturbed or altered habitat resulting from human activities to its former condition as functional caribou habitat. | <p><u>Linear Features</u></p> <ul style="list-style-type: none"> • In areas with high levels of historical human-caused disturbance, and harvesting has not been identified in upcoming forest management 20 year tactical plans, actively reclaim and restore non-permanent roads. <p><u>Linear and Area-based Features</u></p> <ul style="list-style-type: none"> • Carry out managed reclamation of new human-caused habitat disturbance. |
| Mitigation Offsets | Reduce levels of human-caused habitat disturbance by compensating with restoration of areas outside of the immediately planned disturbance. | <p><u>Linear and Area-based Features</u></p> <ul style="list-style-type: none"> • When land use creates new habitat disturbance, a mitigation offset will be required. Places of higher importance for caribou will require greater offsets. |
| Forest Harvest Patterns | Through forest harvesting, create natural forest patterns that more closely approximate the range of variation of natural disturbances, both in distribution and scale. | <p><u>Forest Harvesting</u></p> <ul style="list-style-type: none"> • Utilize natural forest pattern harvesting methods to emulate landscape patterns created by natural disturbances, both in distribution and scale, and reduce road network requirements. • Focus near-term forest harvesting within or around areas that received historical forest harvesting to allow for reforestation, road reclamation and closure. |
| Access Management | Reduce amount of human-caused disturbance. Alter and manage the pattern, locations, and frequency of human access. Reduce sensory disturbance for caribou. | <p><u>Linear Features</u></p> <p>Create access management plans to:</p> <ul style="list-style-type: none"> • Identify suitable areas and or linear features for active reclamation and restoration. • Prevent human access to restored features to ensure they remain on the path to restoration. • Coordinate future access. <p><u>All Activities</u></p> <p>Reduce the intensity of, or conduct human activities outside of, seasonally sensitive caribou periods (late-winter and calving and post-calving).</p> |

5.2.1 Avoidance

Avoidance primarily refers to limiting or reducing human access in areas with characteristics or features that make them uniquely important to the maintenance of caribou, their movement, or other habitat requirements. The intention is to avoid preventable human-caused impacts on caribou and caribou habitat.

Avoidance of areas with substantial historical or recent species occurrences, unique habitat features, areas that attract, alter, or facilitate species movement or other natural features required for the species will limit the risk to the species.

The identification of important caribou habitat management areas (e.g. tier 1) and the purposeful avoidance of these areas is designed to aid in the location of new northern developments by identifying areas considered to pose high risk to the species or its habitat. tier 1 areas constitute higher current habitat value and use by woodland caribou and any activity proposed in these areas will be subject to greater assessment. Additionally, more stringent operating conditions will be required and greater planning effort is expected.

5.2.1.1 Application:

- Avoidance is the purposeful altering of plans, operations or activities to maintain caribou habitat and its connectivity.
- Avoidance of important caribou habitat management areas (e.g. tier 1) will need to be considered by all provincial Crown land users.
- Avoidance is the first strategy identified under section 3-8(1)(b) of *The Crown Resource Land Regulations, 2019* to achieve mitigation outcomes.
- New disturbance in tier 1 habitat is strongly discouraged and should only be considered in exceptional circumstances.

5.2.1.2 Considerations:

- As a management strategy, avoidance generally provides the greatest degree of habitat protection because reclamation, restoration, and mitigation efforts may still not be sufficient to provide for sufficient quality, quantity, and distribution of functional habitat for woodland caribou.
- Areas to be avoided are anticipated to be dynamic in nature and the relevancy of these areas may change over time as disturbance occurs or due to the natural succession of vegetation on the area.
- When avoidance is not appropriate and not selected, greater planning, mitigation, and monitoring will be required.
- Enhancing wetland conservation through deliberate avoidance can achieve multiple provincial priorities beyond caribou conservation, including enhancing climate change resiliency and mitigation, reducing flooding, improving water quality and contributing to broader biodiversity goals including waterfowl.
- Avoidance may not necessarily be desirable in all cases such as i) the potential activity or development would yield greater and shared societal benefits (e.g. public infrastructure) or ii)

an ecological (e.g. net long-term habitat) efficiency would be realized such that the destruction of habitat in one area could be compensated to a greater degree by habitat creation or improvement in another area.

5.2.2 Reclamation and Restoration

While the terms reclamation and restoration are sometimes used interchangeably, they can represent different processes. Reclamation can be considered to be the process of returning formerly disturbed lands or wetlands to their former or alternative productive uses. Restoration implies that the disturbed site is being returned to a vegetated condition that is similar or identical in composition and structure to the original condition so that ecosystem functions are restored. For range planning, these collective terms (reclamation and restoration) are being used to describe the process of returning sites disturbed by human activities back to a suitable condition as caribou habitat. One benchmark for defining the natural state of Saskatchewan's forest ecosystems is the *Field Guide to the Ecosites of Saskatchewan's Provincial Forests* (McLaughlan et al., 2010). This field guide identifies the composition (e.g. vegetation, soils) and structure (e.g. vegetation constancy and cover) associated with the ecosites found across the Boreal Plain, Boreal Shield, and Taiga Shield ecozones. The ecosites can and have been further interpreted in terms of function for providing habitat for woodland caribou.

Reclamation and restoration applies to both legacy and recent human-caused linear and area-based disturbances. Reclamation and restoration of legacy disturbance may come as a result of a government funded activity or as part of an industry led mitigation offset associated with new development. In both cases reclamation and restoration activities will focus on areas with higher levels of human-caused disturbance and moderate to high potential caribou habitat. The expedient reclamation of recent human-caused disturbance is necessary to maintain a sufficient extent and connectivity of caribou habitat across the landscape and to prevent ongoing human use of the disturbed feature.

5.2.2.1 Linear Features

Linear features and their associated buffer are responsible for the majority of the human-caused disturbance footprint in the SK2 East area; much of the linear features were associated with previous forest harvesting. Reducing the amount of linear features through reclamation and closure can therefore be an effective means to reduce the amount of human-caused disturbance and improve landscape composition. Reclamation of linear features reduces fragmentation, creates larger patches of undisturbed habitat and may reduce undesirable human and or predator access. Access management supports the reclamation of disturbed sites by allowing and promoting revegetation to desired species and hastens the recovery of habitat.

Tier 2 areas are well suited for linear disturbance reclamation. Tier 2 boundaries are generally formed by recent wildfire boundaries and because of this may not be suitable for forest harvesting for many decades.

In the SK2 East, historical land use practices have resulted in a large number of legacy roads, trails, and geophysical lines, many of which have become part of the established transportation network. While new resource roads are subject to modern reclamation standards, legacy linear features have not yet been fully addressed.

5.2.2.2 Area-based Features

In the SK2 East area, forest harvest blocks are the main source of human-caused area-based disturbance. Since 1999, *The Forest Resources Management Act* has required the Saskatchewan forest industry to reforest all harvested areas when harvesting activities are complete. In accordance with the *Forest Operations* chapter of the *Saskatchewan Environmental Code*, in-block roads are required to be reclaimed and non-in-block roads are also required to be reclaimed and renewed once they are no longer in use. The success of forest industry reforestation efforts is assessed under the *Forest Regeneration Assessment* chapter and standard in the *Saskatchewan Environmental Code*. The Ministry of Environment's Forest Service Branch has addressed previously not sufficiently regenerated harvest blocks resulting from harvesting activities conducted prior to 1999.

Other land uses also contribute to area-based disturbance in the SK2 East. These include settlements, recreation areas, mineral exploration sites, and material extraction activities such as gravel and peat moss harvesting. Roads built through wetlands that do not maintain natural water flow can also create disturbance by destroying or altering the function of these wetland ecosystems. The Ministry's Forest Service branch is currently developing a *Forestry Wetland and Watercourse Crossing* chapter and standards for inclusion in the *Saskatchewan Environmental Code* that will establish management practices to reduce the impact of roads to wetland ecosystems on provincial forest lands. (Government of Saskatchewan, n.d.).

5.2.2.3 Application

- Reclamation and restoration of human-caused legacy habitat disturbance will be achieved through various programs and mechanisms that may be community-led, industry-led, government-led or combinations thereof.
- Implementation of consistent restoration standards is expected to accelerate the natural regeneration process and shorten the period for areas to be considered functional caribou habitat.
- Access management planning will assist in identifying appropriate locations for the reclamation of legacy linear features. The Ministry is currently acquiring and processing Light Detection and Ranging (LiDAR) data within a subset of tier 2 areas in SK2 to assess revegetation status on linear features. Using this information, coupled with information on suitable caribou habitat, a prioritization queue of linear features that are suitable for reclamation and restoration efforts, with the most benefit for caribou, will be developed.
- Managed reclamation and restoration of human-caused habitat disturbance will be required for all new disturbance features and will apply to all provincial Crown land users.
- A comprehensive reclamation and restoration framework will be produced in consultation with affected stakeholders, land users and communities. This framework will delegate details of responsibilities, targets, funding mechanisms, and end-points

5.2.2.4 Considerations

- Expectations and reclamation standards currently differ among various land-use activities. For example, the *Forest Regeneration Assessment Standard* (Government of Saskatchewan, 2012)

commonly used by the forest sector, identifies survey protocols and standards to assess tree regeneration requirements by tree species, free-to-grow height and stocking.

- While reclamation is a requirement for most natural resource development activities, greater coordination and compliance to explicit standards is required to improve effectiveness. For example, reclamation activities should be conducted in priority areas in a sequential or progressive approach working from far to near with the intent to hasten forest establishment on large contiguous tracts of undisturbed habitat.
- Definitions for what constitutes reclaimed and restored (i.e. undisturbed) caribou habitat are not currently well-defined:
 - Environment Canada (2011) defines wildfires ≥ 40 years in age as undisturbed
 - Definitions for linear features are not currently available.
- The backlog of historical linear features in the SK2 East area will require a significant financial investment to reclaim.
- Linear feature reclamation and restoration success will largely depend on restricting motorized vehicle use on reclaimed roads and trails, which can be challenging. This will require high levels of education, compliance, and enforcement in order to achieve linear feature reclamation goals.
- Currently, the revegetation condition and human use status of many linear features have yet to be verified.

5.2.3 Mitigation Offsets

Mitigation is the process of reducing or lessening the negative consequences associated with industrial developments on the landscape. Mitigation generally involves a progression of actions to avoid, minimize, and recompense residual adverse effects associated with human disturbance, followed by monitoring, to ensure goals are met. Residual effects are the environmental effects predicted to remain after all practical avoidance, minimization, and mitigation options have been implemented. Residual effects are generally described by their direction (i.e. nature of effect), magnitude, geographic extent, duration/frequency, reversibility, and other factors (Government of Saskatchewan, 2014).

Offsets are applied as part of a mitigation framework that is designed to reduce the overall amount of human-caused habitat disturbance, in order to maintain future economic opportunities. This approach has been successfully used by other jurisdictions and most recently in Saskatchewan within the potash and peat harvesting industries.

Mitigation offsets will be applied to both new linear and area-based disturbances in order to reduce and alter the pattern of human-caused disturbance. New disturbances in areas of higher importance to caribou will require greater offsets. Identification of higher importance areas within respective range planning areas will provide land users certainty as to the expectations and opportunities for avoidance and/or mitigation offsets.

5.2.3.1 Application

- Mitigation offset requirements will be applied to provincial Crown land users.
- Many industries are currently responsible for reclamation and reforestation which aids in minimizing but not removing all adverse effects.

- While requiring further documentation, mitigation offset requirements will be administered through existing environmental assessment, leasing, and permitting processes.
- Currently, mitigation offsets are generally implemented where a project has been deemed a development under The Environmental Assessment Act. The need for mitigation offsets is being presented during range planning to ensure that all stakeholders are aware that this is a measure that the ministry is working toward to assist with the caribou recovery. Work is being done by the ministry to examine potential benefits of conservation banking and boreal offsets including a monitoring component. Industry, First Nations, Métis communities, and other groups will be engaged during the process to ensure that there is an opportunity to provide input in its development or application.
- Offsets will be scheduled for areas of high priority for caribou habitat restoration. Initially tier 2 areas will be the priority to ensure they are on a pathway to become suitable caribou habitat, as soon as possible.
- Currently, details around mitigation offsets are in development; however, concepts being pursued include:
 - Mitigation offset requirements on provincial Crown lands will be based on areas of importance to caribou and habitat objectives. Caribou habitat management area tier 1 mitigation offset requirements would be the highest and tier 3 the lowest (see Section 5.3.1 for description of the caribou management area tiers).
 - Specific mitigation offset requirements and methods for their calculation have yet to be finalized. Saskatchewan anticipates using a risk-based formula approach that incorporates the spatial extent, intensity and duration of the disturbance¹ and the time lag and uncertainty of restoration success.
 - Mitigation and offset protocols will be developed in consultation with affected stakeholders, land users and communities.

5.2.3.2 Considerations

- While reclamation activities to meet mitigation offset requirements can be performed rapidly, it will take many decades to restore caribou habitat. The benefits of habitat mitigation offsets will therefore not be realized for many years. In addition, there is uncertainty whether actions taken to reclaim the site will result in caribou habitat restoration.
- Supporting tools and processes for tracking and identifying mitigation offset opportunities and completed reclamation activities require development.
- To establish a mitigation offset database, detailed mapping of the location of all linear features and the status of those features will be developed, as well as ongoing tracking of features reclaimed under a mitigation offset activity.

¹ Saskatchewan has used a formula-based approach for several preliminary cases of upland and wetland prairie systems and one boreal wetland. This method integrates ecological values and function.

5.2.4 Forest Harvest Patterns

The commercial forest is a large provincial natural resource of significant economic and ecological value. Saskatchewan's commercial forests are disturbance-adapted ecosystems, with wildfire being the primary natural agent of both disturbance and renewal. Wildfire creates and maintains a shifting landscape mosaic of different-sized and aged forest stands. If planned and implemented correctly, forest harvesting and its associated post-harvest reforestation activities can also play similar roles.

The *Saskatchewan Environmental Code - Forest Management Planning Standard* outlines the natural forest pattern requirements that aim to achieve forest harvest events that more closely emulate disturbance patterns created by wildfire events. The natural forest patterns approach will result in a reduction in the overall forest harvesting footprint, fewer forestry roads, allow for more rapid reclamation of required forestry roads and create larger areas of future caribou habitat.

Working towards the goal of emulating natural forest patterns is also aligned with steps identified in Saskatchewan's climate change strategy, *Prairie Resilience*, specifically by providing the province with another mechanism to:

“Ensure natural and commercially forested lands are managed in a manner that enhances the removal and storage of carbon from the atmosphere while allowing for sustainable harvesting, respecting normal forest cycles and fire preparedness.”, and

“Maintain or restore landscape integrity to optimize ecological goods and services, enhance resilience to extreme weather events and manage the risk to biodiversity.” (Government of Saskatchewan, 2017b).

Figure 14 compares a traditional forest harvest block pattern with a natural forest pattern harvest event.

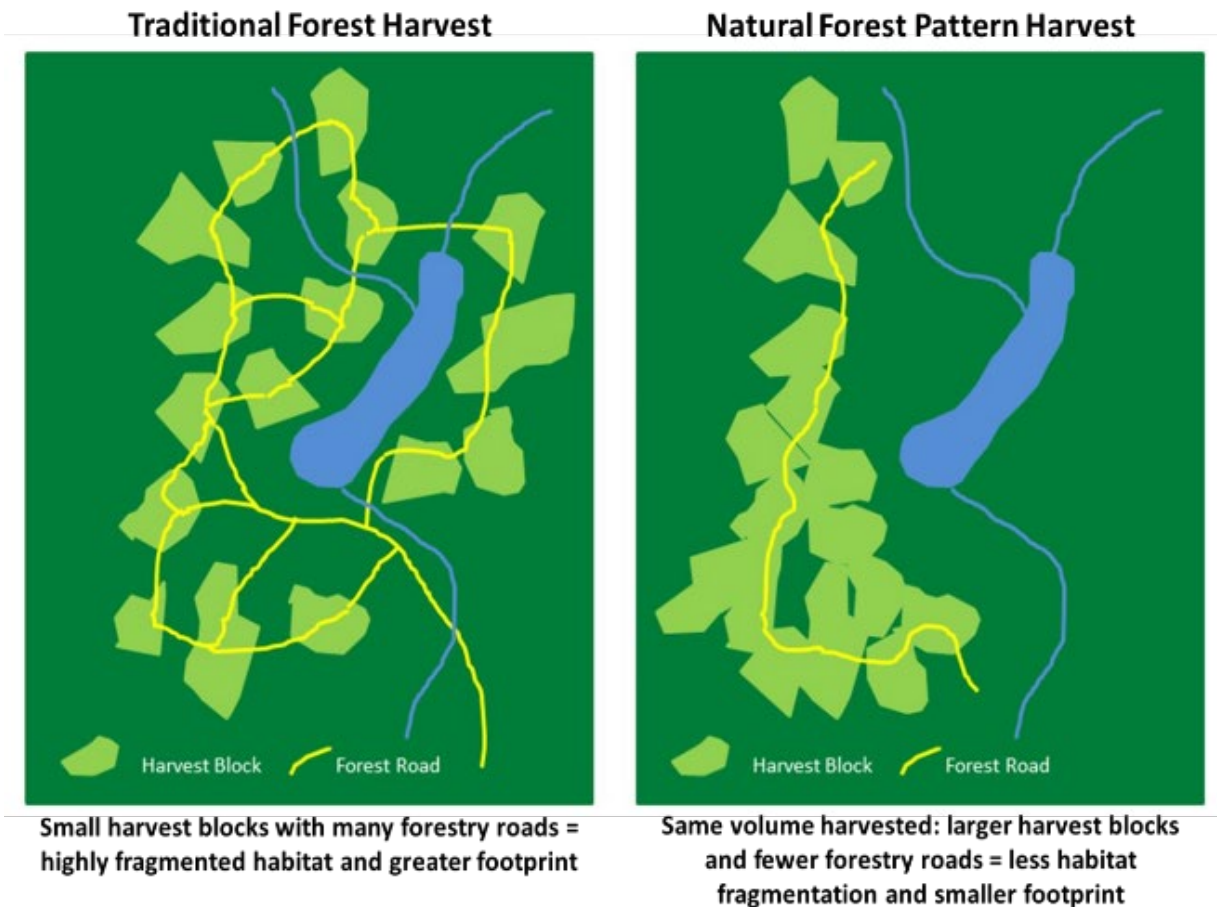


Figure 14. Comparison of a traditional harvest block pattern with a natural forest pattern harvesting event ¹.

Forest harvest events are larger than traditional, dispersed harvest blocks, but will maintain standing tree structure at the local level after harvest similar to live trees surviving a wildfire event. Retaining live trees provides a variety of structure in regenerating forest stands that serve many ecological functions. They provide habitat for cavity nesters, and deadwood-dependent invertebrates, amphibians, lichens, fungi, and micro-organisms. Harvest events will maintain at least nine per cent of the harvested area as live representative tree residuals within the harvest event boundary (Figure 15). Tree retention will be comprised of both insular retention (including single trees, clumps and islands), which is separated from the surrounding undisturbed forests and wetlands and proximal retention (including peninsular retention extending into the harvest area and non-peninsular retention extending along the harvest area boundary), which is connected to a portion of the harvest boundary.

¹ For further information on natural forest patterns, refer to the *Forest Management Planning Standard* of the *Saskatchewan Environmental Code* <http://publications.gov.sk.ca/documents/66/86843-Forest%20Management%20Planning%20Standard.pdf>

Six per cent insular retention is required by the *Forest Management Planning Standard* while proximal retention can only account for a maximum of three per cent of the total retention retained¹. Areas between harvest patches or blocks that do not contain merchantable timber (e.g. young forest, wetlands, riparian buffers) will also be included in the harvest event as matrix residuals (Figure 16).

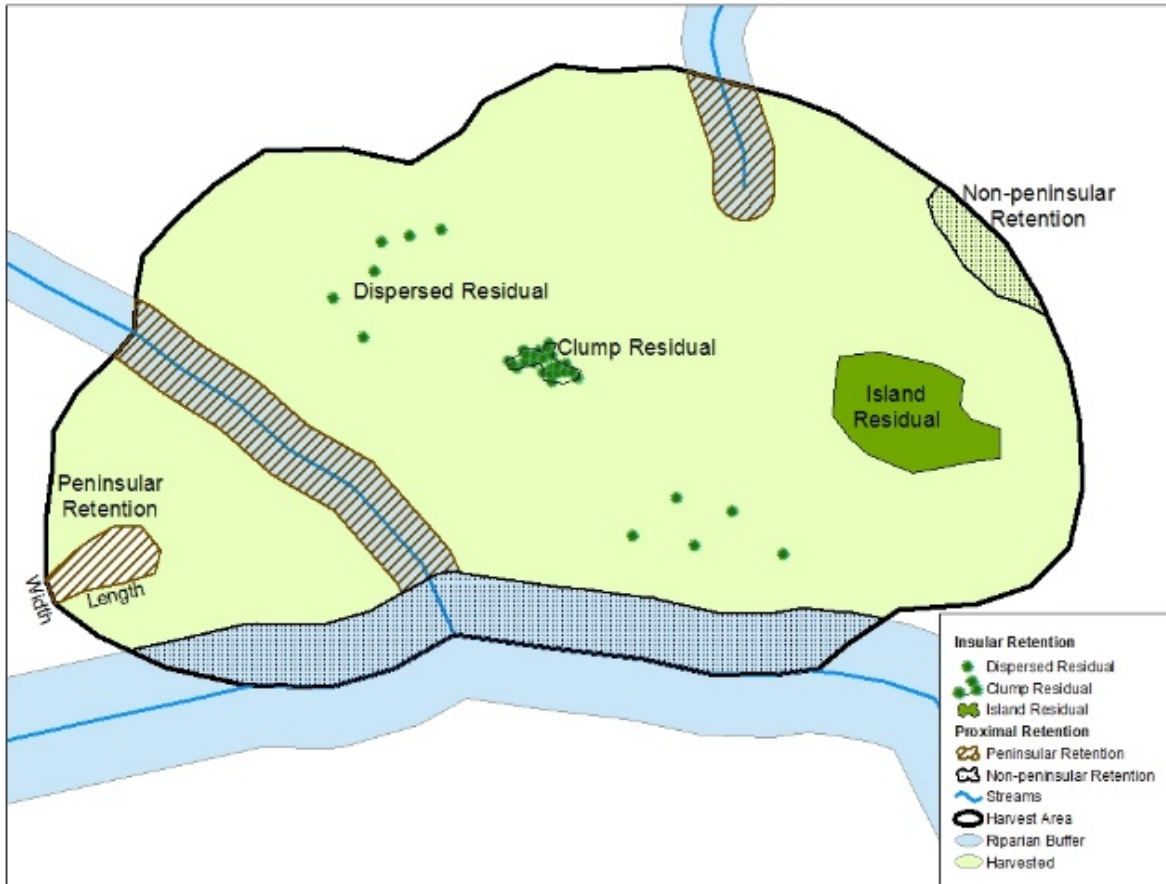


Figure 15. Illustration of how tree retention may occur within a harvest block (Government of Saskatchewan, 2017)

¹ While the retention area of live representative tree residuals for each harvest event is identified as a minimum of nine per cent of the total harvested area in the *Forest Management Planning Standard*, some licensees have implemented alternative approaches to natural forest patterns and specific insular and proximal residual targets that may vary from the standard.

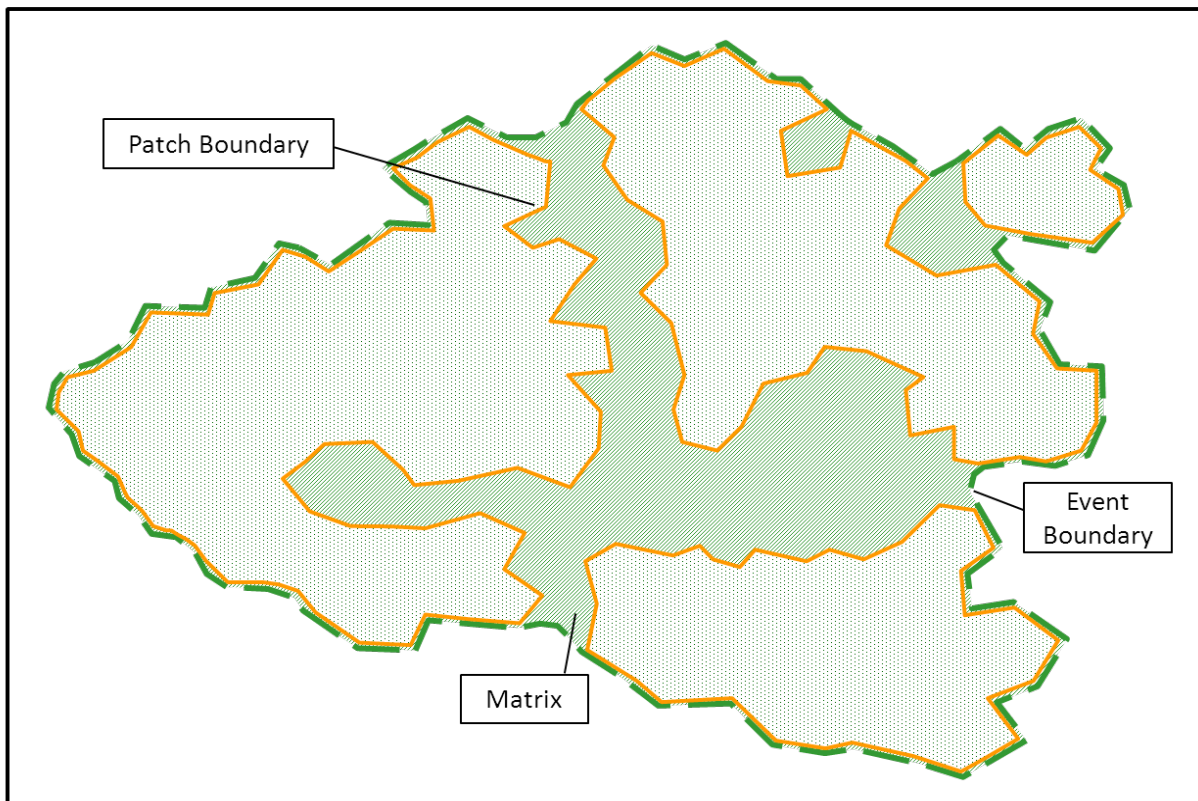


Figure 16. Illustration of unharvested areas (i.e., matrix residual) within a harvesting event (Government of Saskatchewan, 2017).

The legacy of past harvest practices provides an opportunity to schedule existing and immediate harvest plans around remnant forest harvest blocks enabling the provision of larger future caribou habitat that is less fragmented. Identification of areas within respective caribou administrative units for consolidated harvest around existing disturbances will provide the forest industry guidance for forest harvesting planning. Forest management plans currently in development will implement natural forest pattern strategies at both the stand and the landscape-level. As future operational planning will take direction from these plans, natural forest planning harvest events will become the prevailing forest harvesting practice across Saskatchewan's commercial forest. The natural forest pattern harvesting approach has been implemented within the Pasquia-Porcupine timber supply area since 2015.

5.2.4.1 Application

- The natural forest pattern harvesting approach has been embedded in all new forest management plans and these plans will direct harvest operations by the forest industry under area-based term supply licences or forest management agreements¹.
- Natural forest pattern harvesting will also be promoted as the conventional approach for application in other areas of forest harvesting or where vegetation management is required (e.g. provincial parks for vegetation or fuel management).

5.2.4.2 Considerations

- Given multiple land user concerns, objectives, and scales of operation, it may be challenging to fully implement spatial aggregation and natural forest pattern-based forest harvest strategies. For example, implementation of the larger harvest event sizes may conflict with other land uses like outfitting or trapping.
- Another factor to consider is that although planning may identify natural forest pattern-based harvesting, licensees may locate up to 15 per cent of their harvest areas outside of the delineated spatial boundaries of their tactical plan but will still have to adhere to natural forest pattern targets within the forest management plan.

5.2.5 Access Management

Access management primarily refers to limiting or reducing human access to areas or linear features such as roads and trails. Access management supports the reclamation of disturbed sites by allowing and promoting revegetation to desired species and hastens the recovery of habitat. It also encourages consolidation of access and reduces sensory disturbance to caribou during key seasonal periods.

Access management planning will be conducted to identify linear features suitable for reclamation and will coordinate human industrial and recreational access. Access management planning will be carried out with the input of local users, and is planned to include public and stakeholder outreach and education.

In addition, policy will identify the necessary restrictions to industrial operational practices for seasonal periods to reduce sensory disturbance for caribou. The approach is intended to minimize sensory disturbance during the sensitive late-winter and calving and post-calving time periods (e.g. April 1 to July 31) which support successful population recruitment. A study of caribou habitat use during the calving season in SK2 Central (Dyke, 2009) showed strong selection for treed muskegs, but avoidance of jack pine, mixed hardwood stands and roads. Rettie and Messier, (2000) found preferential selection of open and treed peatlands and black spruce/jack pine forests by caribou. Black spruce dominated ecosites were assessed as having the highest calving and post calving habitat value (Appendix C).

¹ Although the *Forest Management Planning Standard* only applies to licensees with a forest management plan, all timber allocation holders are required to integrate their forest management activities with the forest management agreement holder or the area-based timber supply license holder.

5.2.5.1 Application

- Access management will be applied to all areas of SK2 East, and will be strategically applied to maximize disturbance recovery and habitat connectivity.
- Access management will be applied to all provincial Crown land users.
- Seasonal operating restrictions will be implemented to minimize sensory disturbance to caribou during sensitive periods.
- The ministry has completed a cross jurisdictional scan of best management practices in order to assist with the development of standard permit conditions relevant to caribou and industry activities. The Ministry of Environment will be engaging industry with a draft of the document to obtain feedback prior to finalizing best management practices. Temporal restrictions would be a consideration for discussion and input during industry/ministry engagement. Best management practices are expected to be used by ministry staff and proponents during the planning and operational phases of projects.

5.2.5.2 Considerations

- This will require high levels of education, compliance, and enforcement in order to manage or prevent human motorized access on established roads and trails.
- Developing detailed access and reclamation plans for all of SK2 East, and subsequent range planning areas, will require a substantial investment of effort, time, and collaboration.
- To be effective, access management and reclamation planning will require detailed mapping of linear features (e.g. roads, trails), and the use and re-vegetation status of those features, as well as ongoing monitoring.
- Access management is an important aspect of range planning and further engagement with First Nations, Métis communities and stakeholder groups will be required during the implementation phase to further this work.
- Early and ongoing engagement between First Nations, Métis locals, Ministry of Environment staff and stakeholders by industry during the planning phase is an important component in assisting to develop an access management plan that will be most effective.
- Activities required to advance caribou recovery, have the potential to impact Indigenous rights. The ministry understands the importance of early engagement and ongoing dialogue, in order for the range plan landscape goals to be successful. During development of an access management plan and in planning for linear disturbance restoration, the ministry will engage with First Nations and Métis Locals to ensure there is a clear understanding of the significance of this work and that it is approached with a coordinated effort.
- Long term planning for common corridors and the implementation of shared road use agreements have the potential to minimize impacts and disturbance and have potential to be very beneficial tools for caribou recovery. In some instances, common corridors may be detrimental as a result of the need to create longer access routes or the need to route access through habitat that is more critical. Pre-planning will aid in identifying the most appropriate approach.

5.3 Spatial Application of Management Strategies

5.3.1 Caribou Habitat Management Areas

Provincial Crown lands within the SK2 East area have been divided into three types of caribou habitat management areas: tier 1, 2 and 3 (Figure 17). Different management objectives and strategies were developed for each tier based on their relative importance to and known use by caribou, current habitat condition and potential risks (Table 7). Appendix B provides a detailed description of each caribou habitat management area. Biophysical and disturbance attributes of the caribou habitat management areas and other land categories are described in Appendix C.

Other management concepts associated with the caribou habitat management areas include:

- The currently identified caribou habitat management areas are intended to be in place for a maximum period of 20 years, after which time they will be re-evaluated.
- The delineation of the caribou habitat management areas considered numerous factors including habitat potential based on ecosite-habitat relationships and Indigenous traditional knowledge, level and type of disturbance, caribou occupancy/utilization, connectivity, risk of northwards range retraction, and forest industry operational plans.
- The future location and classification of caribou habitat management areas may change on the landscape in response to habitat disturbance recovery, wildfire, changes in land use, and woodland caribou population trends and will be updated as is practically feasible to reflect these changes.
- The area managed as tier 1, 2 and 3 on provincial Crown lands in the future will be determined based on caribou habitat and population status.
- A new decision support-tool is being developed to help identify areas within all three tiers that would maintain or enhance connectivity within SK2 East and between SK2 East and SK2 Central (see Landscape Management Goal 3b) and other jurisdictions. For example, high potential habitat patches within tier 3, depending on their landscape context and configuration, likely provide important stepping stones between large patches of undisturbed habitat in tier 1 and 2 areas.
- On average, tier 1 CHMAs have the greatest proportion of high value habitat potential when compared to tier 2 and tier 3 areas. Conversely, tier 3 CHMAs have the greatest proportion of low value habitat potential compared to tier 1 and tier 2 areas. However, tier 3 areas are still comprised of approximately ten per cent high value habitat potential.
- Saskatchewan currently has all of the regulatory instruments in place (e.g. section 6.2) in order to implement the management strategies of avoidance, reclamation and restoration, mitigation offsets, forest harvest patterns, and access management across all three tiers of the caribou habitat management areas. However, work remains in order to further define some of the policies and mechanisms by which the work will be carried out. Policy development is a priority in order to facilitate their implementation.

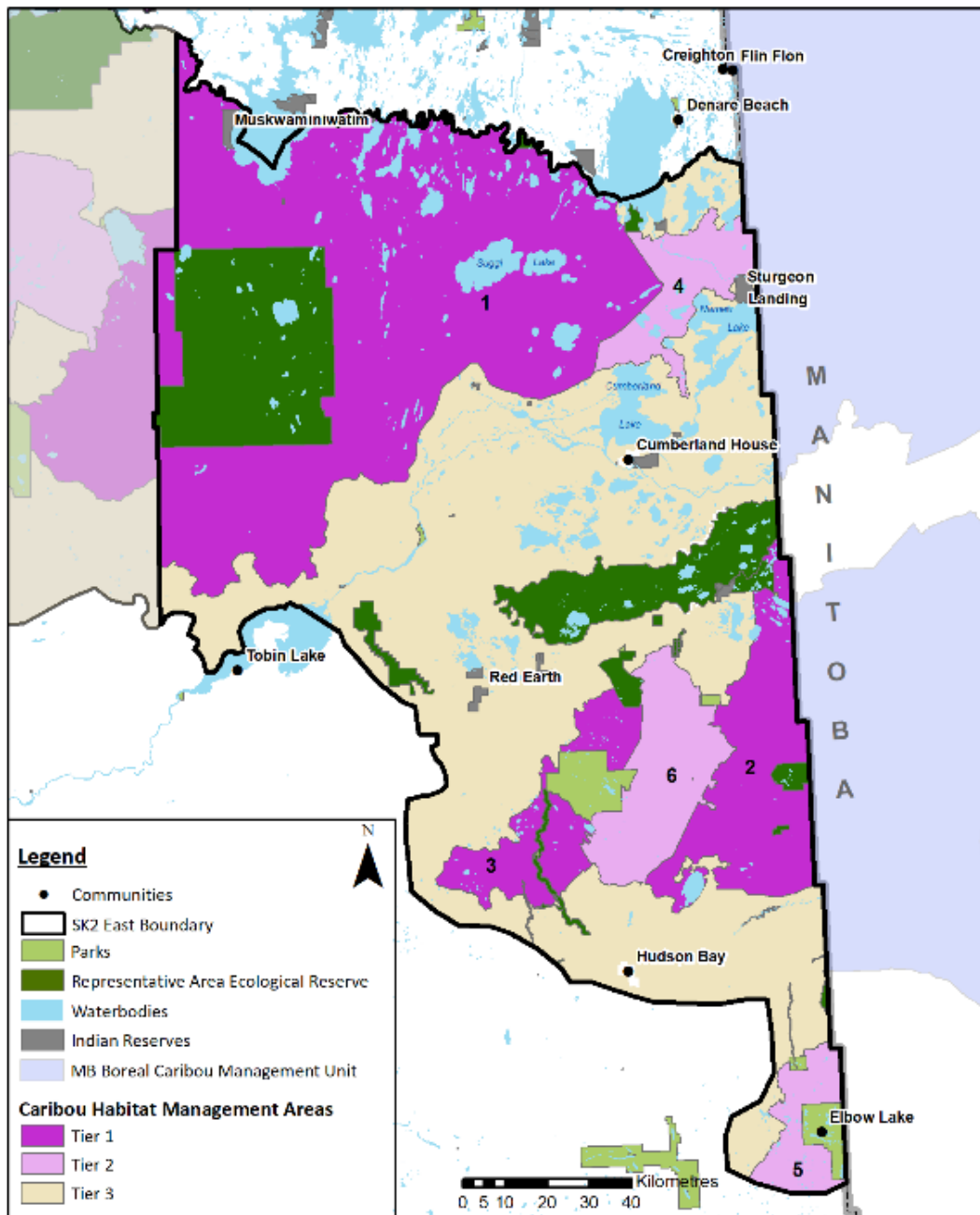


Figure 17. Location of caribou habitat management areas¹ on provincial Crown lands in the SK2 East caribou administration unit².

¹ Specific information pertaining to the designation of the caribou habitat management areas can be found in Table 1 of Appendix B.

² Caribou habitat management area shapefiles are available to detailed users on the HABISask website at: <https://gisappl/saskatchewan.ca/html5ext/?viewer=habisask> and available for download via the Saskatchewan GeoHub <https://geohub.saskatchewan.ca/>.

Table 7. Area summary, criteria for selection, management objectives, and strategies for the caribou habitat management area tiers, ecological reserves, wildlife refuges, and provincial parks on SK2 East provincial Crown lands¹.

| CHMA Tier | Area (km ²) | Area (per cent) | Criteria for Selection | Management Objectives | Management Strategies |
|--|-------------------------|-----------------|--|---|---|
| Tier 1 | 9,322 | 36.8 | Areas of high-moderate caribou habitat potential with high levels of observed caribou use ² and low levels of human-caused disturbance. | <ul style="list-style-type: none"> • Caribou habitat retention. • These areas are preferred deferral or avoidance areas for industrial developments or other land uses. | <ul style="list-style-type: none"> • Avoidance. • Mitigation offsets³. • Access management. |
| Tier 2 | 2,041 | 8.1 | Areas of high-moderate caribou habitat potential with observed caribou use and higher levels of wildfire and human-caused disturbance. | <ul style="list-style-type: none"> • Caribou habitat restoration. | <ul style="list-style-type: none"> • Avoidance. • Reclamation and Restoration⁴. • Natural forest pattern harvesting. • Mitigation offsets. • Access management. |
| Tier 3 | 10,401 | 41.0 | Areas of general caribou habitat between tier 1 and tier 2 areas. Tier 3 areas provide general habitat and connectivity between tier 1 and tier 2 areas. | <ul style="list-style-type: none"> • General caribou habitat management. • Maintain connectivity across the landscape. | <ul style="list-style-type: none"> • Natural forest pattern harvesting⁵. • Mitigation offsets. • Reclamation and restoration. • Access management. |
| Representative Area Ecological Reserves | 3,032 | 12.0 | Caribou habitat retention. | <ul style="list-style-type: none"> • Caribou habitat retention • General caribou habitat management. • Maintain connectivity across the landscape. | <ul style="list-style-type: none"> • Avoidance. • Mitigation offsets (if needed for access or other purposes, would be required at the same level as tier 1 areas). • Access management. |

¹ Detailed descriptions of the caribou habitat management areas are provided in Appendix B.

² A map showing areas of caribou use in SK2 East is presented in Figure 13.

³ Mitigation offsets associated with the various tiers of caribou habitat will assigned based on risk.

⁴ Tier 2 boundaries are generally formed by recent wildfire boundaries and because of this may not be suitable for forest harvesting for many decades. Tier 2 areas are well suited for linear disturbance reclamation.

⁵ In tier 3, some harvest will be planned within or adjacent to previously disturbed remnant harvests to create harvest events. This approach, in addition to using natural forest patterns for new harvest areas, will assist in reducing caribou habitat fragmentation.

Table 7. (continued) Area summary, criteria for selection, management objectives, and strategies for the caribou habitat management area tiers, ecological reserves, wildlife refuges, and provincial parks on SK2 East provincial Crown lands.

| CHMA Tier | Area (km ²) | Area (per cent) | Criteria for Selection | Management Objectives | Management Strategies |
|-------------------------------|-------------------------|-----------------|---|--|--|
| Provincial Parks ¹ | 346 | 1.4 | General caribou habitat management. Maintain connectivity across habitat. | <ul style="list-style-type: none"> • Caribou habitat retention. • General caribou habitat management. • Maintain connectivity across the landscape. | <ul style="list-style-type: none"> • Avoidance. • Forest harvest patterns (as required, for vegetation/fuel management). • Mitigation offsets (as required for park infrastructure, access, etc.; would be required at the same level as tier 2 areas). • Reclamation and restoration. • Access management. |
| Total² | 25,142 | 99.2 | | | |

5.3.2 Other Provincial Lands

In addition to the designated caribou habitat management areas, there are other categories of provincial Crown lands that have management and protection features associated with them. Provincial parks are managed by the Ministry of Parks, Culture and Sport and designated under *The Parks Act*. Ecological reserves are managed by the Ministry of Environment and designated under *The Provincial Lands Act, 2016*. Game preserves and wildlife refuges are managed by the Ministry of Environment under the authority of *The Wildlife Management Zones and Special Areas Boundaries Regulations, 1990*. Each of the aforementioned provincial Crown land categories offer varying levels of protection and criteria that identify the circumstances and conditions under which they may be entered and the activities that may be conducted on them. Details for each are identified under the respective act and regulations.

5.3.3 Federal Lands

Federal lands such as Indian Reserves are not within Saskatchewan's management authority and may have different management objectives, but account for approximately 126 km² (0.5 per cent) of the SK2 East. Where integration, co-operation, and collaboration is possible, the Ministry will endeavour to

¹ Does not include recreation sites.

² The remaining 0.8 per cent of the SK2 East is comprised of federal lands (e.g. Indian Reserves), municipal lands, and small parcels of private or leased lands.

coordinate habitat management strategies with those on adjacent provincial Crown lands and Federal lands. Responsible management authorities will determine specific management objectives and strategies for these areas. Efforts will be made to coordinate the objectives and strategies developed within this plan as closely as possible with adjacent lands.

5.4 Achieving Landscape Management Goals in SK2 East

The management strategies identified in this plan are designed to reduce disturbance to woodland caribou habitat while allowing for sustainable levels of continued compatible land use. The range plan recognizes that some management activities may not result in optimized outcomes to caribou habitat for many years. The plan has adopted a 50-year implementation horizon, but will be reviewed and revised periodically (e.g. CHMAs are intended to be in place for a period of 20 years).

5.4.1 Projecting Land Use Impacts on Caribou Habitat into the Future

Using historical information and forecasted land use, an assessment was completed to understand potential impacts of human activities on SK2 East woodland caribou habitat over a 50-year future time horizon. Any modelling beyond 50 years resulted in greater uncertainties in the main assumptions that were made (e.g. harvest level, levels of other industrial development, amount of fire disturbance) and therefore a lower confidence in disturbance outcomes. Effects of wildfire were added into the disturbance assessment aspatially due to difficulties in predicting locations and intensities of future wildfire. While these scenarios are meant to be as realistic as possible, wildfire, market fluctuations, current linear feature regeneration status, and human dimensions all complicate future projections in SK2 East. Given these complications, it is unlikely that the projected disturbance levels and geographic locations of disturbance that are depicted in SK2 East will match realized disturbance levels. However, tracking of disturbance levels in SK2 East and monitoring of the caribou population status and trend will provide a more robust method for assessing the success with which Saskatchewan is meeting the landscape management goals above and the degree to which the selected tools are effective for managing a self-sustaining caribou population in the SK2 East.

Based on these analyses, comparative scenarios and assumptions¹ are described in Table 8.

¹ As per Environment Canada (2011) methodology, our management scenario assumes a 500 m buffer around all human-caused direct footprints included in the SK2 East disturbance map, and a restoration period of 40 years for all disturbances.

Table 8. Parameters and assumptions for scenarios assessed in SK2 East caribou administration unit.

| Management Factor | Assumptions |
|---|---|
| Forest Harvest Utilization | With existing mill capacity and historic forest product market conditions, future forest harvest levels in SK2 East are forecast to increase from previous levels. For both scenarios, a separate harvest volume schedule (e.g. annual allowable cut) was projected for the Pasquia-Porcupine and North East timber supply areas. Harvest for the Pasquia-Porcupine timber supply area was forecast at 70-80 per cent of the harvest volume schedule. The harvest volume schedule for the portion of the North East timber supply area that fell within the SK2 East was forecast at up to 7 per cent utilization. While harvest levels in the scenarios were projected to increase from historic conditions, timber harvest licences allow for up to 100 per cent utilization of the licence allocation. |
| Location of Forest Harvest | For both scenarios, the majority of future forest harvesting will continue to occur in low and moderate potential caribou habitats. The tier 3 CHMA is anticipated to receive the majority of forest harvesting and limited forest harvest is expected to occur within tier 2 areas. In the forest harvest scenarios, harvest did not occur in tier 1 areas over the 50-year period however 13,000 ha of harvest occurred in tier 2 areas in the first two decades and then no harvest thereafter. Forest harvest occurred at any time in tier 3 areas. |
| New forestry Roads | New forestry-related roads were added to the landscape based on information obtained by the Ministry of Environment from the forestry company tactical plan for the Pasquia Porcupine timber supply area. |
| Forest Harvest Patterns | For both scenarios, Saskatchewan natural forest pattern-based harvesting standards will be implemented for all future commercial forest harvesting. |
| Reclamation of New Non-permanent Roads | For both scenarios, as per <i>The Forest Resources Management Act</i> , all new in-block roads will be reforested within two years of harvesting and are projected to recover at the same rate as the surrounding harvest block. New non-permanent resource access roads will be reclaimed and restored following closure. |
| Reclamation of Non-permanent Roads | <p><u>Scenario 1</u> Through a combination of focused reclamation, mitigation off-sets and access management planning, an aggressive road reclamation strategy for all of SK2 East is projected for this scenario and all legacy class 2-6 roads¹ are projected to be reclaimed by year 50 unless they intersect a new harvest block.</p> <p><u>Scenario 2</u> This scenario represents the sensitivity analysis to illustrate the effect of linear feature reclamation in SK2 East. This scenario examined possible outcomes when all non-permanent linear features that are currently on the landscape are not reclaimed by year 50.</p> |

¹ Road classification definitions: Class 2 = improved bush road; Class 3 = bush road; Class 4 = in-block spur road; Class 5 = access road for resource extraction or public backcountry use; Class 6 = other roads unsuitable for timber extraction (Government of Saskatchewan, 2012).

Table 8. (continued) Parameters and assumptions for scenarios assessed in the SK2 East caribou administration unit.

| Management Factor | Assumptions |
|-------------------------------------|--|
| Mineral Exploration | There have been significant mineral exploration activities in SK2 East in the past and the relatively recent Targeted Mineral Exploration Incentive by the Government of Saskatchewan will likely result in further exploration activities in this region. To be consistent with ECCC disturbance mapping methodology, geophysical exploration lines in SK2 East are not included in human-caused disturbance totals. Despite these linear features not being included in the disturbance assessment, inappropriate local placement could increase habitat fragmentation, predator movement, or have otherwise adverse effects on woodland caribou, in addition to negative impacts on other species in the boreal forest. |
| Mineral Resource Development | Mineral potential in SK2 East is high and given that the Targeted Mineral Exploration Incentive program overlaps some of SK2 East, thus the likelihood of new mineral developments in SK2 East is also high. Given this information, a plausible scenario is that the following number and types of mine sites could be developed over the next 50 years: <ul style="list-style-type: none"> • one silica sand mine; • three base metal extraction mines; • one base metal processing site; and • two peat harvest sites. |
| Reclamation Time | For both scenarios, a 40-year recovery period was used for all human and wildfire disturbances to become undisturbed caribou habitat. |
| Other Land Uses | The location and intensity of all other land uses are projected to occur in similar locations and amounts as the current situation for the duration of the 50-year scenario period. While development of small linear and area-based disturbances contribute little to the overall disturbance levels in the SK2 East, there may be significant localized negative effects on caribou habitat and connectivity that are not reflected in these scenarios. |
| Wildfire | To account for fire overlap with human-caused disturbance, the adjusted annual disturbance associated solely with fire was modelled. The amount of wildfire disturbance outside of human-caused disturbances over the last 20 years was calculated and then added on a per decade basis to future projections. |
| Wildfire Management | Future wildfire management objectives and suppression efforts are not expected to change. The majority of SK2 East falls within the primary and secondary timber areas and will continue to be in the high value commercial forest full response wildfire management zone for the duration of the 50-year scenario period. |

5.4.2 The Projected Landscape Management Outcomes and Goals

Based on the scenario analyses and despite key uncertainties, the following outcomes were projected to occur in the SK2 East¹:

- While the 65 per cent undisturbed habitat threshold is met within the administration unit, ultimately, the population status and trend of woodland caribou in SK2 East will be used as the benchmark for assessing the effectiveness of management strategies in SK2 East. It is anticipated that population and trend figures will be available in 2023. In addition, regular reporting of disturbance levels in the SK2 East will help the Ministry of Environment continually assess actual, not projected, disturbance levels on the landscape (e.g. Section 7.0 Monitoring) and the success with which the landscape management goals are being met.
- Light Detection and Ranging (LiDAR) data has been acquired for a subset of tier 2 areas in SK2 East to assess linear feature revegetation status. This will allow the ministry to prioritize reclamation activities and report on linear feature revegetation trajectory with more certainty than is currently available.
- The amount of human-caused disturbance is projected to remain about the same or increase (up to 5 per cent) compared to current conditions. Increases in disturbance levels can be attributed to scenarios where new disturbances are placed on the landscape but there is little to no reclamation of legacy linear features.
- Greater than 80 per cent of high potential woodland caribou habitat across the entire SK2 East caribou administration unit is projected to remain in a condition largely undisturbed by human activities and will potentially increase to over 85 per cent. The amount of moderate potential caribou habitat that is undisturbed by human-caused factors is projected to increase in the future and is expected to also reach the 85 per cent undisturbed landscape management goal.
- The location of the caribou habitat management areas and associated management actions within those areas are anticipated to contribute to maintaining connectivity within the SK2 East and between the SK2 East and SK2 Central caribou administration units, the SK1 caribou conservation unit, and the Manitoba ranges.
- Natural forest pattern-based harvest standards will result in larger forest harvest patch sizes that more closely emulate natural disturbance patterns, thereby resulting in an overall reduction in disturbance level compared to historical forestry operations.
- The amount of linear features (e.g. non-permanent roads) is expected to be reduced through the combined application of reclamation, mitigation offsets, access management and natural forest pattern-based forest harvesting. The projected reductions in human-caused disturbances in the SK2 East rely on significant linear feature reclamation activities.

¹ Detailed outcomes associated with the individual landscape management goals are presented below.

- The impacts of climate change on wildfire was not assessed in this analysis, but climate change is likely to result in an increased amount of wildfire disturbance in SK2 East. However, the magnitude of that increase and how fire suppression activities in the commercial forest may respond are unknown, and so the results from these scenarios should be viewed as the minimum amount of new wildfire in the landscape.

Landscape Management Goal 1:

The total amount of disturbance does not exceed 35 per cent.

It is expected that human-caused disturbance levels will change from 25.6 per cent to between 23.7 and 30.8 per cent in all of SK2 East, depending how many linear features are reclaimed (Figure 18). Total disturbance levels (i.e. wildfire and human-caused) in SK2 East are also likely to range between 27.7 and 34.8 per cent 50 years into the future (current total disturbance level is 30.5 per cent).

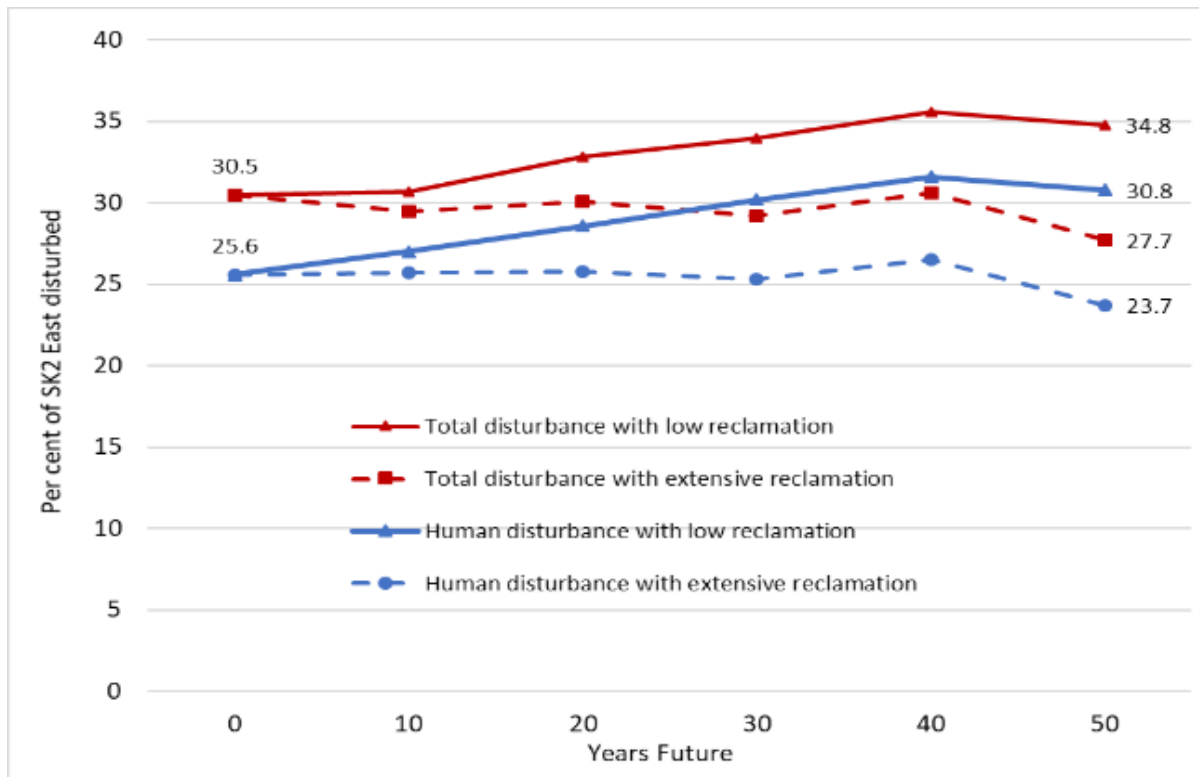


Figure 18. Projected total and human-caused disturbance in the SK2 East caribou administration unit resulting from extensive and low linear feature reclamation.

Wildfire disturbance in the SK2 East is considerably lower than that in the SK2 Central, and SK2 West caribou administration units. For the purpose of calculating future total disturbance, new wildfire disturbance was considered aspatially by adding a constant non-overlapping burn rate of 25.5 km²/year or 0.18 per cent per of the SK2 East per year. Maps illustrating how the SK2 East landscape may change as a result of human-caused disturbance and reclamation activities over 50 years are provided in Appendix D. The long-term effects of non-permanent linear disturbance reclamation and natural forest pattern-based harvest strategies are expected to become realized near the end of the 50-year scenario period.

Landscape Management Goal 2:

Increase the amount of high potential woodland caribou habitat that is unaffected by human-caused disturbance above current levels.

Based on the scenario modeling results, the projected amount of high potential habitat affected by human-caused disturbance could slightly decrease from current levels with extensive reclamation, but will vary between 11.1 and 13.7 per cent over the 50-year planning period (Figure 19). Similarly, the amount of moderate and low potential habitat classes affected by human-caused disturbance could also be expected to decrease with extensive reclamation. These results suggest that with appropriate management actions (e.g. extensive linear reclamation), the goal of increasing the amount of high habitat potential unaffected by human-caused disturbance above current levels may be met in the SK2 East. In the absence of reclamation or with only low reclamation efforts, habitat disturbance in each of the three habitat potential classes are expected to continually rise over the 50-year planning period above current levels.

A decision support tool will be developed in the future to prioritize which patches of high potential habitat should be the focus to achieve this target. This decision support tool will incorporate factors such as patch size, landscape context, connectivity (e.g. providing stepping stones for caribou movement, see landscape management goal 3), and Indigenous traditional knowledge to prioritize patches of high potential habitat that have the most benefit for caribou.

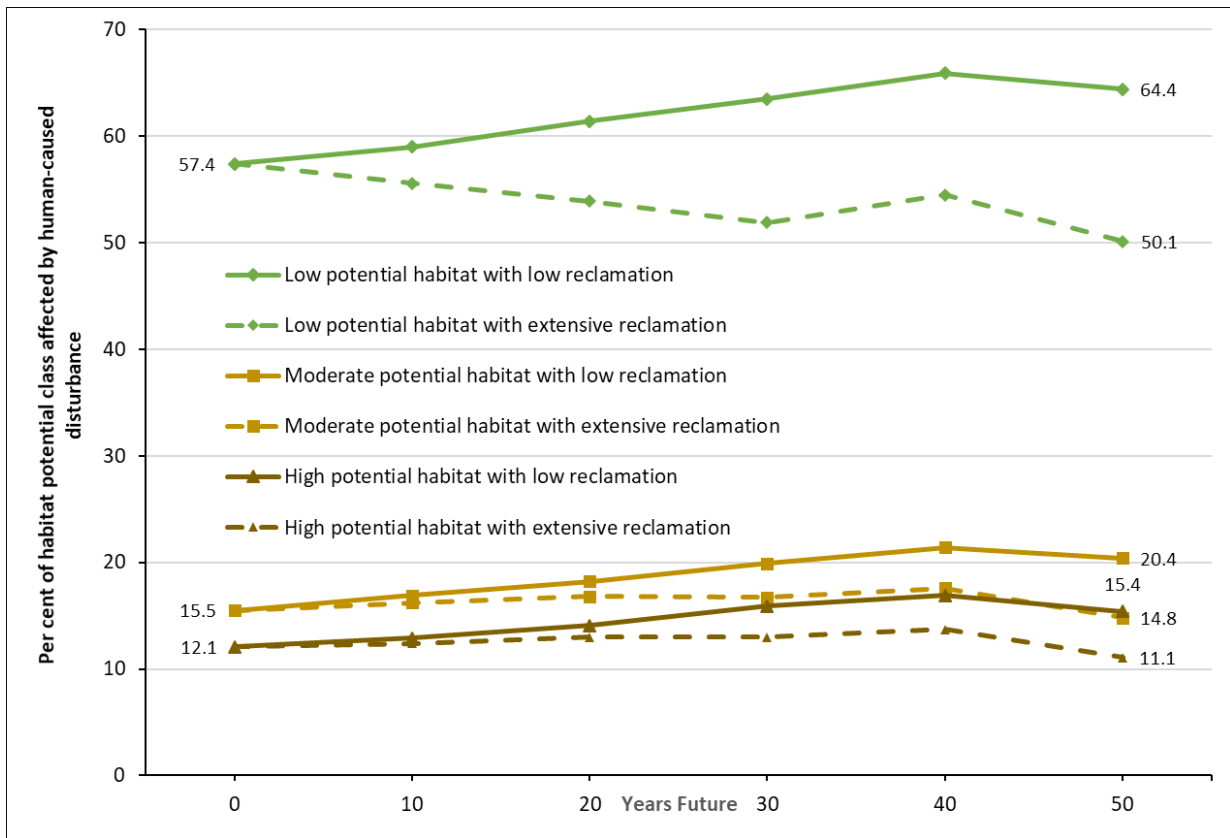


Figure 19. Proportion of each habitat potential class affected by human caused disturbance under low and extensive reclamation scenarios.

Landscape Management Goal 3:**Maintain adequate connectivity between different areas of the SK2 East and adjacent caribou administration units, conservation units, and Manitoba ranges.**

A fine-scale decision-support tool to identify potential caribou movement corridors and where impediments to potential movement occur on the landscape (Section 7.4 Research) is currently in development. This tool will be critical for proper management of tier 3 areas that provide essential connectivity between tier 1 and tier 2 areas. The tool is taking advantage of new connectivity modelling techniques (e.g. circuit theory) and using already developed map products such as ecosites, caribou habitat potential, and natural and human-caused disturbance. The tool will be useful for:

- identifying priority areas where mitigation offsets and reclamation would be most beneficial for restoring landscape connectivity for caribou; and
- identifying areas where future development may impair connectivity.

This research will complement genetic analyses by identifying potential mechanisms leading to genetic isolation. Landscape level genetic analysis has shown the caribou population to be relatively continuous with weak structure. Weak structure within the woodland caribou population suggests that there are still relatively few connective barriers across the landscape and that gene flow is still possible and occurring (COSEWIC, 2014). Much of the structure represented in Saskatchewan is caused by distance between animals across a vast range. Landscape features which cause resistance to movement and also affect population structure include large water bodies, roads and forest harvest blocks (Priadka et al., 2018). Management actions to improve connectivity are anticipated to focus on human-caused disturbance in areas where resistance to movement has affected population structure. Reducing human disturbance around natural landscape features that constrict movement will help ameliorate the compounding effect of barriers on connectivity.

Landscape Management Goal 4:**Increase forest harvest event sizes to more closely emulate natural forest patterns.**

Based on the concepts of the natural range of variation, Saskatchewan is implementing natural forest pattern-based harvest requirements that more closely emulate natural disturbances in scale and pattern. Prior to this evolution in the approach to forest harvesting, traditional harvest blocks typically ranged from 40 to 100 ha in size. The natural forest pattern-based harvesting approach, found in the *Forest Management Planning Standard*, requires that forest management plans identify a distribution of harvest sizes that will better approximate that found within the natural range of variation. The event size classes are defined in the *Forest Management Planning Standard* and presented in Table 9.

Table 9. *Forest Management Planning Standard* harvest event size classes for the purposes of planning and reporting.

| Event Size Classes | Size Range (ha) |
|--------------------|-----------------|
| Small | 0 - 100 |
| Medium | 101 - 1,500 |
| Large | 1,501 - 3,500 |
| Very Large | 3,501 - 8,000 |
| Extremely Large | > 8,000 |

The forest management plan for the Pasquia-Porcupine TSA is largely contained within the SK2 East caribou administration unit plan boundary, and is associated with harvest event size distribution targets as shown in Table 10. The difference in harvest event size target ranges are a function of the preferred management scenario in the forest management plan, unique to the composition of forest stands in the TSA. Although the size ranges differ, they effectively represent very similar distribution profiles. While no extremely large (i.e. greater than 8,000 ha) events have been proposed, it is expected that the aggregation of multiple smaller adjacent harvest events will result in a similar pattern over time. A shift toward a distribution favouring even larger event sizes compared to the natural forest pattern requirements could result in further disturbance reduction.

Table 10. Harvest event size distribution targets for Weyerhaeuser Company Ltd. and Dunkley Lumber Ltd., in the SK2 East caribou administration unit.

| Licence | Size Range (ha) | Event Size Distribution Target (per cent) |
|---|-----------------|---|
| Pasquia-Porcupine Forest Management Agreement | 5-100 | 17 |
| | 101-1500 | 68 |
| | 1501-3500 | 10 |
| | 3501-8000 | 5 |
| | > 8000 | 0 |

Landscape Management Goal 5:

a. Maintain and or reduce disturbance levels in CHMA 1 and 4.

b. Reduce the total amount of non-permanent linear features in CHMAs 2,3,5, and 6.

Non-permanent roads are considered to be class 2, 3, 4, 5 and 6 within the Saskatchewan forest road network database. These roads were originally created to facilitate temporary access for resource use in previous decades, but were not purposefully reclaimed. Many of these legacy roads are now used for recreational activities or other uses, but may no longer be required for their original purposes.

While the re-vegetation status and level of human activity associated with many linear features is currently uncertain, the total length of non-permanent roads represented in the SK2 East disturbance assessment is estimated to be approximately 5,383.4 km.

Through the combined efforts of access management planning, reclamation, and mitigation offsets, Saskatchewan anticipates the amount of non-permanent legacy roads to be reduced over time. All future dispositions will require the developer of the road to have a plan and will be responsible to restore and reclaim the road prior to the disposition terminating. A previous assessment in the SK2 Central administration unit projected that focusing near-term harvesting close to previously disturbed areas, and implementation of natural forest pattern-based forest harvesting practices, will result in much lower road to harvest areas ratios (e.g. 0.5 or 1.0 km of road to 1 km² of area harvested) than traditional harvest patterns. Further information about lowering road to harvest area ratios can be found in the *Range Plan for Woodland caribou in Saskatchewan: Boreal Plain Ecozone – SK2 Central Caribou Administration Unit* available here:

<https://publications.saskatchewan.ca/api/v1/products/101694/formats/112399/download>

However, given current uncertainties about re-vegetation status, levels of human activity, and definitions for caribou habitat restoration, it is difficult to project the level of non-permanent legacy road reduction that can be achieved. Therefore, the development of tools for assessing habitat connectivity, information from Light Detection and Ranging (LiDAR) imaging within a subset of Tier 2 areas in SK2 East will allow for prioritization of reclamation activities on linear features where benefits are greatest for caribou and likelihood of reclamation success is high. This assessment of revegetation status will also allow for greater certainty in projections of when certain disturbances could likely to be removed from the disturbance assessment.

Detailed access management planning and enhanced inventory information is required prior to specific target development. Current assumptions and projections about reclamation activity, reclamation lag time, amount of future forest road requirements, and the modern reclamation standards indicate a declining trend in total non-permanent road length.

6.0 Critical Habitat Protection

Identifying the legislative tools available to Saskatchewan that enable protection of critical habitat for woodland caribou provides certainty of the province's ability to manage activities on the landscape to ensure there is sufficient, connected habitat, capable of supporting a self-sustaining woodland caribou population.

Saskatchewan has a number of legislative tools and processes to support protection in a manner that contributes both to the long-term viability of the woodland caribou population and supports continued economic development, including *The Environmental Management and Protection Act, 2010*, *The Forest Resources Management Act*, and *The Provincial Lands Act, 2016*.

6.1 Range-Specific Activities Likely to Result in the Destruction of Critical Habitat

Habitat loss is variable and can be non-permanent or permanent, short to long-term, and large or small. It may be caused by wildfire, forest harvesting, other resource extraction, or through the construction of roads, trails, seismic lines and other linear features. Additionally, functional habitat loss may occur when woodland caribou stop using suitable habitat because of nearby disturbance.

The federal recovery strategy defines destruction as the degradation of critical habitat, either permanently or temporarily, such that it would not serve its function when needed by boreal woodland caribou. Destruction may result from a single activity, multiple activities at one point in time, or from the cumulative effects of one or more activities over time. Activities that are likely to result in the destruction of critical habitat, include, but are not limited to, the following:

- Any activity resulting in the **direct loss** of woodland caribou critical habitat (e.g. conversion to agriculture, forestry cut blocks, mines, industrial and infrastructure development);
- Any activity resulting in the **degradation** of critical habitat leading to a reduced, but not total loss of both habitat quality and availability for woodland caribou (e.g. pollution, drainage, and flooding); and
- Any activity resulting in the **fragmentation** of habitat by man-made linear features (e.g. road development, seismic lines, pipelines, and hydroelectric corridors) (Environment Canada, 2012).

For the purpose of identifying activities likely to result in the destruction of critical habitat, current activities also constitute foreseeable activities in the SK2 East caribou administration unit and are presented in Table 11.

Table 11. Current and foreseeable activities likely to result in the destruction of boreal caribou critical habitat in the SK2 East caribou administration unit.

| Activity | Direct loss ¹ of habitat | Degradation ² of habitat | Fragmentation ³ of habitat |
|--|-------------------------------------|-------------------------------------|---------------------------------------|
| Conversion of habitat to agriculture | ✓ | | ✓ |
| Transportation – road or trail development | ✓ | | ✓ |
| Forestry cut blocks | ✓ | ✓ | ✓ |
| Wildfire | ✓ | ✓ | ✓ |
| Mining development – peat | ✓ | | ✓ |
| Mining development – other | ✓ | | ✓ |
| Oil and gas development | ✓ | | ✓ |
| Urban/community development | ✓ | | ✓ |
| Seismic/Exploration/Geophysical lines ⁴ | ✓ | | ✓ |
| Tourism - snowmobile or ATV trail development | ✓ | | ✓ |
| Pipelines | ✓ | | ✓ |
| Electrical power transmission lines | ✓ | | ✓ |
| Pollution - mining development | | ✓ | |
| Pollution - oil and gas development | | ✓ | |
| Drainage - peat development | | ✓ | |

¹ Direct loss suggests complete loss or conversion of habitat to a condition that no longer provides functional habitat.

² Degradation suggests a deterioration of habitat quality and availability.

³ Fragmentation suggests activity caused separation of otherwise functional habitat.

⁴ Geophysical lines vary in terms of their established width, subsequent effect on habitat, and degree to which they are mapped in the disturbance layer.

6.2 Current Protection of Critical Habitat on Non-Federal Lands

The following Saskatchewan provincial statutes provide for solid protection against activities likely to destroy critical habitat on provincial land, as well as supporting the management strategies identified in this plan:

- *The Forest Resources Management Act*
 - *The Forest Resources Management Regulations*
 - *The Forest Resources Management (Saskatchewan Environmental Code Adoption) Regulations*
 - *Saskatchewan Environmental Code*
- *The Provincial Lands Act, 2016*
 - *The Crown Resource Land Regulations, 2019*
- *The Environmental Management and Protection Act, 2010*
 - *The Environmental Management and Protection (General) Regulations*
 - *The Environmental Management and Protection (Saskatchewan Environmental Code Adoption) Regulations*
 - *Saskatchewan Environmental Code*

The Provincial Lands Act, 2016 works in conjunction with *The Environmental Management and Protection Act, 2010* and *The Forest Resources Management Act* to re-inforce the strength of these two statutes, and provides strong legislative authorities for future land use arising from woodland caribou range plans.

Pending updates to the Saskatchewan Environmental Code, including a new chapter and standard related to linear activities and linear corridors, will reinforce the strength of Saskatchewan's woodland caribou critical habitat protection.

The provincial statutes with the greatest coverage and influence over the SK2 East caribou administration unit are *The Forest Resources Management Act* and *The Provincial Lands Act, 2016*. Other statutes that provide additional support in the protection against habitat destruction to achieve the desired outcomes are identified in Table 12.

Saskatchewan's legislation provides considerable protection and conservation measures for both habitat and species. The various parts, sections, schedules, and clauses of the legislation outline the primary mechanisms by which habitat or species may be protected, managed, or conserved on provincial Crown lands. To illustrate how some specific Acts afford protection and conservation of habitat and species three important pieces of legislation were evaluated for the sections that are most directly applicable. For the purpose of this evaluation, only the Acts have been referenced; further and more specific mechanisms are identified in the relevant associated regulations. Other sections or clauses are not cited but can provide secondary, supportive, or ancillary protection or enforcement measures. Since legislation is periodically updated to maintain relevancy, readers are advised to refer to the most recent copy of the legislation at: <https://publications.saskatchewan.ca/#/home>.

Sections illustrating specific measures relevant to woodland caribou conservation identified in *The Forest Resources Management Act*, *The Environmental Management and Protection Act, 2010*, *The Provincial Lands Act, 2016*, and *The Wildlife Act, 1998* are presented in Tables 12, 13, 14, and 15 in the appendices. The sections have been selected as examples of being the most relevant, least duplicative and cover the authority, responsibility, compliance, and protection of both habitat (e.g. land) and species. For brevity, the associated regulations and Saskatchewan Environmental Code have been omitted.

The specific legislation, regulations and other environmental controls relied upon to protect the environment and associated woodland caribou habitat are unique to the conditions and considerations of the various and numerous types of land-use permitting or environmental assessment in Saskatchewan. Regulators responsible for permitting and or assessment or approval of industrial activities and other land-uses on Saskatchewan's Provincial forests draw from the appropriate environmental and regulatory controls depending upon the scale, type, location, or other factors associated with the proposed activity. The measures outlined in Appendix F: Tables 12 through 15 provide examples of those controls.

Table 12. Statute relevance to activities likely to result in the destruction of boreal caribou critical habitat on provincial land.

| Activities | Provincial Statute | | | | | | | | | | | | | | | | | | | | | | | |
|---|-------------------------------------|---|--|--|--|-------------------------------|---|---------------------------------------|----------------------|---------------------------|----------------------------|--|-------------------------|-------------------------------|--|--|--|--|--|--|--|--|--|--|
| | <i>The All Terrain Vehicles Act</i> | <i>The Environmental Assessment Act</i> | <i>The Environmental Management and Protection Act, 2010</i> | <i>The Forest Resources Management Act</i> | <i>The Mineral Resources Act, 1985</i> | <i>The Crown Minerals Act</i> | <i>The Oil and Gas Conservation Act</i> | <i>The Provincial Lands Act, 2016</i> | <i>The Parks Act</i> | <i>The Snowmobile Act</i> | <i>The Water Power Act</i> | <i>The Wildlife Habitat Protection Act</i> | <i>The Wildfire Act</i> | <i>The Wildlife Act, 1998</i> | | | | | | | | | | |
| Extent of critical habitat affected | local | local | all | all | all | all | all | extensive | local | all | local | local | all | all | | | | | | | | | | |
| Direct loss of habitat | | | | | | | | | | | | | | | | | | | | | | | | |
| Conversion to agriculture | | | | X | | | | X | X | | | X | | X | | | | | | | | | | |
| Forest harvesting | | | | X | | | | | X | | | X | | | | | | | | | | | | |
| Human-caused wildfire | | | | | | | | | | | | X | X | | | | | | | | | | | |
| Mining development - peat | | X | X | X | | | | X | X | | | X | | | | | | | | | | | | |
| Mining development - oil and gas | | X | X | X | X | X | X | X | X | | | X | | | | | | | | | | | | |
| Mining development - other | | X | X | X | X | X | X | X | X | | | X | | | | | | | | | | | | |
| Urban / community development | | | | | | | | X | | | | | | | | | | | | | | | | |
| Degradation of habitat | | | | | | | | | | | | | | | | | | | | | | | | |
| Human-caused wildfire | | | | | | | | | X | | | | | X | | | | | | | | | | |
| Pollution - mining development | | X | X | X | | | | X | X | | | X | | | | | | | | | | | | |
| Pollution - oil and gas development | | X | X | X | | | X | X | X | | | X | | | | | | | | | | | | |
| Drainage - peat development | | X | X | X | | | | X | X | | | X | | | | | | | | | | | | |
| Flooding - hydroelectric power development | | X | X | X | | | | X | X | | X | X | | | | | | | | | | | | |
| Habitat fragmentation by human linear features | | | | | | | | | | | | | | | | | | | | | | | | |
| Road / trail development | | X | X | X | | | | X | X | | | X | | X | | | | | | | | | | |
| Snowmobile / ATV trail development | X | | | X | | | | X | X | X | | X | | | | | | | | | | | | |
| Seismic / exploration / geophysical lines | | | X | X | X | X | X | X | X | | | X | | | | | | | | | | | | |
| Pipelines | | | X | X | X | X | X | X | X | | | X | | | | | | | | | | | | |
| Electrical power transmission lines | | X | X | X | | | | X | X | | | X | | | | | | | | | | | | |

The management strategies identified in this plan are supported by existing statutes and can be implemented within the context of existing legislation, and new associated regulations/standards and policies (Table 13).

Table 13. Provincial statutes supporting management strategies.

| Management Strategy | Supporting Legislation/Tools |
|--------------------------------|--|
| Avoidance | <i>The Forest Resources Management Act</i> <i>The Forest Resources Management Regulations</i> <i>The Provincial Lands Act, 2016</i> <i>The Crown Resource Land Regulations, 2019</i> <i>The Parks Act</i> <i>The Wildlife Act, 1998</i> |
| Reclamation | <i>The Crown Resource Land Regulations, 2019</i> <i>The Environmental Assessment Act</i> <i>The Forest Resources Management Act</i> <i>Forest Operating Plan Standard (Saskatchewan Environmental Code)</i> <i>Forest Regeneration Assessment Standard (Saskatchewan Environmental Code)</i> <i>The Forest Resources Management Regulations</i> <i>Linear Corridor Standard (Saskatchewan Environmental Code) (in progress)</i> <i>The Parks Act</i> <i>The Provincial Lands Act, 2016</i> <i>Roads on Provincial Forest Lands Standard (Saskatchewan Environmental Code) (in progress)</i> |
| Mitigation Offsets | <i>The Crown Resource Lands Regulations, 2019</i> <i>The Environmental Assessment Act</i> <i>Linear Corridor Standard (Saskatchewan Environmental Code) (in progress)</i> <i>The Provincial Lands Act, 2016</i> <i>Roads on Provincial Forest Lands Standard (Saskatchewan Environmental Code) (in progress)</i> |
| Forest Harvest Patterns | <i>The Forest Resources Management Act</i> <i>The Forest Resources Management Regulations</i> <i>Forest Management Planning Standard (Saskatchewan Environmental Code)</i> <i>Forest Operating Plan Standard (Saskatchewan Environmental Code)</i> <i>The Parks Act</i> |

Table 13. (continued) Provincial statutes supporting management strategies.

| Management Strategy | Supporting Legislation/Tools |
|--------------------------|---|
| Access Management | <i>The All Terrain Vehicles Act</i> <i>The Crown Resource Land Regulations, 2019</i> <i>The Environmental Assessment Act</i> <i>The Forest Resources Management Act</i> <i>The Forest Resources Management Regulations</i> <i>Linear Corridor Standard (Saskatchewan Environmental Code) (in progress)</i> <i>Forest Wetland and Watercourse Crossing Standards (Saskatchewan Environmental Code) (in progress)</i> <i>The Operation of All Terrain Vehicles on Crown Land Prohibition Regulations</i> <i>The Parks Act</i> <i>The Provincial Lands Act, 2016</i> <i>Roads on Provincial Forest Lands Standard (Saskatchewan Environmental Code) (in progress)</i> <i>The Snowmobile Act</i> <i>The Snowmobile Regulation, 1998</i> |

6.3 Steps Being Taken by Jurisdiction

With a sound legislative foundation in place for the protection of critical habitat, Saskatchewan has identified several actions and suggested timelines that would support the effective implementation of the management strategies (Table 14), in order to address considerations identified in Section 5.

Parts of the woodland caribou range in Saskatchewan fall under federal jurisdiction (e.g. the Prince Albert National Park) and will require federal plans which will complement actions being taken by the province to ensure critical habitat is maintained for woodland caribou.

Table 14. Actions proposed to support effective implementation of management strategies.

| Action | Intent / Purpose | Timeline | Status |
|---|---|----------|----------------|
| Finalize and implement the Forest Management Planning Standards. | Provide standards for forest harvest patterns in forestry sector operations to support long term caribou habitat restoration. | 2017 | Complete |
| Identify caribou best management practices to provide insight into the development of standard permitting conditions. | Develop caribou protection measures to restrict activities during periods when caribou are vulnerable to sensory disturbance. | 2019 | In development |
| Develop and implement a habitat mitigation framework for Crown lands. | Provide land users with a habitat mitigation framework that defines principles and standards for habitat mitigation offsets. | 2020 | In development |
| Undertake access management planning in caribou habitat management areas. | Work with land-users to identify non-permanent roads for closure, develop access management plans, and provide educational opportunities for client groups and communities. | On-going | On-going |
| Enhance existing processes and tools to capture and manage disturbance features. | Improve disturbance tracking, status of legacy features, and cumulative effects assessment required for landscape level planning and assessment of development initiatives. | 2020 | In development |
| Finalize and implement the <i>Linear Corridor Standard and Roads on Provincial Forest Lands Standard</i> under the <i>Saskatchewan Environmental Code</i>. | Define required outcomes for the reclamation and regeneration of linear corridors in the provincial forest, regardless of land user origin. | 2023 | In development |

6.4 Range Plans as Evidence of Critical Habitat Protection

The legislative tools and regulations identified in this initial range plan for the SK2 East area are in place to ensure critical habitat protection. These legislative tools are also applicable for the western and central portions of the Boreal Plain and the Boreal Shield ecozones.

In addition to the numerous regulatory instruments available for the protection of woodland caribou and their habitat, this plan also identifies and outlines principles, activities, programs, and management strategies that work toward the provision of recovery measures that benefit Saskatchewan’s woodland caribou. The modelling conducted and illustrated within the plan and the appendices provide insight into the sensitivity associated with various disturbance factors and management strategies. While initial aspatial projections of a 65 per cent undisturbed habitat have been demonstrated in the SK2 East, it is recognized that habitat management strategies such as avoidance, reclamation and restoration, and

access management will benefit the landscape on which the woodland caribou depend. It is also recognized that the benefits of some activities on the landscape such as reclamation and restoration cannot be immediately appreciated, but their early and continued implementation are essential to long-term landscape integrity and connectivity of woodland caribou habitat.

7.0 Monitoring

As part of the provincial commitment to an adaptive management approach, Saskatchewan will continue to monitor population trends, habitat condition, protection measures and range plan implementation.

7.1 Population Monitoring

Caribou population monitoring will be done using a variety of methods, which may include genetic sampling using capture/mark/recapture, telemetry, surveys and traditional knowledge to estimate population size, trend and occupancy (Table 15). Work began in January of 2020 to collect fecal DNA in order to identify population status and trend of woodland caribou in the SK2 East. This work is expected to continue in 2021 and 2022 with results becoming available in 2023. Further to this initial and baseline sampling, it is proposed that this reoccur approximately every 10 years thereafter. In this way, it may be feasible to track longer-term population trends across all of the province's caribou administration and conservation units. This work will be conducted to provide baseline information and to evaluate the effectiveness of management strategies. Species response to management actions will be used to make necessary program refinements to ensure the sustainability of the species.

Additionally, the Report a Woodland Caribou¹ sighting database compiled through the Saskatchewan Conservation Data Centre tracks caribou occurrence information to help understand woodland caribou distribution throughout SK1 and SK2. Similarly, caribou sighting occurrences will soon be reportable on the Saskatchewan Co-Operative Wildlife Management survey app. Additionally, related information is sometimes gathered in the process of providing information for environmental assessments and development or exploration applications. Further population and distribution monitoring approaches will be considered as they become available.

¹ - <http://www.biodiversity.sk.ca/ReportaCaribou.php>

Table 15. Proposed frequency of monitoring of various caribou population indicators.

| Indicator | Timeline |
|---|----------------|
| Population size | 2023 |
| Population demographic rates and growth (lambda/adult survival and recruitment) | 2023 |
| Occupancy | Annual updates |

7.2 Habitat Condition Monitoring

Saskatchewan will continue to monitor caribou habitat condition and suitability using key disturbance metrics (e.g. the area of caribou range affected by human caused disturbance, buffers, and wildfire) on a regular basis to assess whether we are meeting the stated landscape goals. Habitat condition will be further informed as new science and tools become available. Metrics (Table 16) will be fully supported by information technology systems and processes, to assist in determining and managing overall habitat condition. In doing so, this monitoring will provide Saskatchewan with a means to assess:

- changes in suitable caribou habitat over time since range plan implementation;
- changes in disturbance amounts, types and levels (severities/intensities) over time since range plan implementation;
- amount of linear and area-based disturbances reclaimed or currently being reclaimed;
- functionally restored habitat (will be done in conjunction with occupancy information from population monitoring surveys); and,
- cumulative impacts of all disturbances at a landscape level.

Table 16. Habitat condition indicator monitoring.

| Measure | Indicator | Description |
|-----------------------------|---|--|
| Human caused disturbance | Footprints and buffers | Area of human-caused direct and indirect disturbance, both permanent and non-permanent |
| Reclaimed disturbance areas | Footprint reclaimed (i.e. areas in the early stages of revegetation and on a trajectory to becoming mature forest habitat). | Reclaimed habitat areas, both linear and area based |
| Caribou habitat restored | Footprint functionally restored (i.e. areas that have reached a mature forest habitat conditions [> 40 years old]). | Disturbed area restored to functional caribou habitat |
| Wildfire disturbance | Wildfire perimeter boundaries | Area of wildfire disturbance |

7.3 Protection Measures Monitoring

Saskatchewan will monitor protection measures that support protection of critical habitat to verify that protection is effective over time, as outlined below (Table 17).

Table 17. Protection measures indicator monitoring.

| Protection Measure | Tool | Indicator |
|---|--|---|
| <i>The Forest Resources Management Act</i> | Forest management agreements Forest management plans Operating plans | Forest management plans and operating plans incorporate management strategies identified. |
| <i>The Forest Resources Management Act</i> | Forest product permits | Permits issued under <i>The Forest Resources Management Act</i> incorporate management strategies identified. |
| <i>The Environmental Assessment Act</i> | Environmental assessment approvals | Approvals issued under <i>The Environmental Assessment Act</i> incorporate management strategies identified. |
| <i>The Provincial Lands Act, 2016</i> | Permits and dispositions | Permits and dispositions related to boreal Crown lands incorporate management strategies identified. |
| Enterprise Law Enforcement Records Management System | Enforcement and compliance actions reported | Enforcement and compliance actions related to the statutory tools are tracked and reported. |

7.4 Research

Saskatchewan is committed to ongoing assessment and integration of research into range planning to support adaptive management and to inform habitat indicators and targets. Examples of themes and topics that may be explored in collaboration with appropriate researchers, communities, and agencies to deliver research priorities, are identified in Table 18. The research progress sections subsequent to Table 18 illustrate some of the research outcomes, further work, and details about some previously identified research needs that better enable decision-making.

Table 18. Themes and topics of research to explore to enhance range planning and implementation.

| Research Themes or Topics | Application |
|---|---|
| Define the post-disturbance successional pathways to determine when caribou habitat is functionally restored following wildfire and forest harvesting. | Determine which practices hasten and promote the return of harvest blocks and events to caribou habitat. |
| Evaluate linear feature restoration success following natural and managed processes. | Understand which reclamation and restoration practices on linear features contribute to effectively restored caribou habitat. |
| Explore and develop opportunities and mechanisms to establish community-based monitoring programs. | Foster local stewardship of woodland caribou by involving caribou range communities, subsistence users, and the general public in research and population monitoring. |
| Develop landscape level models of caribou habitat to assist decision makers to plan for caribou habitat connectivity. | Incorporate models and analysis of caribou habitat change in decision support tools to enable the prioritization of landscape areas for different planning responses, and the exploration of habitat connectivity under several management scenarios. |

7.4.1 Research Progress

Since the drafting of the initial range plan for the SK2 Central caribou administration unit, considerable progress has occurred in understanding the species both in Saskatchewan and beyond. Advancements in woodland caribou research contribute to improved decision-making. Examples of previously identified research needs have yielded knowledge that is in the process of being applied in woodland caribou conservation.

7.4.1.1 Climate Change Considerations

Climate change research to date points to a somber forecast of future conditions and challenges for the conservation of woodland caribou. Cascading, cumulative, and consequential climate change effects such as habitat degradation and loss (Price et al., 2020; Masood et al., 2017), increased predation (Racey, 2005; Barber et al., 2018; Seip, 1992), increased disease (Pickles et al., 2013), and other factors (Witter et al., 2012) make management planning for woodland caribou particularly challenging. Given the global effects of climate change, a concerted national, provincial, and territorial effort is required to devise possible approaches to accommodate and mitigate the direct and indirect effects of climate change on woodland caribou.

7.4.1.2 Woodland Caribou Habitat Connectivity Modelling Considerations

Habitat connectivity at multiple scales is important for woodland caribou as it facilitates movement in response to disturbance, resource needs, and allows gene flow. Habitat fragmentation can create pockets of genetically distant animals, as such, there is a need to allow for woodland caribou movement between large patches of intact habitat (Priadka et al., 2018).

Currently, a pilot project is in progress to identify and prioritize potential movement corridors in SK2 Central through the creation of a fine-scale decision-support tool. This project is incorporating previously developed habitat and disturbance datasets (natural and human-caused), to determine linkages between clusters of high quality habitat using connectivity modelling techniques such as circuit theory. The resulting product will help inform management guidance for resource development and identify priority areas for the restoration of the historical human footprint.

7.4.1.3 Woodland Caribou Use of Post-Wildfire Habitat Considerations

Wildfire is the dominant natural ecological process responsible for forest stand replacement in boreal forests. Fires consume not only the tree species, but also the shrub, herb, and lichen and moss layers although not necessarily entirely. Depending on previous stand composition and structure as well as fire characteristics (e.g. intensity), and other characteristics, the level of 'vegetation' layer removal and subsequent recovery will vary.

In the Boreal Shield ecozone for example, a terrestrial caribou forage lichen (i.e. *Cladonia arbuscula* subsp. *mitis*) has been found to recover as early as 21-30 years following fire in jack pine stands however optimal habitat may not occur until 100 years post fire (Skatter et al., 2014). The relatively prompt recovery of this lichen has implications for woodland caribou forage availability and habitat use especially during winter periods when other food sources are not readily available.

In addition to forage lichen availability, woodland caribou habitat resource selection also reflects other conditions. Another example from the Boreal Shield identified that while woodland caribou prefer mature (i.e. > 40-year-old) habitat for both calving and post-calving periods, they will also use residual patches dominated by bogs and fens within burned areas (Skatter et al., 2017). In the Boreal Plain in Alberta, Koncolics et al., (2018) found that even though fire boundaries may contain a large proportion of unburned residual patches, habitat selection results suggested that caribou avoided burned landscapes, including the residual patches and that this avoidance persisted for up to 30 years after the fire.

Becoming more sophisticated in our understanding of caribou habitat use will enable us to better plan for the future.

7.4.1.4 Landscape Level Population Structure Analysis Considerations

Genetic patterns are commonly described by the pattern of isolation-by-distance, which indicates naturally decreasing gene flow based on the average dispersal range of individual animals (Strien et al., 2015). In a landscape level population structure analysis of genetic connectivity, Priadka et al., (2018) found that isolation by distance was significant across Saskatchewan, providing additional evidence that spatial proximity among individuals explains some of the genetic variation within clusters. This study also confirmed that discrete population boundaries do not exist. Caribou dispersal is based more on geographic distance than on social behavior that would support demographically and structurally independent groups (Priadka et al., 2018).

Analysis of caribou spatial familial networks by McFarlane et al., (2021) identified tight family groups within SK2 West, which has high levels of both human-caused and fire disturbance. This may be a result of a decreased likelihood of dispersal because of the high levels of fragmentation between local areas.

7.4.1.5 Risk of Caribou Infection with Chronic Wasting Disease

Chronic wasting disease (CWD) in game farms and wild deer in Saskatchewan poses a risk of disease spillover into woodland caribou. Since 2005, CWD has been present in populations of wild white-tailed deer within several kilometers of the SK2 boreal caribou range. The prevalence of CWD in wild white-tailed in the area is currently estimated at 16% (8-24%) and continuing to increase. The number of positive game farms in the province has continued to increase annually since the Canadian Food Inspection Agency stopped control and depopulation actions in April of 2018. One positive game farm is less than 17 km from the boreal caribou range (SK2 West) and remains operational with single fencing, raising concern over heightened risk of transmission of CWD to wild cervids in the boreal transition zone.

Recent research has demonstrated that woodland caribou in Saskatchewan are susceptible to chronic wasting disease, given the low frequency of the 138N allele (prion gene variant) in the population (Arifin et al. 2020). This allele or variant has been associated with reduced susceptibility under natural routes of infection and is present in less than 25% of Saskatchewan woodland caribou. The introduction of a population limiting disease such as CWD may hinder recovery of woodland caribou and contribute to further population decline.

Questions remain regarding potential routes of introduction and transmission dynamics of CWD in the boreal forest. Currently, a study is underway to evaluate habitat selection and invasion ecology of white-tailed deer into Saskatchewan's deep boreal forest, which should aid in understanding potential routes of disease transmission to woodland caribou including identification of areas of overlap in habitat (P. McLaughlin, University of Saskatchewan, personal communication, April 12, 2020). Additional research to aid in early detection of CWD in woodland caribou using analysis of fecal samples has been proposed (S. Gilch, University of Calgary, personal communication, May 10, 2020).

8.0 Timelines: Reporting and Range Plan Updates

8.1 Reporting on Range Plan Implementation and Monitoring

Saskatchewan will report on a five-year basis on range plan implementation, habitat condition, population trends, and protection measures as identified in Section 7. This reporting will include elements such as monitoring observation information, management strategy effectiveness in improving habitat conditions, and identifying required management approaches necessary or beneficial to the desired outcomes. As more or better monitoring information becomes available for woodland caribou habitat condition or population, it will be included as appropriate in revised range plans or other reporting mechanisms and requirements.

The complexity, diversity, and breadth of application of the management strategies and goals identified in this range plan necessitates a successful integration, collaboration, and cooperation of numerous

agencies. Additionally, the regulatory instruments and policies necessary to implement the strategies and goals must be aligned and consistency applied. To ensure the alignment across government, an internal implementation committee has been developed. The goal of the woodland caribou range plan implementation committee is to lead necessary policy and procedure development for consistent and coordinated implementation of actions in the caribou range plans. Specific objectives of this committee include:

- prioritizing policies and procedures that require development or adaptation in order to implement caribou range plan recovery actions,
- ensuring that range plan recovery implementation actions are coordinated across branches,
- providing input to the woodland caribou steering committee and recovery planning tables on future opportunities or recommendations on actions,
- providing gap analysis and guidance documents that will provide direction until all plans are approved, and
- providing coordination with the planning committee.

8.2 Range Plan Updates

Following the population and habitat condition monitoring identified in this plan, Saskatchewan will be in a position to update range plans in response to the management strategies deployed and the outcomes attained. Management strategies will then be revised within the range plan to improve habitat and population outcomes. Range plans may also be updated following landscape disturbance which significantly exceeds the norm or as new information on important areas for woodland caribou becomes available.

9.0 Range Planning Engagement

The development of the SK2 East range plan has involved the input and insight of numerous organizations and individuals from across the province. Range planning table meetings were held in Hudson Bay and Nipawin, Saskatchewan to gather perspectives, information and direction on how best to manage for woodland caribou and its habitat while allowing for continued economic activity in northern Saskatchewan. The planning table was comprised of First Nations and Métis communities, various sectors of industry and consulting, other levels of government and jurisdictions, non-governmental organizations, and others.

9.1 Planning Table Insight and Context

Assessment of proposed management strategies and scenario implications were also obtained from the planning table and other groups. This input was carefully considered when preparing the plan and reflected in the plan as it currently stands. Among the diversity of perspectives received, some key messages were derived especially as they reflect the implications of scenario development. Some key messages expressed by members of the planning table can be summarized as follows according to a variety of themes.

9.1.1 General, Overview and Plan Specific Comment

- Multispecies benefits can occur from caribou conservation and the SK2 East is a priority conservation landscape with important habitat for North American waterfowl and other wildlife.
- The conservation of all wetland classes is required to sustain wetland dependant wildlife populations such as woodland caribou and there is recognition and support for the protection of important habitat areas (e.g. high habitat potential) necessary for life-cycle requirements of the species (e.g. calving). Approaches to reinforce this could include the further designation of protected areas, and the reduction of human access.
- Different human activities contribute differently to habitat loss, habitat degradation, and habitat fragmentation, some of which are difficult to recover from and others with less impact should be recognized with smaller disturbance buffers and that young forests and residual patches in burns have a role to play in contributing to habitat.
- Further interest, clarity, and prioritization was being sought to complete the relevant chapters in the *Saskatchewan Environmental Code* (e.g. wetland and watercourse crossing standards) to improve guidance for land managers, and clearly articulate the types of activities permitted within caribou habitat management area tiers, and how the tier may be revised when and where necessary.
- Other management strategies suggested through the planning table included possible predator control and restrictions on hunting.

9.1.2 Forestry and Mining Specific Comment

- While some planning table members identified that forests provide habitat, biodiversity, and ecosystem services to caribou and other wildlife species and forest harvesting reduces the availability of these so harvesting reduction could increase habitat, provide additional environmental benefits, and afford other forest users more opportunities.
- However, others noted that consideration of harvest reductions or restrictions associated with operating in tier 1 caribou habitat would benefit caribou, but could affect tactical plans, have volume implications, could impact jobs, and there is a need to become more sophisticated in optimizing harvesting in order to balance habitat availability and economic sustainability.
- Additionally, there was a perception that forest aggregation (larger harvest blocks) equals more harvesting and that ecosystem integrity (i.e. losing ecosystem components like other plant species) will be lost in doing so and that aggregation of activities would likely have greater impact on single local users.
- With respect to mining, it was noted by some that mining developments have a relatively small landscape footprint and that substantial economic benefits accrue to the province from this activity and that so long as disturbance targets are met, there is little benefit from restricting mining development.
- It was also noted that whereas the mine disturbance footprint is relatively small, there can be a much larger disturbance footprint associated with exploration and if areas are to be restricted from access, companies should be informed before investment occurs in an area. An exception

to the local impact of mines was noted with peat mining owing to its occurrence in high value caribou calving habitat.

9.1.3 Reclamation Specific Comment

- There tends to be general recognition that activities associated with reclamation and restoration of roads would require considerable resources, and need to be carefully and comprehensively planned to maximize benefit to the species and its habitat while also considering and engaging with current users. Some were seeking clarification and identification of specific areas for road restoration to assist with planning to access other areas.
- Some expressed support for a provincial mitigation framework that included avoidance, minimizing impact through best management practices, and compensation of impacts with offsets and also suggested that aggressive road reclamation should be a government priority while recognizing potential impact on other forest users. Others noted that recreational forest users be engaged to ensure that restoration activities were not compromised by continued human use.
- Others identified that reclamation activities would contribute to long term habitat renewal, but would cause short term sensory disturbance to caribou.

While not exhaustive, the feedback received reflected a recognition of the complexity and interconnectedness of elements and considerations that must be considered in caribou conservation efforts. As noted, the Saskatchewan Ministry of Environment considered all of the input received and appreciates the candor and sincerity with which it was shared. The province recognizes the value of an inclusive process and looks forward to continued cooperation and collaboration with local and regional groups in the implementation of the range plans.

9.2 Supporting and Validating Western Science with Traditional Knowledge

This section of the SK2 East range plan constitutes a substantial enhancement from the earlier range plan (i.e. the SK2 Central caribou administration unit range plan). It represents a concerted deliberation of the numerous factors that must be considered from both traditional knowledge and western science perspectives which are more in alignment than they are in discord.

Various work has been conducted by researchers, land-use planners, non-government organizations, and others across northern Saskatchewan to identify and better understand approaches, aspects and information that enhances management of the environment and in the case of this range plan, woodland caribou. Some work has been *ad hoc* and some has been part of a larger directed study. One such important piece of work previously cited is the report: *Characterizing, Mapping and Modelling Aboriginal Traditional Knowledge about Woodland Caribou in Saskatchewan in Support of Range Planning* (Mamun and Brook, 2017). In addition to identifying information on population distribution patterns and habitat use of woodland caribou within their historic and contemporary ranges in northern Saskatchewan, it has enabled individual communities to shape and direct attention to a better understanding of land use by woodland caribou and people. This work also validates the habitat potential mapping that has been conducted in the preparation of this plan (i.e. Figure 7) and has contributed to the development of the caribou habitat management areas (i.e. Figure 15).

Other important work, both complete and ongoing, that continues to support woodland caribou range planning includes efforts of the Prince Albert Model Forest (PAMF), the Prince Albert Grand Council, the Cumberland House Cree Nation, and the Métis Nation Saskatchewan - Region 1. Insights obtained from documentation of shared Indigenous traditional and local knowledge through past and ongoing Prince Albert Model Forest projects continue to enhance understanding and appreciation of woodland caribou, its habitat, and management options. An assessment by the Prince Albert Model Forest (n.d.) identified that historically and continually, woodland caribou have been important to the people of Cumberland House by providing sustenance, clothing, tools, art, medicine, and supporting Indigenous economies and culture. While participant numbers in the assessment were somewhat limited, observations of caribou, habitat use, and threats to species sustainability were identified.

Among participant observations included an overwhelmingly indication of a decline in woodland caribou numbers in the area with sightings decreasing in recent years. Reductions in numbers were attributed to predation, as wolf populations have been purported to be rising; additionally, participants identified concerns around roads/trails, resource exploration, and climate change and their subsequent effects through interrupting movement, destroying shelter/habitat, and changing food availability. Activities identified as associated threats to caribou sustainability included forest harvesting, resource exploration and seismic, mining, damming of waterways, and the resulting changes to habitat, predator movement, travel impediment, and noise avoidance. (Carriere, 2010; PAMF, 2019; PAMF, n.d.).

In addition to observations of condition and causes, was the identification of management actions and options that demonstrate respect for the species and the environment. Examples of actions documented to respect and help maintain woodland caribou include the identification of specific important habitat areas, the maintenance of muskeg areas (e.g. for food, shelter, and calving), the avoidance of invasive monitoring techniques (e.g. radio collaring), and the selective harvest of only bulls for subsistence or voluntarily hunting avoidance. Further actions identified to enhance species management included community education, supporting youth awareness of traditional knowledge around woodland caribou, and developing enhanced stewardship opportunities (PAMF, 2019).

Literature Cited

- Acton, D.F., Padbury, G.A., and C.T. Stushnoff. 1998. The Ecoregions of Saskatchewan. Canadian Plains Research Centre, University of Regina. Saskatchewan Environment and Resource Management. Regina, SK. 205 pp.
- Arifin, M. I., Staskevicius, A., Shim, S. Y., Huang, Y. H., Fenton, H., McLoughlin, P. D., Mitchell, G., Cullingham, C. I., and S. Gilch. (2020). Large-scale prion protein genotyping in Canadian caribou populations and potential impact on chronic wasting disease susceptibility. *Molecular ecology*, 29(20): 3830–3840. <https://doi.org/10.1111/mec.15602>
- Arlt, M. 2009. Historical perspectives on woodland caribou (*Rangifer tarandus caribou*) and landscape changes in the Prince Albert Greater Ecosystem. MSc. Thesis. University of Manitoba. Winnipeg, MB. 108 pp.
- Arlt, M.L. and M. Manseau. 2011. Historical change in caribou distribution and land cover in and around Prince Albert National Park. Land management implications. *Rangifer*, Special Issue 19:17-31.
- Arsenault, A.A. 2003. Status and conservation management framework for woodland caribou (*Rangifer tarandus Caribou*) in Saskatchewan. Fish and Wildlife Technical Report 2003-3. Saskatchewan Environment and Resource Management. Regina, SK. 40 pp.
- Boucher, D., Boulanger, Y., Aubin, I., Bernier, P.Y., Beaudoin, A., Guindon, L., and S. Gauthier. 2018. Current and projected cumulative impacts of fire, drought, and insects on timber volumes across Canada. *Ecological Applications* 28: 1245-1259
- Boulanger, Y., Gauthier, S., and P.J. Burton. 2014. A refinement of models projecting future Canadian fire regimes using homogeneous fire regime zones. *Canadian Journal of Forest Research* 44: 365-376.
- Carriere, N. 2010. Distribution patterns and general biology of woodland caribou based on collection of local and traditional knowledge in north-central Saskatchewan. A thesis submitted to the College of Graduate Studies and Research. Department of Biology, University of Saskatchewan. 133 pp. Retrieved July 29, 2019 from: <https://harvest.usask.ca/handle/10388/etd-09202010-225013>
- COSEWIC, 2014. COSEWIC assessment and status report on the caribou *Rangifer tarandus*, Newfoundland population, Atlantic-Gaspésie population and Boreal population, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxiii + 128 pp. Retrieved Aug. 23, 2017 from: <https://www.registrelep-sararegistry.gc.ca/default.asp?lang=En&n=46B86DC7-1&offset:1&toc:show>
- Dyke, C. 2009. Spatial and temporal characterization of woodland caribou (*Rangifer tarandus caribou*) calving habitat in the boreal plains and boreal shield ecozones of Manitoba and Saskatchewan. MSc. thesis. University of Manitoba. Winnipeg, MB. 105 pp.

- Environment and Climate Change Canada. 2017. Report on the progress of recovery strategy implementation for the woodland caribou (*Rangifer tarandus caribou*), Boreal population in Canada for the period 2012-2017. *Species at Risk Act Recovery Strategy Series*. Environment and Climate Change Canada, Ottawa. ix + 94 pp.
- Environment and Climate Change Canada. 2020. Amended recovery strategy for the woodland caribou (*Rangifer tarandus caribou*), Boreal population, in Canada. *Species at Risk Act Recovery Strategy Series*. Environment and Climate Change Canada, Ottawa. xiii + 143pp
- Environment Canada. 2011. Scientific assessment to support the identification of critical habitat for woodland caribou (*Rangifer tarandus caribou*), boreal population, in Canada. Ottawa, ON. 115 pp. plus appendices.
- Environment Canada. 2012. Recovery strategy for the woodland caribou, boreal population (*Rangifer tarandus caribou*) in Canada. *Species at Risk Act Recovery Strategy Series*. Environment Canada, Ottawa, ON. xi+138 pp.
- Godwin, B. and J. Thorpe. 2000. Status of the woodland caribou (*Rangifer tarandus caribou*) in Saskatchewan. Saskatchewan Environment and Resource Management, Fish and Wildlife. 44 pp.
- Gruel, R. 2018. Abundance of forage lichens for boreal caribou in the Boreal Shield of Saskatchewan. MSc Thesis, University of Saskatchewan, 102 pp.
- Government of Saskatchewan. 2012. Saskatchewan forestry road network data standards. 4th Ed. (draft) Ministry of Environment, Forest Service Prince Albert, SK. Unpublished Internal Report. 18 pp.
- Government of Saskatchewan. 2017. D.1.5 Forest management planning chapter. Code Chapter in the Saskatchewan Environmental Code. 45 pp. Regina, SK. Retrieved February 12, 2019 from <http://www.publications.gov.sk.ca/deplist.cfm?d=66&c=4334>
- Mamun, A.A. and R. Brook. 2017. Characterizing, mapping and modelling aboriginal traditional knowledge about woodland caribou in Saskatchewan in support of range planning - Final report to the Saskatchewan Ministry of Environment. University of Saskatchewan, Saskatoon, SK. 119 pp.
- McLaughlan, M.S., Wright, R.A., and R.D. Jiricka. 2010. Field guide to the ecosites of Saskatchewan's provincial forests. Saskatchewan Ministry of Environment, Forest Service. Prince Albert, SK. 343 pp.
- McLoughlin, P.D., Superbie, C., Stewart, K., Tomchuk, P., Neufeld, B., Barks, D., Perry, T., Greuel, R., Regan, C., Truchon-Savard, A., Hart, S., Henkelman, J., and J.F. Johnstone. 2019. Population and habitat ecology of boreal caribou and their predators in the Saskatchewan Boreal Shield. Final Report. Department of Biology, University of Saskatchewan, Saskatoon. 238 pp.
- Priadka, P., Manseau, M., Trottier, T., Galpern, P., Hervieux, D., McLoughlin, P., and P. Wilson. 2018. Partitioning drivers of genetic variation for a continuously distributed population of boreal caribou: Implications for management unit delineation. *Ecology and Evolution*. 1-13 DOI: 10.1002/ece3.4682.
- Prince Albert Model Forest (n.d.) Woodland caribou of Cumberland House: An examination into the context surrounding the woodland caribou in the Cumberland House region. Unpublished Internal Report. 25 pp.

- Prince Albert Model Forest. 2019. Traditional ecological knowledge – Community participation in the research and recovery of woodland caribou in northern Saskatchewan. March 31, 2019. Prince Albert, SK. Unpublished Internal Report. 22 pp.
- Proulx, G. 2013. Late-winter Habitat of the Boreal Woodland Caribou (*Rangifer tarandus caribou*) in Northwestern Saskatchewan. *Canadian Wildlife Biology and Management*. 2:11-22.
- Proulx, G. and K. Gillis. 2017. Winter Habitat of the Boreal Woodland Caribou (*Rangifer tarandus caribou*) in the Northwestern Region of the Mistik Forest Management Area, Saskatchewan. *Canadian Wildlife Biology and Management*. 6:79-88.
- Rettie, W.J. and F. Messier. 2000. Hierarchical habitat selection by woodland caribou: its relationship to limiting factors. *Ecography* 23:466-478.
- Rettie, W.J. and F. Messier. 2001. Range use and movement rates of woodland caribou in Saskatchewan. *Can. J. Zool.* 79:1933-1940.
- Roddy, D. (Ed.) 2013. Woodland caribou habitat workshop. Saskatchewan Ministry of Environment. Saskatoon, SK. Unpublished Internal Report. 22 pp.
- Saskatchewan Ministry of Environment. 2014. Conservation strategy for boreal woodland caribou (*Rangifer tarandus caribou*) in Saskatchewan. Saskatchewan Ministry of Environment. Fish and Wildlife Technical Report 2014. Regina, SK. 29 pp.
- Schmid, S. n.d. Barren ground caribou & woodland caribou – Cree and Dene traditional knowledge. A presentation. 19 pp.
- Skatter, H. G., Kansas, J.L., Charlebois, M.L., and B. Balicki. 2014. Recovery of terrestrial lichens following wildfire in the Boreal Shield of Saskatchewan: Early seral forage availability for woodland caribou (*Rangifer tarandus caribou*). *Canadian Wildlife Biology and Management*. Vol. 3(1):1-14.
- Skatter, H. G., M.L. Charlebois, S. Eftestøl, D. Tsegaye, J.E. Colman, J.L. Kansas, K. Flydal, and B. Balicki. 2017. Living in a burned landscape: Woodland caribou (*Rangifer tarandus caribou*) use of post fire residual patches for calving in a high fire/low anthropogenic Boreal Shield Ecozone. *Canadian Journal of Zoology*. 95 975-984. [Dx.doi.org/10.1139/cjz-2016-0307](https://doi.org/10.1139/cjz-2016-0307).
- Trottier, T. 1988. A survey of woodland caribou occurrences in Saskatchewan. Wildlife Population Management Report 88-WPM-9, Saskatchewan Ministry of Parks, Recreation and Culture. Regina, SK.

Glossary

The following terms are defined in accordance with their use in this document.

Biophysical attributes: Habitat characteristics required by boreal caribou to carry out life processes (see Appendix H in the recovery strategy) (Environment Canada, 2012).

Caribou conservation unit: A type of caribou range with low certainty in the delineated boundary because of a lack of information (Environment Canada, 2012).

Caribou range: A geographic area occupied by a group of boreal woodland caribou that are subject to similar factors affecting their demography and used to satisfy their life history processes (e.g. calving, rutting and wintering) (Environment Canada, 2012).

Critical habitat: The habitat that is necessary for the survival or recovery of a wildlife species that is listed in the federal *Species at Risk Act* and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species.

Disturbance (habitat): Habitat that has been affected either directly or indirectly by human or natural disturbances. Human activities such as forest harvesting or agriculture, or natural disturbances such as wildfire, either temporarily or permanently remove or alter habitat, resulting in a direct habitat disturbance. Indirect or functional habitat disturbance results when animals use habitats differently or they alter their behaviour adjacent to the direct disturbance. These indirect effects are measured by a zone of influence around the direct disturbance.

Disturbed habitat: Habitat showing: i) anthropogenic disturbance visible on Landsat satellite imagery at a scale of 1:50,000, including habitat within a 500 m buffer of the anthropogenic disturbance; and/or ii) fire disturbance in the last 40 years, as identified in data from each provincial and territorial jurisdiction (without buffer) (Environment Canada, 2012).

Fragmentation (habitat): The process by which habitats are increasingly divided into smaller units. Habitat fragmentation results in increased isolation of habitat patches, reduced habitat areas, and smaller habitat patches with reduced interior area relative to edge.

Human development footprint: The area directly disturbed by human development and land use activities (e.g. roads, gravel pits, residential lots, agricultural fields, etc.). The human development footprint results in the physical loss or alteration of wildlife habitat.

Harvest Volume Schedule: The maximum sustainable timber volume that can be harvested each year, as determined or approved by the minister, and includes a timber depletion schedule (Government of Saskatchewan, 2020).

Human zone of influence: The area around a human development footprint that is indirectly influenced by the human activities. Sensory disturbance, increased mortality risk or similar factors may influence the use of areas by wildlife adjacent to human developments. Wildlife may avoid or use areas less intensively within the zone of influence, resulting in indirect habitat loss and reduced habitat effectiveness.

Non-permanent disturbance: Existing features found within a range, such as seismic lines and commercial foresting areas that do not currently possess, but have the potential to possess the biophysical attributes of critical habitat for boreal caribou.

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, nor have the potential to possess, the biophysical attributes of critical habitat for boreal caribou (Environment Canada, 2012).

Range assessment: A process that examines habitat conditions and population trends for a wildlife species and identifies key risk factors affecting the viability of the species.

Range plan: A document that demonstrates how the habitat condition within a given range will be managed over time and space to ensure that critical habitat for boreal caribou is protected from destruction with the aim of ensuring that each local population will either continue to be self-sustaining or become self-sustaining over time (Environment Canada, 2012).

Threatened (population status): Under the federal *Species at Risk Act*, a status of threatened means “a wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction”.

Undisturbed habitat: Habitat not showing any: i) anthropogenic disturbance visible on Landsat satellite imagery at a scale of 1:50,000, including habitat within a 500 m buffer of the anthropogenic disturbance; and/or ii) fire disturbance in the last 40 years, as identified in data from each provincial and territorial jurisdiction (without buffer). Disturbance within the 500 m buffer would result in a reduction of the undisturbed habitat.¹ (Environment Canada, 2012)

¹ This specific definition of disturbance was used in Environment Canada’s 2011 scientific assessment to develop the disturbance-recruitment relationship upon which the categories of risk for the disturbance thresholds were derived.