Rook I Project

Environmental Impact Statement

Annex VII.1: Vegetation Baseline Report 1 (Mapping)

NexGen Energy Ltd.
Rook I Project

Terrestrial Environment
Vegetation Baseline Report 1
(Mapping)

December 2023

OMNIA
ECOLOGICAL SERVICES

Terrestrial Environment
Vegetation Baseline Report 1 (Mapping)

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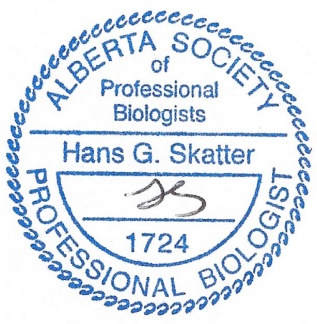

December 2023

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LIST OF ACRONYMS

Abbreviation	Explanation
ATV	all-terrain vehicle
DBH	diameter at breast height
CRDN	Clearwater River Dene Nation
CWD	coarse woody debris
EC	Environment Canada (1971 - 2015)
ECCC	Environment and Climate Change Canada (2015 - Current)
ENV	Saskatchewan Ministry of Environment
JWG	Joint Working Groups
LSA	local study area
RSA	regional study area
CRSA	caribou regional study area
P	probability
PEM	Predictive Ecosite Mapping
ROW	right-of-way
sp.	species
spp.	multiple species
TLU	Traditional Land Use
UTM	Universal Transverse Mercator
VC	valued component

1.0 INTRODUCTION

The Rook I Project (Project) is a proposed new uranium mining and milling operation that is 100% owned by NexGen Energy Ltd. (NexGen). The Project would be located in northwestern Saskatchewan, approximately 40 kilometres (km) east of the Alberta-Saskatchewan border, 130 km north of the town of La Loche, and 640 km northwest of the city of Saskatoon. The Project would reside within Treaty 8 territory and within the Métis Homeland. At a regional scale, the Project would be situated within the southern Athabasca Basin adjacent to Patterson Lake, and along the upper Clearwater River system. Access to the Project would be from an existing road off Highway 955. The Project would include underground and surface facilities to support the extraction and processing of uranium ore from the Arrow deposit, a land-based, basement-hosted, high-grade uranium deposit.

The vegetation baseline report represents a component of a comprehensive baseline program that documents the natural and socio-economic environments in the anticipated area of the Project. The vegetation baseline program was undertaken to provide context from which Project environmental vegetation effects could be assessed in the Environmental Impact Statement (EIS).

Since exploration at the Project commenced in 2013, NexGen has engaged regularly and established relationships with local First Nations and Métis Groups (collectively referred to as Indigenous Groups) and northern communities, specifically those closest and with greatest access to the proposed Project. NexGen respects the rights of Indigenous Peoples and the unique relationship Indigenous Peoples have with the environment, and recognizes the importance of full and open discussion with interested or potentially affected Indigenous communities regarding the development, operation, and decommissioning of the proposed Project. Engagement activities to date, as well as future planned engagement activities, reflect the value NexGen places on meaningful engagement with Indigenous and northern communities who could be potentially affected by the proposed Project. Engagement mechanisms have included, but are not limited to: meetings with leadership, workshops and community information sessions, Project site tours, establishing Joint Working Groups to support the gathering and incorporation of Indigenous and Métis Knowledge throughout the Environmental Assessment (EA) process, and providing funding for Traditional Land Use (TLU) Studies[1] to understand how the proposed Project may interact with the Indigenous communities' traditional use of the anticipated area of the Project.

Feedback received during engagement activities was documented for contribution to the EIS for the Project; examples of feedback received include discussion of concerns, interests, potential adverse effects, mitigation, and design alternatives. Many baseline studies were initiated in advance of formal engagement on the EA for the Project; however, engagement during the execution of baseline studies has helped inform the understanding of baseline conditions and confirmed components of the natural and socio-economic environments that required study. A summary of feedback related to the vegetation baseline program is presented in Appendix A of the Vegetation Baseline Road Map (Annex VII).

[1] Traditional Land Use (TLU) Studies include all land use studies developed by the Project's affected Indigenous Groups, including Traditional Land Use and Occupancy studies, Traditional Knowledge and Use studies, and Indigenous Rights and Knowledge studies, henceforth referred collectively as TLU Studies.

1.1 Study Objectives

The Omnia terrestrial baseline data was used to support the environmental effects assessment for the Project.

The objectives of the Omnia terrestrial baseline surveys were to:

- characterize the existing terrestrial environment (natural and anthropogenic elements) in the Project study areas through the use of available peer reviewed research, applicable professional protocols, and provincial and federal guidelines;
- inform environmental effects and technical assessments;
- ensure the baseline studies meet all provincial and federal regulatory requirements for the effects assessment;
- capture information from community engagements and stakeholder considerations;
- establish a framework to facilitate future environmental effects monitoring; and
- support the development of project specific mitigation strategies.

This report documents and summarizes baseline (current) anthropogenic and natural disturbance, ecosite characterization, and linear feature natural regeneration based on data obtained during field programs completed in 2018 and 2019.

2.0 STUDY AREAS

2.1 Study Area Selection

The Project is located approximately 130 km north of La Loche, Saskatchewan along Patterson Lake near the northern edge of the Boreal Plain Ecozone, in the Mid-Boreal Uplands Ecoregion. The regional study areas extend into the Boreal Shield Ecozone. These Omnia terrestrial baseline surveys were established using three nested study areas to guide impact assessments of Project-specific and cumulative impacts on potential valued components (VC) including: a local study area (LSA), a regional study area (RSA), and a caribou regional study area (CRSA) (Figure 2.1-1). These study areas were developed to account for the entire Project footprint and surrounding regions to help assess both local and regional impacts.

Specifically, the LSA was 41 km^2 and sized to account for direct Project effects and includes a sensory buffer (1.0 km) for the proposed mine access road and mine site development footprint (Figure 2.1-1). The 1.0 km buffer was selected to take into account potential habitat alienation effects on large mammals from mining activity, construction noise and road traffic as per Cristescu et al. (2016).

The RSA was 400 km^2 and designed to account for the potential cumulative effects of the Project at a sub-regional scale (including species with larger home ranges) (Figure 2.1-1). The RSA was also designed to support future impact assessments on VCs and includes areas with potential direct and indirect effects of the Project in addition to suitable reference areas. The size of the RSA was selected to align with those from several other regional studies across Northern Saskatchewan as outlined by McLoughlin et al. (2016).

Both LSA and RSA boundaries are of an appropriate size and location for the inventory and assessment of both local and regional effects on vegetation and wildlife from existing and planned activities.

The CRSA was 2,380 km^2 and accounts for the mean annual home range size of woodland caribou (*Rangifer tarandus caribou*) in the region, and to provide regional context for caribou occurrence and habitat supply as mapped by Environment and Climate Change Canada (ECCC 2018) and the Saskatchewan

Ministry of Environment (ENV 2018) (Figure 2.1-1). No woodland caribou home range data is available for the CRSA. However, a study in the Boreal Shield completed by McLoughlin et al. (2016), to the east of the study area, estimated mean annual home range to be 407 km^2. The mean diameter (24 km) of the home range was used as a buffer for the proposed mine access road and mine site development and to delineate the CRSA.

2.2 Ecological Setting

2.2.1 Ecoregions and Landscape Areas

The Project study areas straddle two Ecozones, three Ecoregions, and three Landscape Areas (Acton et al. 1998) (Table 2.1-1). The entire LSA is situated within the Firebag Hills Plain Landscape Area (E1) in the Mid-Boreal Upland Ecoregion of the Boreal Plain Ecozone. The RSA is situated within the Firebag Hills Plain Landscape Area (93.7%) of the Boreal Plain, and the McTaggart Plain Landscape Area (C3) (6.3%) in the Athabasca Plain Ecoregion of the Boreal Shield Ecozone. The CRSA is situated within the Firebag Hills Landscape Area (58.8%) of the Boreal Plain, the McTaggart Plain Landscape Area (33.6%) of the Boreal Shield, and the Black Birch Plain Landscape Area (D1) (7.6%) in the Churchill River Upland Ecoregion of the Boreal Shield.

Table 2.2-1 Distribution of Project Study Areas within Ecozones, Ecoregions & Landscape Areas.

Ecozone		Boreal Shield		Boreal Plain	**Total Area (km^2)**
Ecoregion		Athabasca Plain	Churchill River Upland	Mid Boreal Upland	
Landscape Area		McTaggart Plain (C3)	Black Birch Plain (D1)	Firebag Hills (E1)	
LSA	km^2	0	0	41.1	**41.1**
	%	0	0	100.0	**100.0**
RSA	km^2	25.1	0	375.0	**400.1**
	%	6.3	0	93.7	**100.0**
CRSA	km^2	798.4	181.2	1400.1	**2,379.7**
	%	33.6	7.6	58.8	**100.0**

Source: Acton et al. 1998.

2.2.2 Landforms

All three Landscape Areas (C3, D1, and E1) have similar landforms characterized by hummocky, sandy glacial till and glaciofluvial deposits, with large areas of bogs and peatlands (Acton et al. 1998). The landforms in these areas are more representative of Boreal Shield landforms than Boreal Plain landforms. Typically, the Boreal Plain usually contains more clay-sized materials and has a more diverse mineralogy (Acton et al. 1998).

2.2.3 Regional Vegetation

The three Landscape Areas are also similar in that jack pine (*Pinus banksiana*) with a lichen understory is prevalent due to the sandy surface materials and frequency of the fire regime. A mixture of black spruce (*Picea mariana*) and jack pine can be found on the slopes of eskers, and closed stands of black spruce are

found in the boggy lowland areas with occasional tamarack (*Larix laricina*) trees found in fens (Acton et al. 1998).

As fire in lichen-dominated systems generally do not increase the amount of deciduous shrubs, the vegetation in this area is typical of the Boreal Shield where frequent fires have promoted the dominance of jack pine. The forests of the Boreal Plain (and particularly the Mid-Boreal Upland Ecoregion) are more commonly represented by a mixture of deciduous and coniferous trees, with closed stands of trembling aspen (*Populus tremuloides*), jack pine, black spruce, white spruce (*Picea glauca*), and balsam poplar (*Populus balsamifera*); these species are listed in order of dominance (Acton et al. 1998).

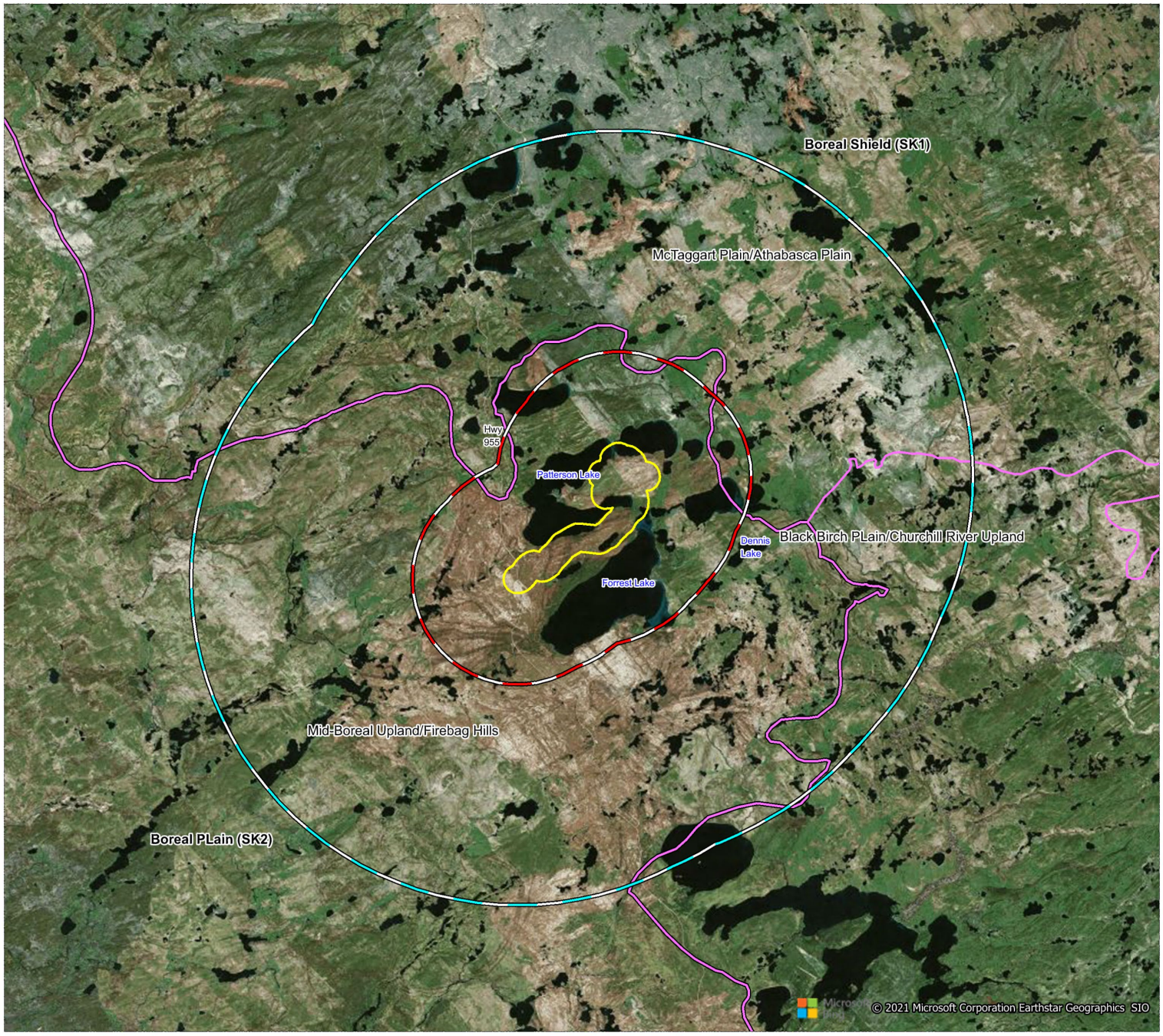

Figure 2.1-1 Omnia Terrestrial Baseline Study Areas of the Project

Legend

- Local Study Area (LSA)
- Regional Study Area (RSA)
- Caribou Regional Study Area (CRSA)
- Ecoregion / Landscape Area
- Ecozone

N
W E
S

0 7.5 15
kilometers
Scale = 1 : 270,000

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3.0 ANTHROPOGENIC DISTURBANCE MAPPING

Anthropogenic disturbance mapping was created, compiled, and refined for the Project LSA and RSA. For the CRSA, federal and provincial government data sources were used. The data is presented in three ways:

- total area disturbed (km^2) by feature type (LSA and RSA);
- linear feature density (km/km^2) by feature type (LSA and RSA); and
- total area disturbed (km^2), including 500 m buffer, by feature type (LSA, RSA, and CRSA).

3.1 Study Objectives

The objective of this mapping was to provide baseline anthropogenic disturbance mapping for the LSA, RSA and CRSA.

3.2 Methods

To develop baseline anthropogenic disturbance mapping for the LSA and RSA, a two-step procedure was used. First, the Environment and Climate Change Canada (ECCC) national level anthropogenic disturbance map was downloaded and clipped to the study area boundaries (EC 2012a, ECCC 2015). Detailed (unbuffered) data has been made available from the 2012 dataset (EC 2012a), while the updated disturbance data from 2015 (ECCC 2015) includes the 500 m buffer (no detailed unbuffered data is available for this dataset). NexGen baseline anthropogenic disturbance data was also included in this step.

Second, to improve the resolution and ensure completeness, all visually discernible anthropogenic features in the LSA and RSA were digitized at a 1:5,000 scale. This was completed to provide the most accurate and complete refined data set to identify existing disturbance and provide information and assistance with future reclamation goals. To support this process and enhance the final product, a combination of 2018 Project-specific ortho-photography, Landsat Imagery (2018), and Map Info Microsoft Bing Imagery (2018) were used to visually identify anthropogenic features. Industrial clearings (i.e., polygons) were hand drawn based on imagery. All linear features were digitized as lines, the feature widths were measured based on imagery, and the average widths were used to create polygons per the widths detailed below:

- cutline: 1.75 m;
- right-of-way: 2.5 m;
- trail: 4 m;
- rough road: 5.5 m; and
- road: 12 m.

The digitized features were layered according to the following priority; where the layers overlapped, the higher priority layer took precedence over the lower priority layer:

1. industrial clearing;
2. road;
3. rough road;
4. trail;
5. cutline; and
6. right-of-ways (ROW).

For the CRSA, the most up to date ECCC (2015) non-refined national level anthropogenic disturbance mapping (footprint and 500 m buffer) was used.

3.3 Results

3.3.1 Total Area Disturbed (km^2)

The results of the anthropogenic disturbance mapping for the LSA and RSA are displayed in Figure 3.3-1. Using the refined anthropogenic disturbance map product (unbuffered), the total amount of anthropogenic disturbance was 0.8 km^2 (2.0%) in the LSA and 2.1 km^2 (0.5%) in the RSA (Table 3.3-1). Industrial clearings, rough roads, and right-of-ways were the most common anthropogenic disturbance types in the LSA.

Table 3.3-1 Refined Mapping of Anthropogenic Disturbance in the Project LSA and RSA.

Disturbance Feature	LSA		RSA	
	km^2	**%**	**km^2**	**%**
Cutline	0.025	0.06	0.454	0.11
Right-of-Way	0.077	0.19	0.146	0.04
Trail	0.050	0.12	0.320	0.08
Rough Road	0.123	0.30	0.332	0.08
Road	0.028	0.07	0.208	0.05
Industrial Clearing	0.534	1.30	0.644	0.16
Total Disturbance	**0.84**	**2.04**	**2.11**	**0.53**

Note: Unbuffered anthropogenic disturbance

3.3.2 Linear Feature Density (km/km^2)

Per the Environment Canada (EC 2012a) mapping, the density of linear feature disturbances was approximately 0.3 km per km^2 in the LSA and approximately 0.2 km per km^2 in the RSA (Table 3.3-2). A comparison of the refined anthropogenic disturbance mapping versus the unbuffered EC (2012a) linear feature data set found the refined LSA map had a linear feature density 8.3 times higher than the EC (2012a) data set. The refined RSA anthropogenic disturbance map had a linear feature density that was 7.6 times greater than EC (2012a) data set. Refined anthropogenic disturbance mapping indicated five linear feature types (road, rough road, trail, cutline, and ROW) in the LSA and RSA, while the EC (2012a) data set only detected one type (road). This difference was likely a result of the approach and scale (1:30,000) of the mapping completed by EC (2012a).

3.3.3 Total Area Disturbed (km^2), Including 500 m Buffer

The results of the updated and improved anthropogenic footprint mapping including 500 m CRSA buffer were compared to the buffered ECCC (2015) anthropogenic disturbance data set (Table 3.3-3). The refined anthropogenic disturbance map for the LSA resulted in total buffered linear disturbance of 33.6 km^2 (81.7%), versus the ECCC (2015) dataset that included 10.5 km^2 (31.5%) of buffered linear disturbance. For the RSA the refined anthropogenic footprint was 195.4 km^2 (48.8%) compared to 65.0 km^2 (16.3%) using the ECCC (2015) dataset. For the CRSA the anthropogenic footprint was 226.72 km^2 (9.5%) using the ECCC (2015).

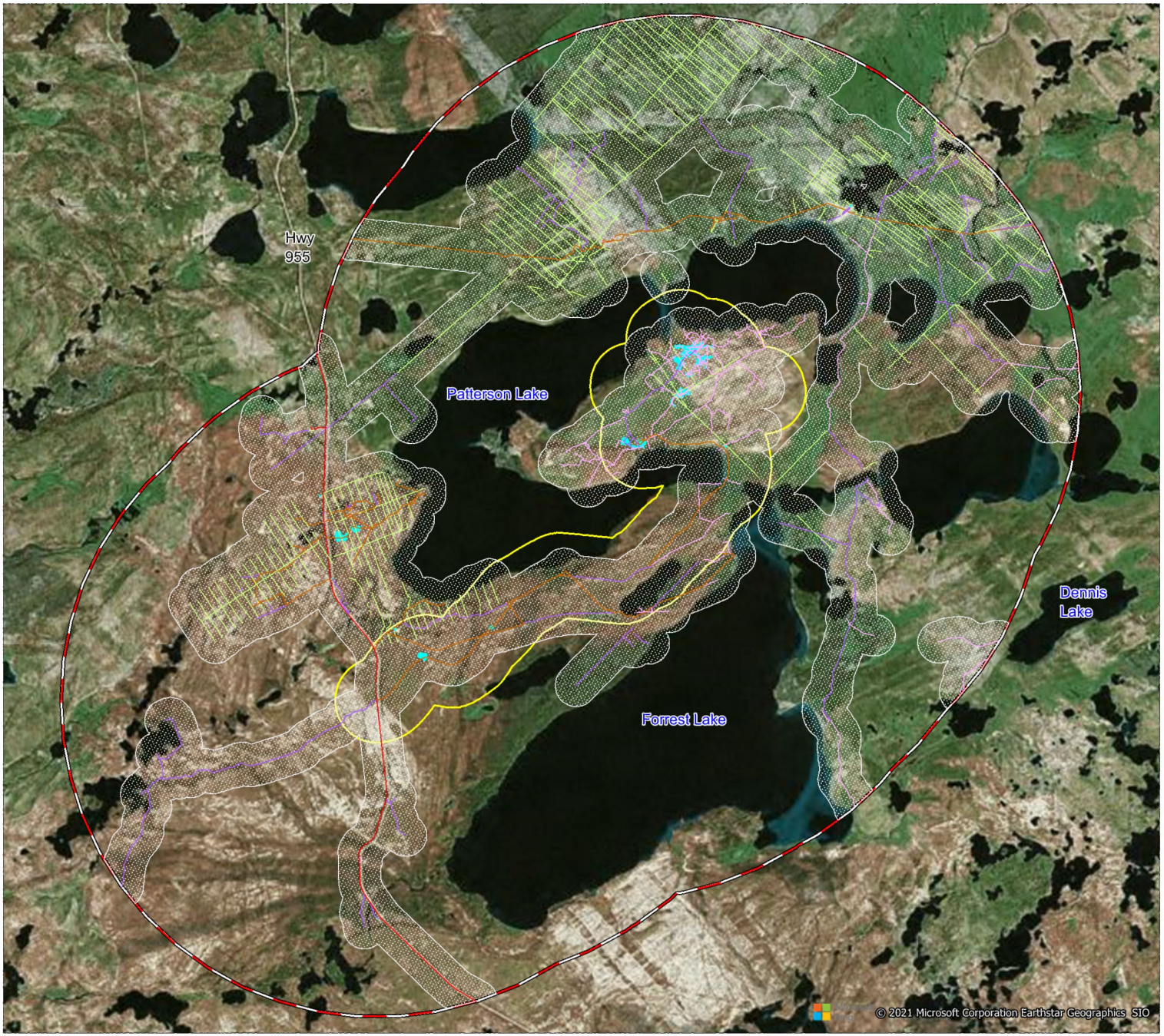

Figure 3.3-1 Project Anthropogenic Disturbance Mapping

Legend

Disturbance Type - Width

- Cutline (1.75m)
- ROW (2.5m)
- Trail (4m)
- Rough Road (5.5m)
- Road (12m)

- 500m Anthropogenic Buffer
- Clearing
- Regional Study Area (RSA)
- Local Study Area (LSA)

N
W E
S

0 2.5 5

kilometers

Scale = 1 : 90,000

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Table 3.3-2 Linear Feature Density in the Area of the Project (ECCC 2015).

Linear Feature	LSA (km/km^2)		RSA (km/km^2)		CRSA (km/km^2)	
	ECCC (2015)	Refined Mapping	ECCC (2015)	Refined Mapping	ECCC (2015)	Refined Mapping
Cutline	0.00	0.38	0.00	0.66	0.00	N/A
Right-of-Way	0.00	0.98	0.00	0.17	0.00	
Trail	0.00	0.34	0.00	0.20	0.00	
Rough Road	0.00	0.53	0.00	0.15	0.00	
Road	0.27	0.06	0.16	0.04	0.09	
Total	**0.27**	**2.28**	**0.16**	**1.23**	**0.09**	

Table 3.3-3 Comparison of updated and improved Anthropogenic Footprint with the ECCC (2015) Footprint.

Study Area		Anthropogenic Footprint (500m buffer included)		Total Area (km^2)
		ECCC (2015)	Refined Mapping	
LSA	**km^2**	10.51	33.58	41.12
	%	25.5	81.7	
RSA	**km^2**	65.03	195.36	400.12
	%	16.3	48.8	
CRSA	**km^2**	226.72	N/A	2,379.63
	%	9.5		

4.0 FIRE MAPPING

The Recovery Strategy for the woodland caribou Boreal Population in Canada applied a threshold of 40 years and beyond for when habitat becomes available for woodland caribou following wildfire (EC 2012b, Skatter et al. 2017). Fire mapping was created/compiled based on federal and provincial government data sources.

4.1 Study Objectives

The objective of this mapping was to provide baseline fire mapping to identify the amount of young forest within the study areas.

4.2 Methods

Historical fire data (mapping) was obtained from the Saskatchewan Ministry of Environment (ENV) Wildfire Management Branch (Jones 2018). The fire data spanned from 1945 to 2018 and was provided as a shapefile. The data was downloaded, clipped, and overlaid onto the Project study areas. The mapped fire polygons included water bodies; therefore, the hydrological layer developed by Natural Resources Canada (2017) was used to exclude water polygons. The resulting imagery was then queried to analyze fire history for the LSA, RSA, and CRSA. The data was presented as percent burned area as a function of the study areas and percent burn of the terrestrial (excluding water) study areas.

The coarse level of fire polygon mapping did not account for residual patches (unburned areas) within the larger fire polygon; the results below are therefore an overestimation of total area burned. It is nevertheless useful as it is the only available source of fire mapping for the CRSA. Further interpretation required to provide a more accurate delineation of burned areas within the LSA and RSA are completed and presented in Section 5.0.

4.3 Results

A total of 19 fires have occurred in the Project CRSA since 1945. The age of these fires ranges from recent (2018) to 51 years (Table 4.3-1). The fires that have occurred within the CRSA during the last 40 years (1979-2018) are displayed in Figure 4.3-1.

Fires in the LSA:

- Two fires occurred within the LSA historically, both within the last 40 years (one in 1990 and the other in 1995) (Table 4.3-1, Figure 4.3-1).
- The two fires covered 28.7 km^2, which equates to 69.7% of the LSA (including water) and 85.9% of the terrestrial area only.

Fires in the RSA:

- Ten fires have occurred in the RSA historically. Nine of these fires have occurred within the last 40 years (Table 4.3-1, Figure 4.3-1).
- These nine fires covered 263.2 km^2, which equates to 65.8% of the RSA (including water) and 90.4% of the terrestrial area only.

Fires in the CRSA:

- Nineteen fires have occurred within the CRSA since 1945. Sixteen of these fires have occurred within the last 40 years (Table 4.3-1, Figure 4.3-1).
- These 16 fires comprise 1,938.2 km^2, which equates to 81.5% of the CRSA (including water) and 94.3% of the terrestrial area only.

Table 4.3-1 Overview of Historical Fires from 1945 - 2018 in the Project LSA, RSA and CRSA.

Fire Period	Year	LSA			RSA			CRSA		
		km²	% of Total	% of Terrestrial	km²	% of Total	% of Terrestrial	km²	% of Total	% of Terrestrial
>40 years	1967	-	-	-	14.2	3.5	4.9	23.4	1.0	1.1
	1970	-	-	-	-	-	-	<0.01	0.0	0.0
	1978	-	-	-	-	-	-	2.2	0.1	0.1
Total area burned >40 years		0.0	0.0	0.0	14.2	3.5	4.9	25.7	1.1	1.2
<40 years	1980	-	-	-	6.3	1.6	2.2	191.4	8.0	9.3
	1981	-	-	-	26.0	6.5	8.9	253.1	10.6	12.3
	1990	13.4	32.6	40.2	23.5	5.9	8.1	23.5	1.0	1.1
	1993	-	-	-	-	-	-	18.6	0.8	0.9
	1995	15.2	37.1	45.7	115.9	29.0	39.8	372.9	15.7	18.1
	2002	-	-	-	-	-	-	14.4	0.6	0.7
	2004	-	-	-	-	-	-	2.2	0.1	0.1
	2006	-	-	-	14.2	3.6	4.9	537.5	22.6	26.2
	2009	-	-	-	2.1	0.5	0.7	56.0	2.4	2.7
	2010	-	-	-	-	-	-	16.2	0.7	0.8
	2012	-	-	-	4.0	1.0	1.4	4.0	0.2	0.2
	2014	-	-	-	-	-	-	0.0	0.0	0.0
	2015	-	-	-	-	-	-	155.9	6.6	7.6
	2016	-	-	-	25.0	6.3	8.6	194.9	8.2	9.5
	2017	-	-	-	46.1	11.5	15.8	70.4	3.0	3.4
	2018	-	-	-	-	-	-	27.2	1.1	1.3
Total area burned <40 years		**28.7**	**69.7**	**85.9**	**263.2**	**65.8**	**90.4**	**1,938.2**	**81.5**	**94.3**
Total of study area (km²)		41.1			400.1			2,379.6		
Waterbodies (km²)		7.8			109.0			324.6		
Total terrestrial study area (km²)		33.4			291.1			2,055.0		

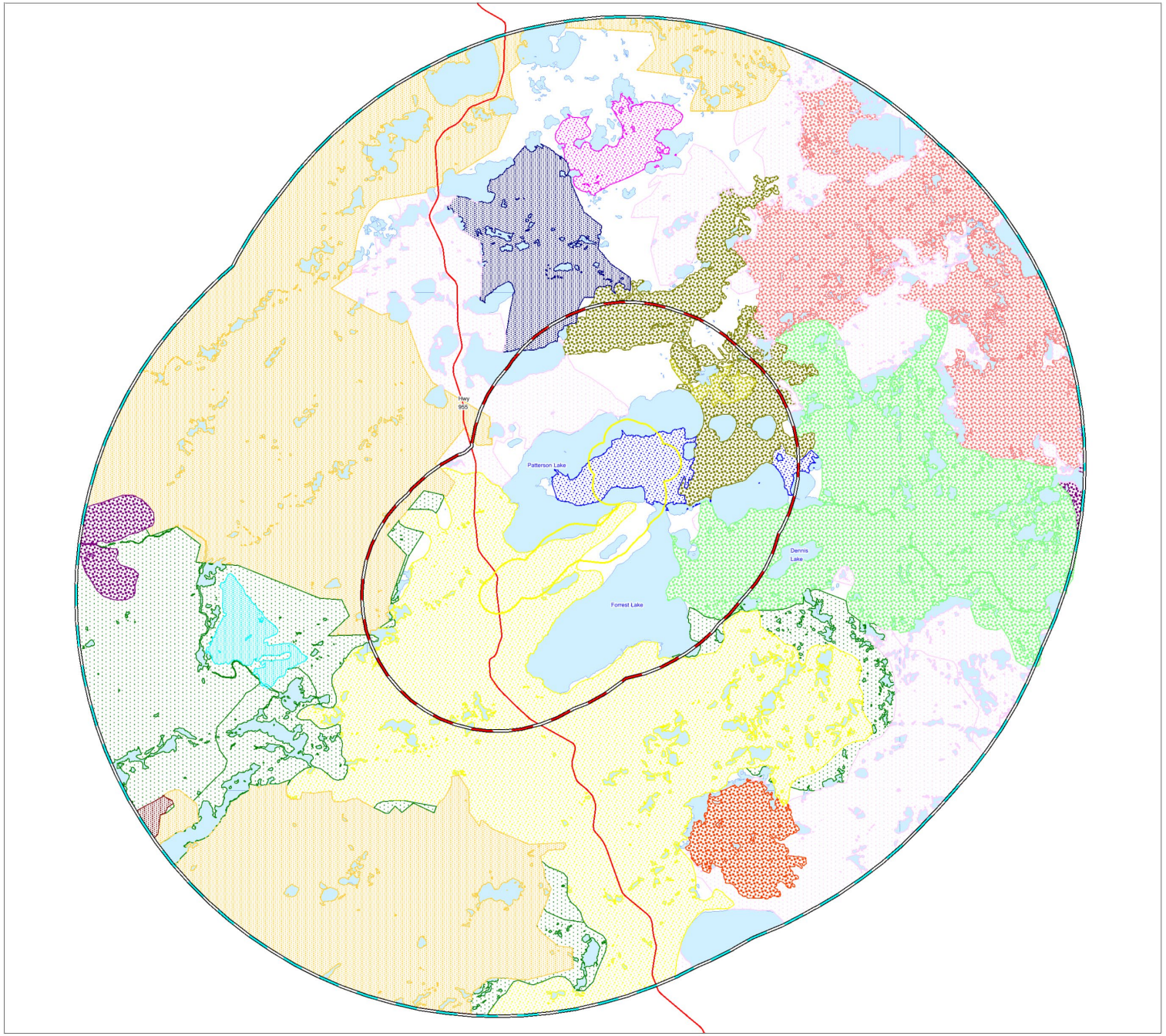

Figure 4.3-1 Project Historical Fire Mapping

Legend

Fire Year
- 1980
- 1981
- 1990
- 1993
- 1995
- 2002
- 2004
- 2006
- 2009
- 2010
- 2012
- 2014
- 2015
- 2016
- 2017
- 2018

Waterbody
Caribou Regional Study Area (CRSA)
Regional Study Area (RSA)
Local Study Area (LSA)

N
W E
S

0 5 10
kilometers
Scale = 1 : 210,000

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5.0 ECOSITE MAPPING

An Interpreted Ecosite map was created, compiled, and refined for the Project LSA and RSA. For the CRSA, federal and provincial government data sources were used.

5.1 Study Objectives

The objectives of this mapping were to provide baseline information on vegetation cover to:

- refine fire mapping to accurately identify residual (non-burned) patches within government-mapped fire polygons, and identify amount of young and old forest types within the study areas; and
- support monitoring and/or assessment of impacts.

Predictive Ecosite Mapping (PEM) was available at the Saskatchewan Technical Branch. The goal was to use the PEM, but if this map was not deemed to have sufficient accuracy, the development of an interpreted Ecosite map would be required.

5.2 Methods

5.2.1 Predictive Ecosite Map

Predictive Ecosite Mapping data was obtained from the Saskatchewan Technical Branch to support the creation of a study area specific ecosite map (Henkleman and Johnstone 2017). The PEM that was obtained only covered the Boreal Plain portion of the study area. To support expansion of the mapping and to further refine and assess mapping accuracy, a ground truth component was included in the baseline field studies.

A total of 1,366 field sampling/ground truthing sites were used, where an ecosite delineation was completed. The sampling sites provided the supporting data for expanding, refining and assessing the accuracy of the PEM for the LSA and RSA.

Field sampling/ground truthing sites included data from:

- ungulate pellet group/browse availability survey: 1,219 locations;
- small mammal trapping program: 21 locations;
- vegetation/ecosite characterization survey: 69 locations; and
- ground control points: 57 locations.

Half of the locations sampling sites (n=650) were used for the map accuracy assessment. The remaining locations were set aside to support ecosite mapping in the event that the PEM was found to have insufficient accuracy. The ground control points were overlain onto the mapped ecosites to assess accuracy of the Predictive Ecosite Map.

5.2.2 Interpreted Ecosite Map

To create a refined ecosite map to accurately outline the current ecosites (including regenerating stages) in the LSA and RSA, a combination of the existing PEM and alternative sources including Landsat Imagery (2018), Bing and Google Earth Imagery (2017-2018), and aerial photographs taken during the aerial waterfowl survey in June 2018 (Figure 5.2-1) were utilized. Visual interpretation was guided by collected baseline field data not used for the accuracy assessment. The resulting ecosite map was completed at a 1:20,000 scale.

The regenerating land cover types less than 40 years old that did not match any of the ecosites described by McLaughlan et al. (2010) were categorized based on vegetation height and therefore broadly on stand age; this follows methods outlined by Skatter et al. (2017). The categories were grouped as recent burn: (0 to 5 years of age), low shrub (< 1m tall, approximately 5 to 20 years of age), tall shrub (1 m to 5 m tall, approximately 20 to 35 years of age), and treed (> 5 m tall, approximately 25 to 0 years of age). The categories were further divided into three vegetation types (bog, coniferous, and deciduous) based on moisture regime (upland versus lowland), and dominant tree species in the upland areas (coniferous versus deciduous).

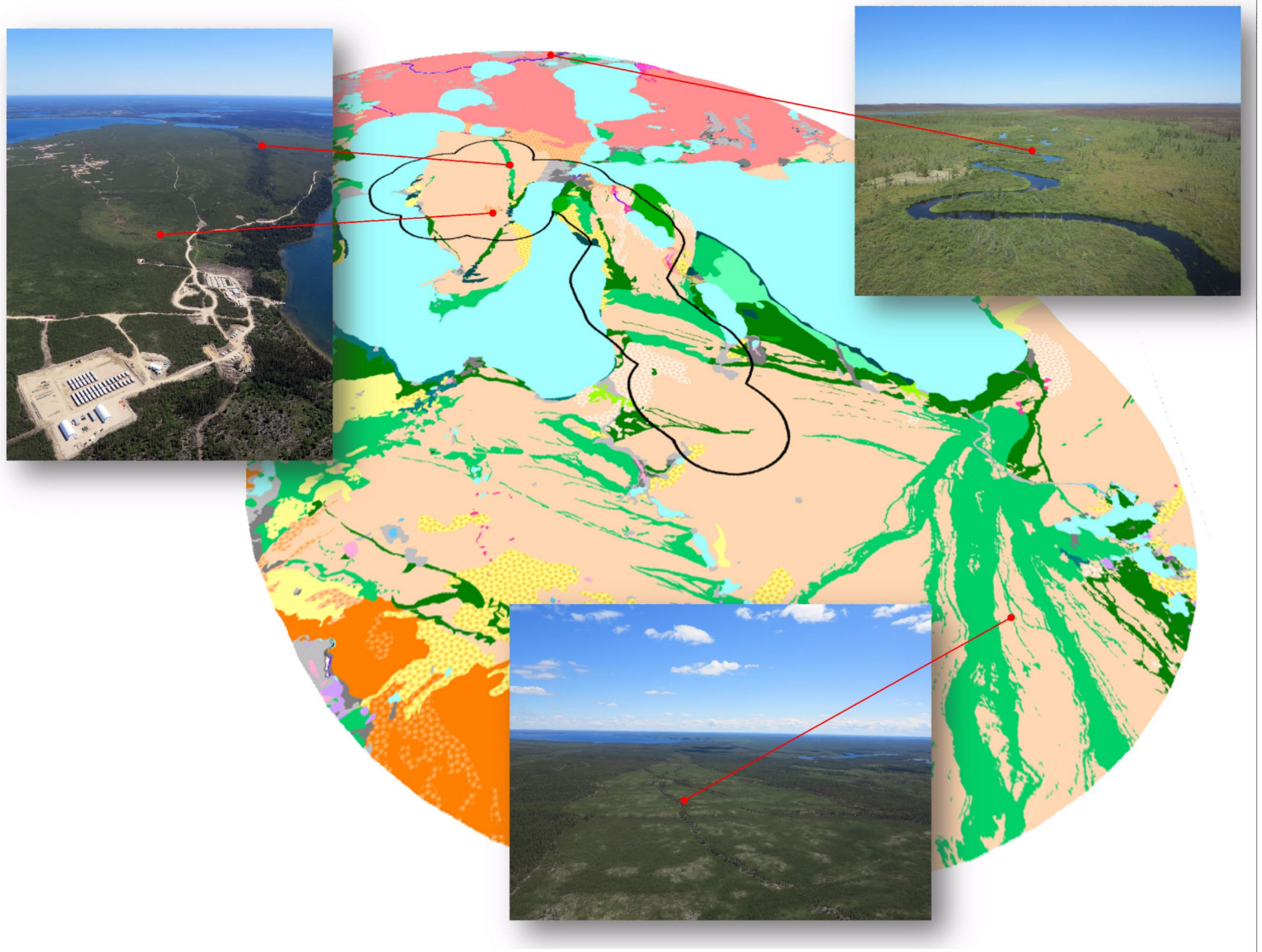

Figure 5.2-1 Example Aerial Photos Used to Assist Ecosite Mapping

Legend

Ecosite Type
- BP02 - Jackpine - lichen
- BP03 - Jackpine / feathermoss
- BP04 - Jackpine - trembling aspen / prickly rose / grass
- BP12 - Jackpine - spruce / feathermoss
- BP14 - Black spruce / Labrador tea / feathermoss
- BP16 - Balsam poplar - trembling aspen / prickly rose
- BP19 - Black spruce treed bog
- BP20 - Labrador tea shrubby bog
- BP21 - Graminoid bog
- BP22 - Open bog
- BP23 - Tamarack treed fen
- BP24 - Leatherleaf shrubby poor fen
- BP25 - Willow shrubby rich fen
- BP26 - Graminoid fen
- BP27 - Open fen
- BS14 - White birch / lingonberry - Labrador tea
- BS26 - Rush sandy shore
- DL1 - Disturbed lands - vegetated
- LAKE - Water body
- RF1-C - Regenerating coniferous forest - treed >5 m tall
- RF1-D - Regenerating deciduous forest - treed >5 m tall
- RF2-B - Regenerating bog - tall shrub 1-5 m tall
- RF2-C - Regenerating coniferous forest - tall shrub 1-5 m ta
- RF2-D - Regenerating deciduous forest - tall shrub 1-5 m ta
- RF3-B - Regenerating bog- low shrub <1 m tall
- RF3-C - Regenerating coniferous forest - low shrub <1 m t
- RF4 - Recent burn (0-5 years)

Local Study Area (LSA)

N

0 7.5 15

kilometers

Approximate Scale = 1 : 270,000

OMNIA ECOLOGICAL SERVICES

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Ref# O-F736_12-18

The RSA occurs predominantly (94%) within the Boreal Plain (Table 2.1-1); therefore, the Boreal Plain key and corresponding ecosite codes in McLaughlan et al. (2010) were used. However, it should be noted that the region displays characteristics of the Boreal Shield Ecozone and two ecosite types detected could not be classified using the Boreal Plain key in McLaughlan et al. (2010). Ecosites BS14 – White birch / lingonberry (*Vaccinium vitis-idaea*)- Labrador tea (*Rhododendron groenlandicum*) and BS26 – Rush sandy shore were identified using the Boreal Shield key in McLaughlan et al. (2010) and are presented as such in this report.

5.3 Results

5.3.1 Predictive Ecosite Map

Predictive Ecosite Map accuracy was 6.8% or 44 of 650 correct ground control points. The accuracy level is due to McLaughlan et al. (2010) not describing forest types under 40 years of age in their ecosite classification system. The majority (94.3%) of the RSA is mapped as having burned within the last 40 years (see Section 4.3), and are therefore covered by regenerating forests that are not described by the McLaughlan et al. (2010). Therefore the PEM was not suitable on its own to map the ecosites in the LSA and RSA, and an interpreted ecosite map was created.

5.3.2 Interpreted Ecosite Map

The accuracy of the resulting ecosite map, taking into consideration the newly created regenerating forest ecosite types, was 80.2%, and included 27 different ecosite classifications (Figure 5.3-1). This accuracy is considered acceptable (Lillesand and Kiefer, 2000). The most abundant ecosites in the RSA were water bodies (27.3%), RF2-C (regenerating coniferous forest) (26.6%), RF4 (recent burn) (16.4%), and BP2 (jack pine / lichen) (9.3%). These four ecosites accounted for 79.6% of the RSA. The most abundant ecosites in the LSA were RF2-C (regenerating coniferous forest) (51.6%), water bodies (18.9%), and BP2 (jack pine / lichen) (6.9%), accounting for 77.4% of the LSA (Table 5.3-1).

The ecosite map outlined several areas of unburned residual patches that were mapped as burned in the fire map provided by ENV (Figure 4.3-1). The ENV mapping overestimated the burned areas by 3.2 km^2 (11.0%) in the LSA and 56.5 km^2 (21.5%) in the RSA (Table 5.3-2). The total areas burned are 25.5 km^2 and 206.6 km^2 in the LSA and RSA, respectively. Findings from other studies in the region have documented similar results. Kansas et al. (2016) studied the potential for residual fire patches to occur in the Saskatchewan Boreal Shield and documented that 25% of the area within mapped fire polygons was unburned (excluding water, which accounted for 8% of the area). Therefore, residual patches can make up a considerable amount of the landscape within this region. Skatter et al. (2017) documented woodland caribou use of these areas for calving. Notwithstanding, refined Project-specific mapping demonstrates that 76.4% of the LSA and 71.0% of the RSA has burned within the last 40 years.

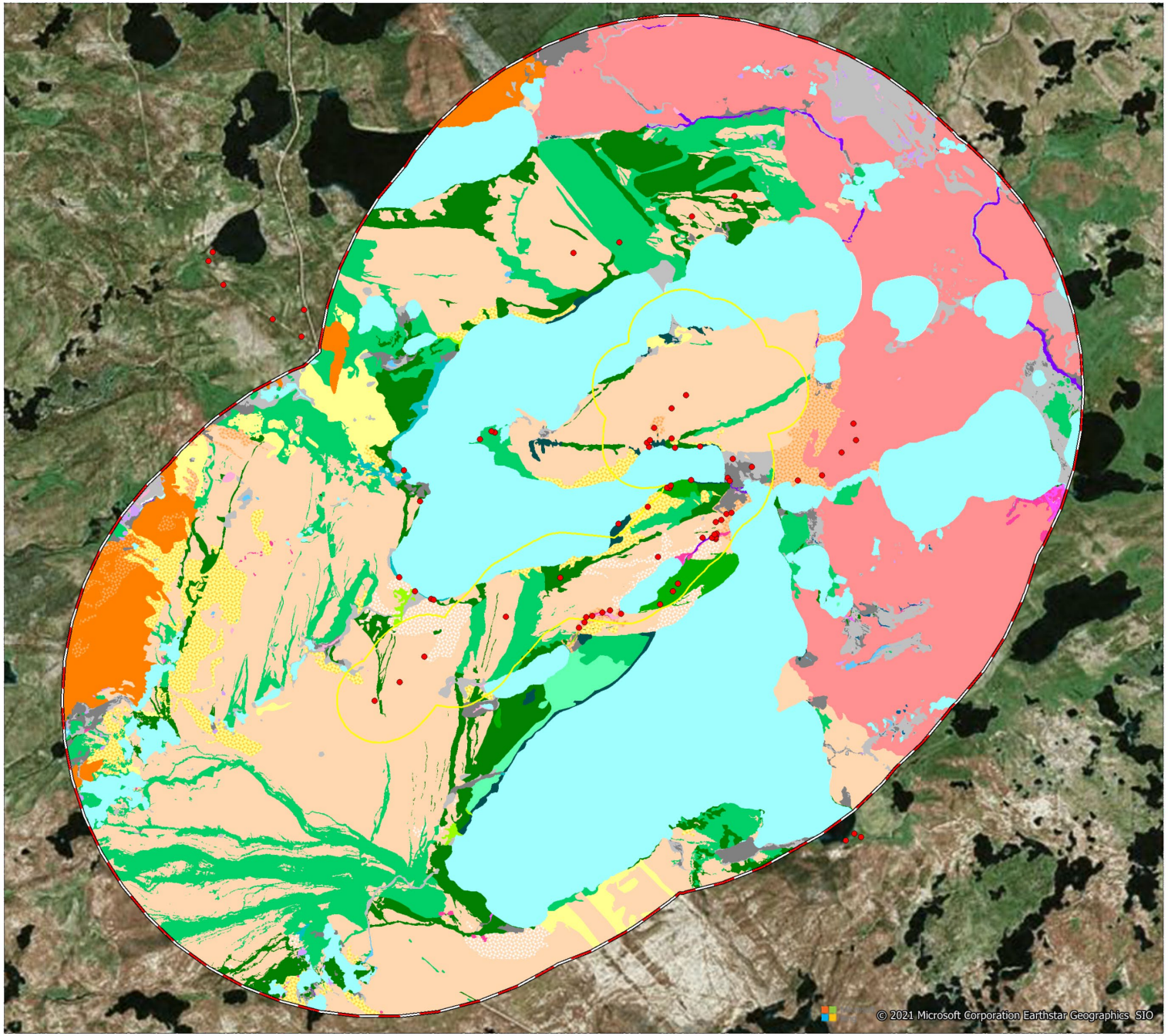


Figure 5.3-1 Project Interpreted Ecosite Mapping

Legend

Ecosite Type

- BP02 - Jackpine - lichen
- BP03 - Jackpine / feathermoss
- BP04 - Jackpine - trembling aspen / prickly rose / grass
- BP12 - Jackpine - spruce / feathermoss
- BP14 - Black spruce / Labrador tea / feathermoss
- BP16 - Balsam poplar - trembling aspen / prickly rose
- BP19 - Black spruce treed bog
- BP20 - Labrador tea shrubby bog
- BP21 - Graminoid bog
- BP22 - Open bog
- BP23 - Tamarack treed fen
- BP24 - Leatherleaf shrubby poor fen
- BP25 - Willow shrubby rich fen
- BP26 - Graminoid fen
- BP27 - Open fen
- BS14 - White birch / lingonberry - Labrador tea
- BS26 - Rush sandy shore
- DL1 - Disturbed lands - vegetated
- LAKE - Water body
- RF1-C - Regenerating coniferous forest - treed >5 m tall
- RF1-D - Regenerating deciduous forest - treed >5 m tall
- RF2-B - Regenerating bog - tall shrub 1-5 m tall
- RF2-C - Regenerating coniferous forest - tall shrub 1-5 m tall
- RF2-D - Regenerating deciduous forest - tall shrub 1-5 m tall
- RF3-B - Regenerating bog- low shrub <1 m tall
- RF3-C - Regenerating coniferous forest - low shrub <1 m tall
- RF4 - Recent burn (0-5 years)

- Vegetation Plot
- Regional Study Area (RSA)
- Local Study Area (LSA)

N W E S

0 2.5 5

kilometers

Scale = 1 : 90,000

OMNIA ECOLOGICAL SERVICES

Produced by RA, Dec. 2018

Ref# O-F736_12-18

Table 5.3-1 Ecosites in the Area of the Project.

Ecosite Code		Ecosite Name/ Description	RSA (Ha)	LSA (Ha)	RSA (%)	LSA (%)
Boreal Plain	Boreal Shield					
RF4		Recent burn (Age: 1 year)	6,581.9	0.0	16.4	0.0
RF3-Coniferous		Regenerating coniferous forest - low shrub <1 m tall (15-20 years)	965.3	0.0	2.4	0.0
RF3-Bog		Regenerating bog- low shrub <1 m tall (15-20 years)	127.9	0.0	0.3	0.0
RF2-Coniferous		Regenerating coniferous forest - tall shrub 1-5 m tall (20-35 years)	10,636.5	2,123.6	26.6	51.6
RF2-Deciduous		Regenerating deciduous forest - tall shrub 1-5 m tall (20-35 years)	474.3	219.0	1.2	5.3
RF2-Bog		Regenerating bog - tall shrub 1-5 m tall (20-35 years)	343.5	52.6	0.9	1.3
RF1-Coniferous		Regenerating coniferous forest - treed >5 m tall (25-40 years)	612.9	20.6	1.5	0.5
RF1-Deciduous		Regenerating deciduous forest - treed >5 m tall (25-40 years)	919.8	133.7	2.3	3.3
BP2	BS3	Jack pine - lichen	3,729.2	282.3	9.3	6.9
BP3	BS4	Jack pine / feathermoss	1,972.4	187.8	4.9	4.6
BP4	BS6	Jack pine - trembling aspen / prickly rose / grass	173.1	104.5	0.4	2.5
BP12	BS4	Jack pine - spruce / feathermoss	216.2	0.0	0.5	0.0
N/A	BS14	White birch / lingonberry - Labrador tea	74.6	0.8	0.2	0.0
BP14	N/A	Black spruce / Labrador tea / feathermoss	132.2	28.8	0.3	0.7
BP16	BS16	Balsam poplar - trembling aspen / prickly rose	33.2	0.6	0.1	0.0
BP19	BS17	Black spruce treed bog	499.1	59.4	1.2	1.4
BP20	BS18	Labrador tea shrubby bog	1,321.2	95.6	3.3	2.3
BP21	BS19	Graminoid bog	25.3	0.0	0.1	0.0
BP22	BS20	Open bog	8.6	0.0	0.0	0.0
BP23	BS21	Tamarack treed fen	21.1	0.8	0.1	0.0
BP24	BS22	Leatherleaf shrubby poor fen	54.1	12.9	0.1	0.3
BP25	BS23	Willow shrubby rich fen	68.9	4.8	0.2	0.1
BP26	BS24	Graminoid fen	45.1	7.7	0.1	0.2
BP27	BS25	Open fen	55.6	0.0	0.1	0.0
N/A	BS26	Rush sandy shore	16.9	0.8	0.0	0.0
DL1		Disturbed lands - vegetated	0.3	0.0	0.0	0.0
LK		Water body	10,903.5	775.6	27.3	18.9
Total			**40,012.6**	**4,111.7**	**100.0**	**100.0**

Table 5.3-2 Comparison of Areas Burned the Last 40 years in the LSA and RSA.

Mapping Product		LSA			RSA		
		km²	**% of Total**	**% of Terrestrial**	**km²**	**% of Total**	**% of Terrestrial**
ENV Fire Mapping (2018)		28.7	69.7	85.9	263.2	65.8	90.4
Refined Fire Ecosite Mapping[a]		25.5	62.0	76.4	206.6	51.6	71.0
Difference	km²	3.2	7.7	9.5	56.6	14.2	19.4
	%	11.0			21.5		

a) Refined fire mapping created from refined ecosite mapping

6.0 ECOSITE CHARACTERIZATION, STRUCTURAL DIVERSITY, AND SPECIES RICHNESS

6.1 Study Objectives

The objectives of the detailed vegetation and wildlife habitat characterization field surveys were to:

- describe and quantify the ecological and botanical conditions within recurring mapped ecosite types and regeneration forest types;
- describe, evaluate, and map the relative ecological importance and integrity of landscapes in the study area; and
- evaluate the structural and compositional diversity and species richness components.

6.2 Methods

In order to describe and classify the vegetation cover types, data for five main vegetation components and four structural components were collected:

Vegetation components:

1. woody plants;
2. graminoids;
3. forbs;
4. bryophytes; and
5. lichens.

Structural components:

1. standing dead trees (Snags);
2. coarse woody debris (CWD);
3. percent cover of bare soil, rock, and open water; and
4. foliar and horizontal hiding cover.

6.2.1 Vegetation Components

Woody Plants

Woody plants were segregated by tree and shrub layer, and these were further divided into five sub-layers as follows (Figure 6.2-1):

A) Trees were defined as all woody plants greater than 5 m tall. Within the tree layer, three sub-layers were recognized:

A1) Super canopy - included the tallest trees of the main canopy, which may be veterans of one or more fires, or the tallest trees of the same age class as the main canopy (usually a minor portion of the stand composition).

A2) Main tree canopy (co-dominant trees) - the main layer of tree cover, composed of trees whose crowns form the upper layer of foliage; typically, the major portion of the stand composition.

A3) Sub-canopy trees - included trees greater than 5 m tall that do not reach the main canopy. These may form a distinct secondary canopy and were often a mixture of trees of various heights younger than those in the main canopy, or they were suppressed trees of the same age.

To be defined as a multi-layer tree stand, tree layers had to differ by at least 2 m.

B) The shrub layer included all woody plants less than 5 m tall. Established tree species regeneration less than 5 m in height was considered part of the shrub layer. Two sub-layers were recognized:

B1) Tall shrub layer – included all woody plants 1 m to 5 m tall, including shrubs and advanced tree regeneration and trees in poorly growing stands where the canopy was less than 5 m high.

B2) Low shrub layer – included all woody plants less than 1 m tall. This layer included dwarfed or immature specimens of species normally considered in tall shrub or tree layers (Figure 6.2-1).

Graminoids, Forbs, Bryophytes and Lichens

Graminoids (Gr) were defined as grasses and grass-like species such as sedges and rushes. Forbs (Fo) were defined as herbaceous flowering plants that were not graminoids. Bryophytes (Br) included mosses and liverworts, whereas lichens (Li) were limited to terrestrial lichen species.

6.2.2 Structural Components

Snags were defined as standing dead trees greater than 10 cm in diameter at breast height (DBH), and at least two metres in height. These were categorized to species and stages of decay based on criteria developed by Lee et al. (1995) (Figure 6.2-2). Coarse woody debris (CWD) comprised any deadfall greater than 10 cm in diameter. Percent cover of bare soil, rock, and open water and foliar and horizontal hiding cover are discussed in Sections 6.2.3 and 6.2.4.

6.2.3 Sampling Plot Layout

Each vegetation/wildlife habitat plot sampling site consisted of: one 30 m x 20 m main plot; five 1 m x 1 m sub-plots; and five 20 cm x 50 cm sub plots (Figure 6.2-3) (see Skatter et al. [2014] and Charlebois et al. [2015] for details). A 30 m tape was laid out to establish the start and end points of the sample site. The 1 m x 1 m sub-plots were placed at 5 m intervals along the sampling transect, and the 20 cm x 50 cm sub-plots were placed within the 1 m x 1 m sub-plots. The Universal Transverse Mercator (UTM) locations for the start and end points of the 30 m transect were recorded and a photograph was taken of each sampling site.

Data for the tree and tall shrub layers, as well as snag data, were collected within the main 30 m x 20 m plots. For each tree layer, species composition, percent canopy closure, median height, and DBH was estimated. Tree core samples were taken to determine the age of representative trees for each layer and cores were age adjusted. The percent canopy closure and median height of tall shrub species within the 30 m x 20 m main plot were estimated. The number and decay class (Lee et al. 1995) of CWD intercepts along the 30 m tape were recorded.

In each of the 1 m x 1 m sub-plots the percent cover of each low shrub, forb and graminoid species were recorded.

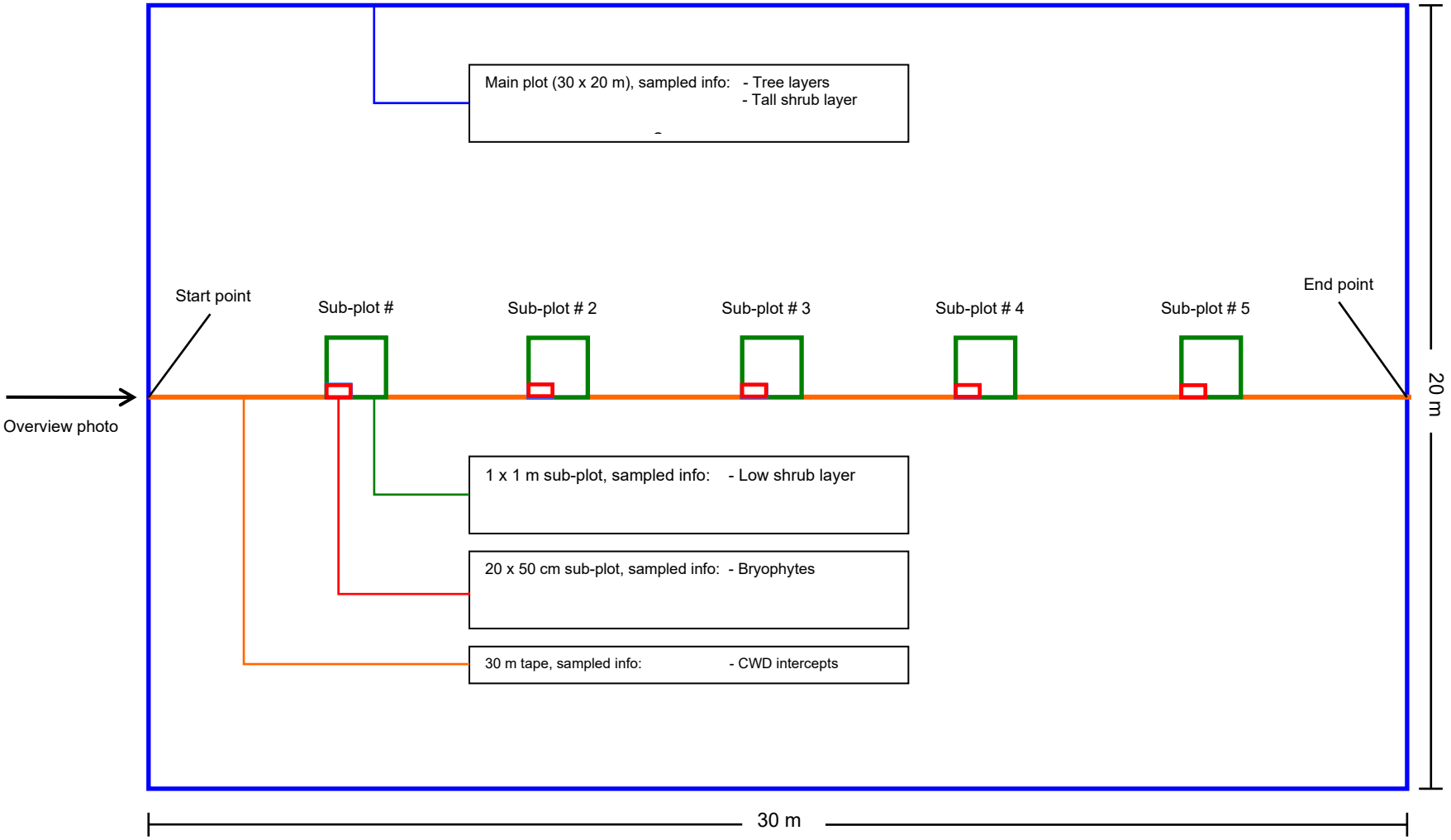
In the 20 cm x 50 cm sub-plots, the percent cover of bryophyte and lichen species as well as bare soil, rocks and open water were estimated. Plant species that could not be identified in the field were collected, pressed, and provided to a plant taxonomist for identification.

Figure 6.2-1 Tree and Shrub Vegetation Layer Criteria (Lee et al. 1995)

Figure 6.2-2 Decay Classification System for Snags (Lee et al. 1995)

Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
recently killed	twigs and leaves lost; bark intact; wood hard	small branches lost; bark beginning to peel; wood hard	only major branches remaining; >20% bark lost; wood condition soft to hard	canopy broken; bark condition variable; wood condition variable	decomposing stump; wood soft; bark peeling

Figure 6.2-3 Layout of the vegetation sampling site.



6.2.4 Hiding Cover

The level of hiding cover afforded by vegetation within each vegetation cover type was measured using methods developed by Nudds (1977). A canvas cloth with ten alternating 25 cm x 30 cm bands of white and red paint at heights from ground level to 2.5 m was held up and viewed in four cardinal directions at a distance of 15 m from the plot centre (Figure 6.2-4). The percent of each of the ten bands that was hidden by vegetation was estimated to the nearest 10%.

6.2.5 Ecosite Fact Sheets

A detailed description of each sampled ecosite type is provided in the form of a two-page fact sheet. The first page of the fact sheet contains information about species composition and vegetation layers. The second page provides information about structural attributes and ratings as well as biodiversity information and ecosite supply in the RSA. An example of the two-page fact sheet is provided in Figure 6.2-5 and Figure 6.2-6. Instructions on how to read the fact sheets are outlined below.

An identification banner at the top of each fact sheet provides the ecosite code [1] and the ecosite name followed by the number of sample plots completed [2] (Figure 6.2-5). The codes and names follow McLaughlan et al. (2010). For habitats that did not match any of the ecosites described in McLaughlan et al. (2010), a two-letter and one number code was assigned. This was predominantly the case for the post fire regenerating stages. In most cases, these would be classified as BP2 (Jack pine/lichen). However, since McLaughlan et al. (2010) did not describe forests younger than 40 years, this would result in a large portion of the RSA that would be excluded because there were extensive areas of young forest. By characterizing each regeneration stage, these younger forests and their attributes are described in detail.

The name of the ecosite conveys information about the ecology of the unit, such as the species and soil conditions that are used to name the site and are diagnostic of the ecosite (McLaughlan et al. 2010). A sample photograph [3] taken from one of the plots for each ecosite provides a photographic representation of the site. A short text description [4] of the ecosite is provided under the Ecosite Description heading. This description is usually taken directly from McLaughlan et al. (2010), but contains additional study area specific comments, obtained during the field program, where applicable.

A bar graph [5] is used to depict the mean percent cover of each vegetation layer. The Species and Vegetation Layer Info section [6] provides the average, minimum, and maximum number of plant and lichen species per sample plot. Detailed botanical and structural information for each vegetation layer within the ecosite is provided in two separate tables. The first table provides information (total number of species observed, average crown closure, mean tree height, mean DBH, species composition, and year of origin) for each tree layer (A1, A2, and A3). The second table provides botanical and structural information for all remaining vegetation layers, including: total number of species observed; species composition; and average percent cover.

On the second fact sheet, the Structural Attributes and Relative Rating table [7] provides information about snags (mean number, diameter, height, and decay class), coarse woody debris (mean frequency, diameter, and decay class), and mean percent cover of litter, bare soil, bare rock, and open water (Figure 6.2-6). A bar graph [8] is displayed to show the vertical distribution of hiding cover for the ecosite. Each bar represents the average hiding cover for each 25 cm layer. The overall average hiding cover (for all vertical layers) per ecosite is presented at the top of the graph.

Section [9] of the second fact sheet page provides information about structural diversity (value), species richness (average number of species per plot), and unique and rare species occurrences (total numbers observed per ecosite). A rating for each of these values is provided in a separate column.

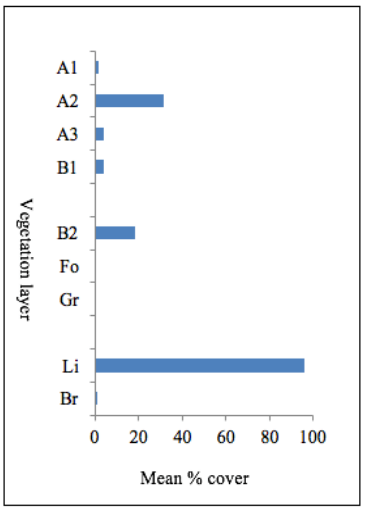
Figure 6.2-4 Display of the Hiding Cover Cloth

Figure 6.2-5 Page 1 of the Ecosite Fact Sheets

1 → **BS3** **Jack pine/blueberry/lichen: Moderately fresh sand** (n=4)

2 ←

3 →



4 → ***Ecosite Description***

BS3 is dominated by jack pine in the overstory. The vascular plant understory is relatively sparse but includes Labrador tea, blueberry, and bog cranberry. Herbs are virtually absent. The forest floor is covered with reindeer lichen. Lichen species diversity is high. The age for this ecosite ranges from approximately 80 years old in the study area.

5 ←

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 17 (15, 19)

6 →

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=0):						
A2 (n=5):	1	27%	9.2 m	13.4 cm	Pj10	1938
A3 (n=6):	2	2%	7.2 m	9.0 cm	Pj9 Sb1	1962

Lower Vegetation Layer info:

Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	2	4%	Pinuban10
B2	6	18%	Vaccmyr7 Vaccvit2 Ledugro1
Forb			
Graminoid			
Lichen	20	96%	Cladmit6 Cladunc2 Cladste1
Bryophyte	5	1%	Polypil6 Pholnut2 Polyjun1 Dicrpol1

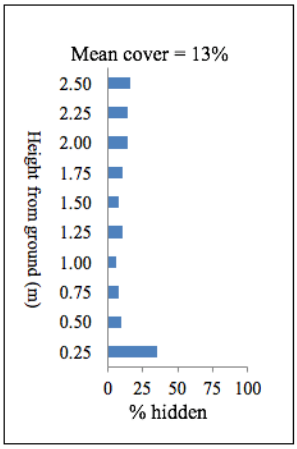
*Only including species that constitute 10% or more by composition.

Figure 6.2-6 Page 2 of the Ecosite Fact Sheets

BS3 **Jack pine/blueberry/lichen: Moderately fresh sand** (n=4)

7 → ***Structural Attributes and Relative Rating***

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.3	Low
	Mean snag diameter (cm)	10.1	
	Mean snag height (m)	0.9	
	Mean snag decay Class	5.0	
Course Woody Debris	Mean frequency of CWD	0.8	Moderate
	Mean CWD diameter (cm)	11.5	
	Mean CWD decay class	3.0	
Mean Percent Ground Cover	Litter Cover	25.5	Moderate
	Litter Depth (cm)	0.9	Moderate
	Bare Soil	1.8	Low
	Bare Rock	0.0	Low
	Open Water	0.0	Low



8 →

9 → ***Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation***

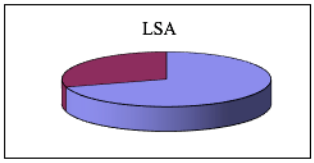
Attribute	Value	Rating
Structural diversity	1.0	Moderate
Species richness	17	Moderate
Unique species	3	Moderate
Provincially listed species	0	Low

Unique species observed:
Pholia moss (*Pholia nutans*), Shingled Cladonia (*Cladonia scabriuscula*), Common bearberry (*Arctostaphylos uva-ursi*)

Provincially listed species observed:
None

10 → ***Ecosite Supply***

Areas occupied by Jack pine /blueberry /lichen forests comprised 3404.3 ha (70.3%) of the LSA and 20678.4 ha (51.6%) of the RSA. It is the most common ecosite in the area.



11 → ***Ecological Interpretation***

BS3 ecosites are relatively dry and occur in almost every topographic position and with every slope class. They are associated with the hills of eskers and drumlins as well as level plains. Following disturbance, these ecosites will usually return to being pine dominated, provided an adequate cone crop existed prior to disturbance. When compared to BS4 ecosites these ecosites tend to be drier, have less understory, and more open canopy. In the absence of disturbance, these ecosites may transition toward the BS7 ecosite condition.

Structural diversity is a measure of the manner in which species are arranged vertically into categories within an ecosystem (Kimmins 1997). Therefore, vegetation structure is based on size and physical features (e.g., trees, tall shrubs, forbs, etc.) rather than taxonomy. Ecosystems that support a high level of diversity of plant species tend to be structurally diverse and productive (Meffe et al. 1997), and these areas in turn support a wide variety and abundance of insect and animal forms. This is especially true for vertebrate wildlife species that require unique and variable reproductive, forage, and cover opportunities or "niches" for survival and reproduction. Areas with high structural diversity also tend to provide greater amounts of hiding cover.

A structural diversity index value was calculated for each sampled ecosite using a Shannon-Wiener coefficient (Shannon 1948). This calculation took into account the number of vegetation layers present in each plot as well as the percent cover of each layer. Due to similarity in height, bryophytes and lichens were considered as one layer. A mean value for each ecosite was calculated. The higher the number of cover and evenness of vegetation layers present, the higher the structural diversity value.

A fundamental principle of conservation biology is to protect sites that support high levels of local species richness (the number of different species present in an area) (Noss 1990; Council on Environmental Quality 1993). Ecosystems that support a high level of diversity of plant species tend to be structurally diverse and productive (Meffe et al. 1997), and these areas in turn support a wide variety and abundance of insect and animal forms.

To estimate and rank the relative plant and lichen species diversity among the different ecosite types in the Project LSA, two species richness measures were used, which were based on plant and lichen species data collected during the field survey. The first measure, species richness of ecosite types, was developed by dividing the total number of plant species found in sampling plots in each ecosite by the number of plots completed per ecosite. A second diversity metric was a count of the number of plant species that were unique to each ecosite type. Both types of measures were rank-ordered by ecosite and rated from Low to High by sorting ecosites from highest to lowest value. The upper 1/3 of the ecosites was given a High value, the middle 1/3 of the ecosites was given Medium value, and the lower 1/3 of the ecosites was given a Low value.

Section [10] (Ecosite Supply) shows the relative proportion of LSA and RSA occupied by the ecosite. Section [11] (Ecological Interpretations) is taken primarily from McLaughlan et al. (2010). It provides a written description of how the site may respond to disturbances such as fire, harvesting, etc. It may also include a predicted successional trajectory of the ecosite.

6.3 Results

The vegetation and wildlife habitat characterization field surveys were completed between 9 and 17 August 2018. Sample site locations were widely distributed throughout the study area (Figure 5.3-1), with a focus on the local study area. A total of 167 species and/or genus of spp. were observed during the survey. In some circumstances, a plant observation could not be identified to species level (e.g., if the head of a sedge species could not be located in the plot and species identification was impossible). In these cases the observation would be counted as an unknown sedge species (*Carex sp*.). A list of all plant and lichen species detected is provided in Appendix A.

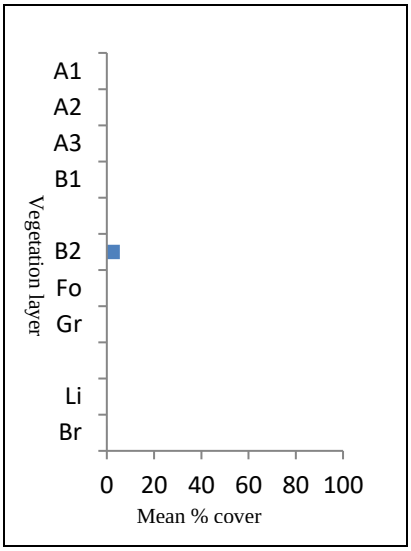
A total of 74 vegetation/wildlife habitat sampling plots were completed in the Project RSA. Two to four sample plot sites were completed in each sampled ecosite. Based on species composition and structural attributes a total of 22 distinct ecosite/regenerating types were identified (Table 6.3-1).

Table 6.3-1 Ecosites Identified in Vegetation Analysis.

Ecosite Code SK2 (SK1)	Ecosite Name
RF4	Recent burn (Age: 1 year)
RF3-Coniferous	Regenerating coniferous forest - low shrub <1 m tall (15-20 years)
RF2-Coniferous	Regenerating coniferous forest - tall shrub 1-5 m tall (20-35 years)
RF2-Deciduous	Regenerating deciduous forest - tall shrub 1-5 m tall (20-35 years)
RF2-Bog	Regenerating bog - tall shrub 1-5 m tall (20-35 years)
RF1-Coniferous	Regenerating coniferous forest - treed >5 m tall (25-40 years)
RF1-Deciduous	Regenerating deciduous forest - treed >5 m tall (25-40 years)
BP2 (BS3)	Jack pine - lichen
BP3 (BS4)	Jack pine / feathermoss
N/A (BS14)	White birch / lingonberry - Labrador tea
BP14 (N/A)	Black spruce / Labrador tea / feathermoss
BP15 (BS16)	Balsam poplar / white spruce / feathermoss
BP19 (BS17)	Black spruce treed bog
BP20 (BS18)	Labrador tea shrubby bog
BP23 (BS21)	Tamarack treed fen
BP24 (BS22)	Leatherleaf (*Chamaedaphne calycaluta*) shrubby poor fen
BP25 (BS23)	Willow (*Salix spp.)* shrubby rich fen
BP26 (BS24)	Graminoid fen
BP27 (BS25)	Open fen
N/A (BS26)	Rush sandy shore
DL1	Disturbed lands - vegetated
DL2	Disturbed lands – non-vegetated

Plot sampling was not conducted for water body (LK), regenerating bog- low shrub (RF3-B), jack pine-spruce / feathermoss (BP12), graminoid bog (BP21) and open bog (BP22), hence no ecosite fact sheets were developed for these types. These ecosites are rare (with the exception of LK) and do not occur in the LSA. As such, no detailed vegetation plots were completed for these types. They were, however, encountered (and confirmed) during pellet group count surveys, allowing for mapping of these types. Land Area (supply) data for these types are included with the total set of ecosite types in Table 5.3-1. Fact sheets for each of the sampled ecosite types are provided below.

RF4 **Recent Burn** (n=4)



Ecosite Description

The RF4 ecosite includes regions that have experienced forest fires within the last 5 years. Tree species are virtually absent and may exist as burnt snags. Blueberry and jack pine are the most common low shrub species. The ground is characterized by a high percentage cover of litter, sand, and CWD (<10cm). Forbs, graminoids, mosses and lichens are virtually absent. The average age of this ecosite is 1 year old.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 4 (2, 6)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=0):						
A2 (n=0):						
A3 (n=0):						

Lower Vegetation Layer info:

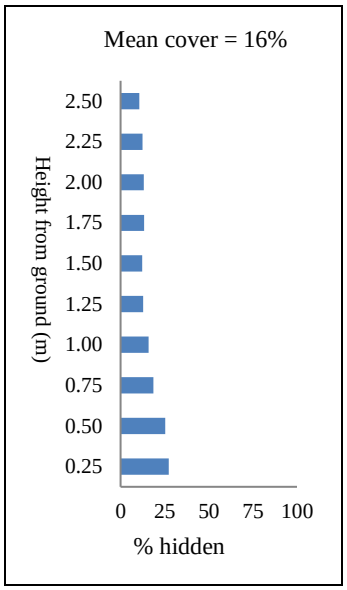
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1			
B2	5	6%	Vaccmyr8 Pinuban1 Alnucri1
Forb	1	<1%	Epilang10
Graminoid	1	<1%	Carecon10
Lichen			
Bryophyte	1	<1%	Polyjun10

*Only including species that constitute 10% or more by composition.

RF4 **Recent Burn** (n=4)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	3.0	High
	Mean snag diameter (cm)	11.9	
	Mean snag height (m)	9.0	
	Mean snag decay Class	2.0	
Course Woody Debris >10cm	Mean frequency of CWD	0.0	Low
	Mean CWD diameter (cm)		
	Mean CWD decay class		
Mean Percent Ground Cover	Litter Cover	70.5	High
	Litter Depth (cm)	0.7	Low
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	14.8	High
	Sand	14.8	Moderate
	Open Water	0.0	Low

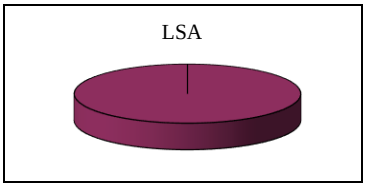


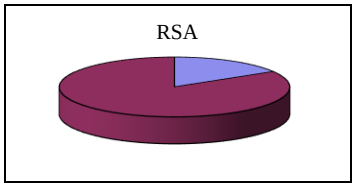
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	0.3	Low
Species richness	4	Low
Unique species	2	Low
Provincially listed species	1	Low
Unique species observed: Low northern sedge (*Carex concinna*); Billberry willow (*Salix myrtillifolia*)		
Provincially listed species observed: Low northern sedge (*Carex concinna*)		

Ecosite Supply

No areas with the RF4 ecosite were located in the LSA, however 6581.9 ha (16.4%) of the RSA were occupied by this ecosite.

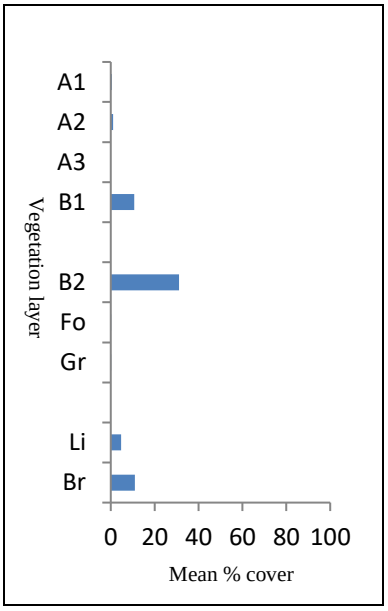




Ecological Interpretation

RF4 ecosites are poor in plant and lichen species diversity. The RF4 ecosite is a pioneer stage following forest fires, and will succeed towards RF3 in absence of fire.

RF3 Regenerating forest – low shrub dominated (n=4)



Ecosite Description

The RF3 regeneration stage is a pioneer stage following forest fires; therefore, it is low shrub dominated. Blueberry and jack pine are the most common low shrub species, though leatherleaf is found in some plots. There are scattered tall shrubs as well, including jack pine and alder. The ground is characterized by a high percentage cover of bare soil and litter. Forbs, graminoids, mosses and lichens are virtually absent. The average age of this stage is 15-20 years in the study area.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 15 (14, 15)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=1):	1	<1%	8.3 m	13.2 cm	Pj10	1983
A2 (n=1):	1	1%	5.1 m	6.3 cm	Pj10	1983
A3 (n=0):						

Lower Vegetation Layer info:

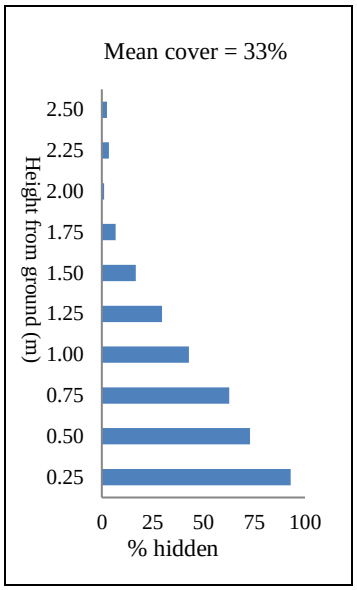
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	4	11%	Pinuban8 Alnucri2
B2	9	31%	Pinuban6 Vaccmyr3 Chamcal1
Forb	4	<1%	Lycocom4 Potetri3 Maiacan2 Melalin1
Graminoid	2	<1%	Oryzpun8 Carefoe2
Lichen	11	5%	Cladsp.7 Cladmit2 Claddef1
Bryophyte	2	11%	Polypil7 Polyjun3

*Only including species that constitute 10% or more by composition.

RF3 Regenerating forest – low shrub dominated (n=4)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.25	Low
	Mean snag diameter (cm)	11.1	
	Mean snag height (m)	3.2	
	Mean snag decay Class	5.0	
Course Woody Debris >10cm	Mean frequency of CWD	0.5	Low
	Mean CWD diameter (cm)	10.5	
	Mean CWD decay class	3.0	
Mean Percent Ground Cover	Litter Cover	71.9	High
	Litter Depth (cm)	0.5	Low
	Bare Soil	7.3	Moderate
	Bare Rock	1.1	Moderate
	CWD <10cm	0.0	Low
	Sand	2.7	Low
	Open Water	0.0	Low



Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

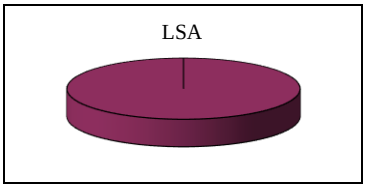
Attribute	Value	Rating
Structural diversity	1.1	Moderate
Species richness	15	Moderate
Unique species	4	Moderate
Provincially listed species	0	Low

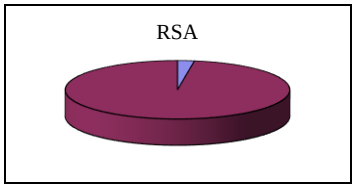
Unique species observed:
Ground cedar (*Lycopodium complanatum*), Three-toothed cinquefoil (*Potentilla tridentate*)
Hay Sedge (*Carex foenea*), Northern rice grass (*Oryzopsis pungens*)

Provincially listed species observed:
None

Ecosite Supply

No areas with the RF3 ecosite were located in the LSA, however 965.3 ha (2.4%) of the RSA were occupied by this ecosite.

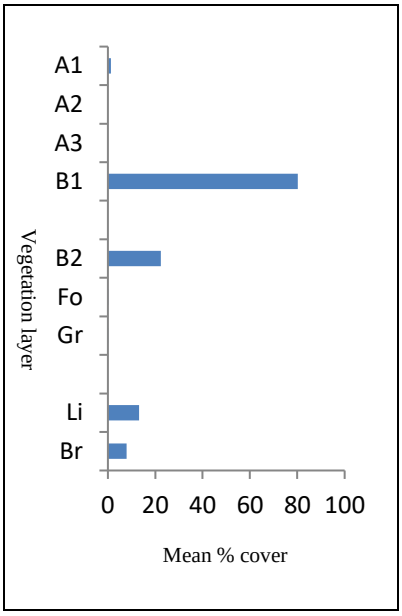




Ecological Interpretation

This ecosite is associated with the hills of eskers and drumlins as well as level plains. RF3 ecosites are moderate in plant and lichen species diversity. The RF3 ecosite is a pioneer stage following forest fires and will succeed towards RF2 in absence of fire.

RF2 - C Regenerating forest coniferous – tall shrub dominated (n=4)



Ecosite Description

This regeneration stage is usually dominated by a thick cover of tall jack pine shrubs. Some areas have residual patches of trees within. The low shrub layer is dominated by blueberry. The dominant ground cover is reindeer lichen. The average age of this phase is 20-35 years in the study area.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 18 (11, 22)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=2):	1	1%	10.7 m	15.9 cm	Pj10	1945
A2 (n=0):						
A3 (n=0):						

Lower Vegetation Layer info:

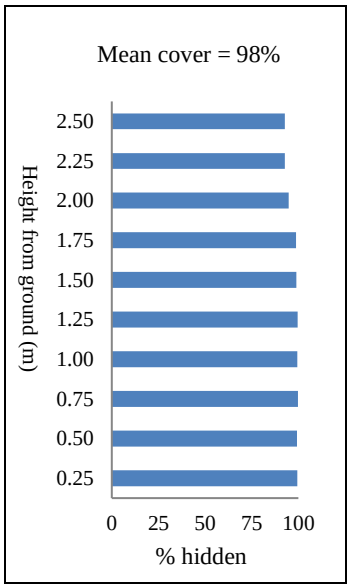
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	4	80%	Pinuban9 Alnucri1
B2	5	22%	Vaccmyr6 Vaccvit2 Pinuban1 Arctuva1
Forb	2	<1%	Corncan9 Maiacan1
Graminoid	1	<1%	Caresp.10
Lichen	15	13%	Cladmit4 Cladgra3 Claddef1 Cladcor1
Bryophyte	5	8%	Pleusch8 Polypil2

*Only including species that constitute 10% or more by composition.

RF2 - C Regenerating forest coniferous– tall shrub dominated (n=4)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.25	Low
	Mean snag diameter (cm)	12.1	
	Mean snag height (m)	2.4	
	Mean snag decay Class	5.0	
Course Woody Debris >10cm	Mean frequency of CWD	1.0	Moderate
	Mean CWD diameter (cm)	11.6	
	Mean CWD decay class	3.75	
Mean Percent Ground Cover	Litter Cover	76.4	High
	Litter Depth (cm)	1.3	Moderate
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	0.0	Low

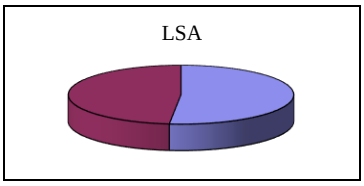


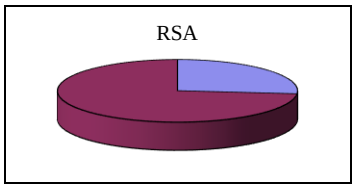
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	1.0	Low
Species richness	18	High
Unique species	0	Low
Provincially listed species	0	Low
Unique species observed: None		
Provincially listed species observed: None		

Ecosite Supply

Areas occupied by the RF2-C ecosite comprised 2123.6 ha (51.6%) of the LSA and 10636.5 ha (26.6%) of the RSA.

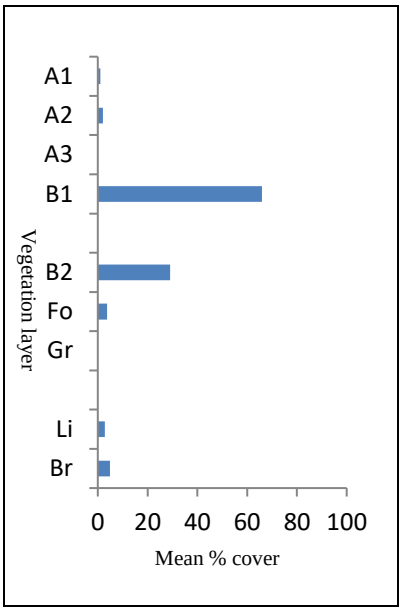




Ecological Interpretation

RF2-Coniferous ecosites are relatively poor in vascular species diversity. However, lichen diversity is relatively high. They closely resemble the RF1 ecosite but are generally younger. This is a commonly encountered ecosite on the Boreal Plain. They are associated with the hills of eskers and drumlins as well as level plains. The RF2 ecosite succeeds the RF3 ecosite, and will continue to succeed towards RF1 in absence of fire.

RF2 - D Regenerating forest deciduous – tall shrub dominated (n=3)



Ecosite Description

This regeneration stage is dominated by deciduous tall shrub cover, predominantly white birch. Some areas have residual patches of trees within. The low shrub layer is dominated by blueberry. The ground cover is largely made up of litter and includes several species of lichen and bryophytes. The average age of this phase is 20-35 years in the study area.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 18 (14, 24)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=1):	1	1%	7.6 m	12.9 cm	Pj10	1967
A2 (n=1):	1	2%	6.4 m	6.3 cm	Bw10	1987
A3 (n=0):						

Lower Vegetation Layer info:

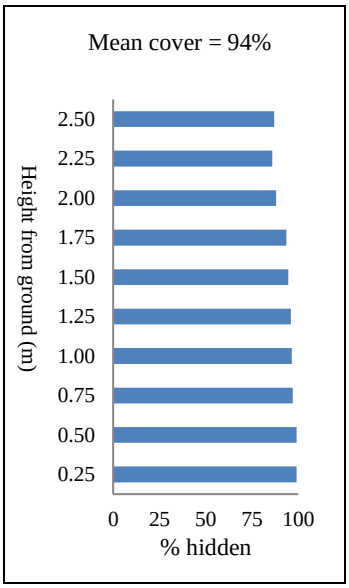
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	7	66%	Betupap6 Alnucri2 Pinuban1
B2	7	30%	Vaccmyr6 Ledugro3 Vaccvit1
Forb	4	4%	Corncan7 Maiacan2 Epilang1
Graminoid			
Lichen	9	3%	Cladgra5 Claddef1 Cladcor1 Cladmit1
Bryophyte	5	5%	Lophven4 Pleusch2 Polypil2 Polyjun1

*Only including species that constitute 10% or more by composition.

RF2 - D Regenerating forest deciduous – tall shrub dominated (n=3)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.0	Low
	Mean snag diameter (cm)		
	Mean snag height (m)		
	Mean snag decay Class		
Course Woody Debris >10cm	Mean frequency of CWD	1.0	Moderate
	Mean CWD diameter (cm)	11.3	
	Mean CWD decay class	4.3	
Mean Percent Ground Cover	Litter Cover	92.0	High
	Litter Depth (cm)	3.9	High
	Bare Soil	0.0	Low
	Bare Rock	0.7	Low
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	0.0	Low

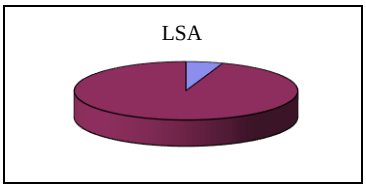


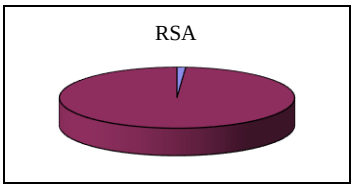
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	1.1	Moderate
Species richness	18	High
Unique species	1	Low
Provincially listed species	0	Low
Unique species observed: Lophozia liverwort (*Lophozia ventricosa*)		
Provincially listed species observed: None		

Ecosite Supply

Areas occupied by the RF2-D ecosite comprised 219.0 ha (5.3%) of the LSA and 474.3 ha (1.2%) of the RSA.

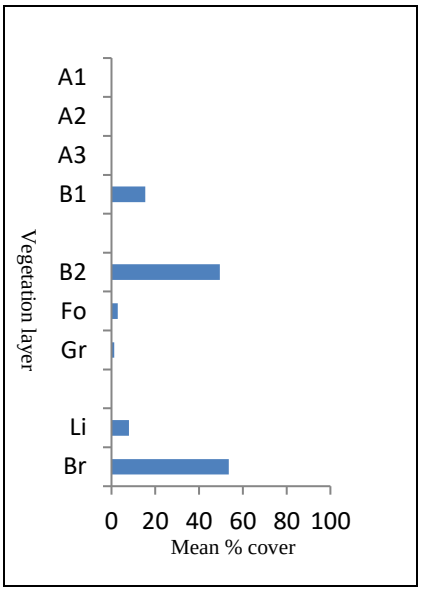




Ecological Interpretation

RF2-Deciduous ecosites are poor to moderate in vascular species diversity. However, lichen diversity is relatively high. They closely resemble the RF1 ecosite but are generally younger. As the case is for RF3, this is a commonly encountered ecosite on the Boreal Shield. They are associated with the hills of eskers and drumlins as well as level plains. The RF2 ecosite succeeds the RF3 ecosite, and will continue to succeed towards RF1 in absence of fire.

RF2 - B Regenerating forest bog – tall shrub dominated (n=4)



Ecosite Description

This regeneration stage is usually dominated jack pine and black spruce tall shrubs. The low shrub layer is dominated by Labrador tea. The dominant ground cover is rusty peat moss and litter. The average age of this phase is 20-35 years in the study area.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 24 (17, 27)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=0):						
A2 (n=0):						
A3 (n=0):						

Lower Vegetation Layer info:

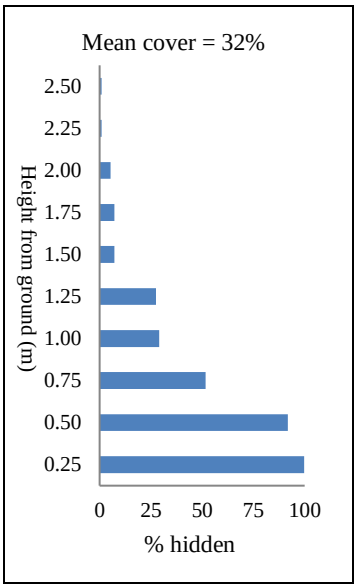
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	4	16%	Pinemar5 Pinuban5
B2	10	50%	Ledugro5 Chamcal1 Oxycmic1 Picemar1 Vaccvit1
Forb	3	3%	Rubucha8 Smiltri2
Graminoid	2	1%	Eriovag10
Lichen	16	8%	Cladmit2 Cladcor1 Claddef1 Cladgra1 Icmaeri1 Parmamb1 Parmhyp1 Peltneo1 Vulppin1
Bryophyte	6	54%	Sphafus8 Sphaang1 Polyjun1

*Only including species that constitute 10% or more by composition.

RF2 - B Regenerating forest bog– tall shrub dominated (n=4)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.0	Low
	Mean snag diameter (cm)		
	Mean snag height (m)		
	Mean snag decay Class		
Course Woody Debris >10cm	Mean frequency of CWD	0.0	Low
	Mean CWD diameter (cm)		
	Mean CWD decay class		
Mean Percent Ground Cover	Litter Cover	35.4	Moderate
	Litter Depth (cm)	0.7	Low
	Bare Soil	2.8	Moderate
	Bare Rock	0.0	Low
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	0.0	Low

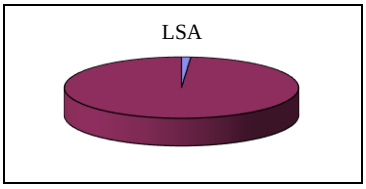


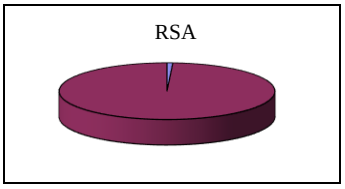
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	1.1	Moderate
Species richness	24	High
Unique species	2	Low
Provincially listed species	1	Low
Unique species observed: Common powderhorn (*Cladonia coniocraea*), Candy lichen (*Icmadophila ericetorum*)		
Provincially listed species observed: None		

Ecosite Supply

Areas occupied by the RF2-B ecosite comprised 52.6 ha (1.3%) of the LSA and 343.5 ha (0.9%) of the RSA.

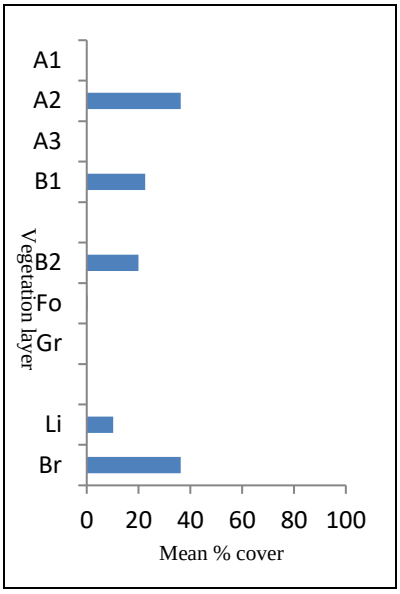




Ecological Interpretation

RF2-Bog ecosites are moderate in vascular species diversity. However, lichen diversity is relatively high. They closely resemble the RF1 ecosite but are generally younger. As the case is for RF3, this is a commonly encountered ecosite on the Boreal Shield. They are associated with the hills of eskers and drumlins as well as level plains. The RF2 ecosite succeeds the RF3 ecosite, and will continue to succeed towards RF1 in absence of fire.

RF1 - C **Regenerating forest coniferous – tree dominated** (n=4)



Ecosite Description

RF1-Coniferous regeneration stage is usually jack pine dominated. Blueberry and bog cranberry shrubs can be found beneath the tree canopy, along with jack pine and the occasional black spruce and Labrador tea. Bryophytes are sporadically distributed and the dominant ground cover is reindeer lichen. This phase is on average 25-40 years old in the study area.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 19 (17, 22)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=0):						
A2 (n=4):	1	36%	6.7 m	6.9 cm	Pj10	1980
A3 (n=0):						

Lower Vegetation Layer info:

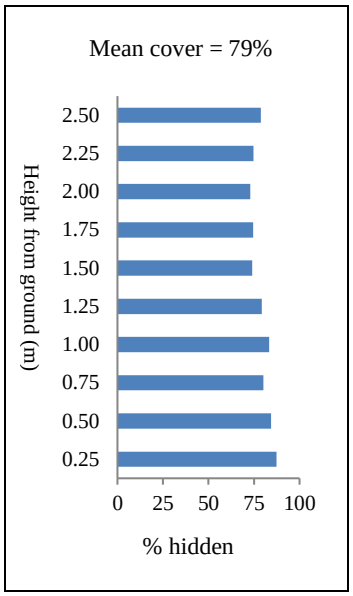
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	3	23%	Pinuban5 Alnucri5
B2	5	20%	Vaccmyr5 Vaccvit3 Ledugro2
Forb	1	<1%	Corncan10
Graminoid			
Lichen	14	10%	Cladmit5 Cladcor1 Cladgra1 Clagunc1 Parmamb1
Bryophyte	6	36%	Pleusch9

*Only including species that constitute 10% or more by composition.

RF1 - C **Regenerating forest coniferous– tree dominated** (n=4)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.0	Low
	Mean snag diameter (cm)		
	Mean snag height (m)		
	Mean snag decay Class		
Course Woody Debris >10cm	Mean frequency of CWD	1.25	High
	Mean CWD diameter (cm)	12.6	
	Mean CWD decay class	4.0	
Mean Percent Ground Cover	Litter Cover	53.8	Moderate
	Litter Depth (cm)	1.8	Moderate
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	0.0	Low

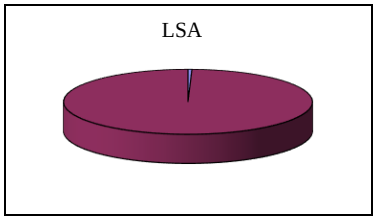


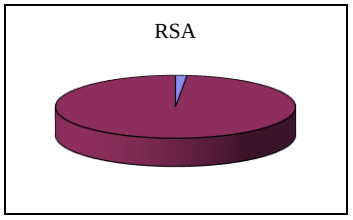
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	1.3	Moderate
Species richness	19	High
Unique species	0	Low
Provincially listed species	0	Low
Unique species observed: None		
Provincially listed species observed: None		

Ecosite Supply

Areas occupied by RF1-C comprised 20.6 ha (0.5%) of the LSA and 612.9 ha (1.5%) of the RSA.

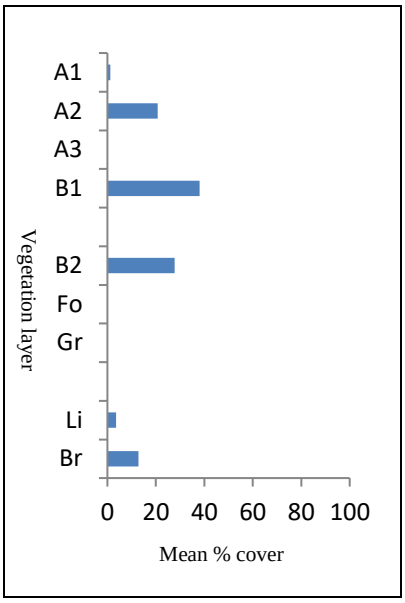




Ecological Interpretation

RF1-Coniferous ecosites have a moderate structural diversity. They have relatively low vascular plant diversity but relatively high lichen species diversity. They closely resemble the RF2 ecosite but RF1 sites have a greater structural diversity and canopy closure. RF1 can be considered to be in a more advanced successional stage than RF2, and will (if wild fires are absent) succeed towards a BP2 over time.

RF1 - D Regenerating forest deciduous – tree dominated (n=4)



Ecosite Description

RF1-Deciduous regeneration stage is usually white birch dominated. Alder and Labrador tea shrubs can be found beneath the tree canopy. Bryophytes are sporadically distributed and litter cover is high. This phase is on average 25-40 years old in the study area.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 16 (12, 20)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=4):	3	1%	10.7 m	16.9 cm	Bw6 Sw2 Pj2	1967
A2 (n=7):	3	21%	6.1 m	5.9 cm	Bw8 Pj2	1982
A3 (n=0):						

Lower Vegetation Layer info:

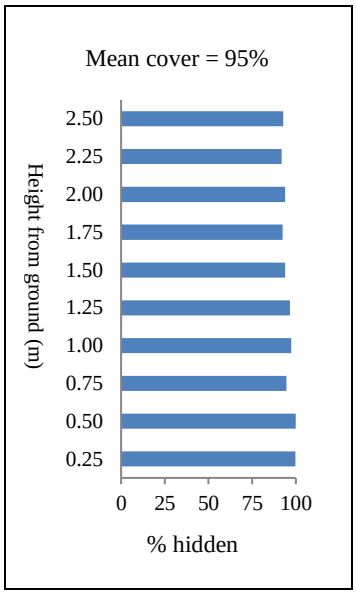
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	5	38%	Betupap4 Alnucri4 Pinuban1
B2	6	28%	Ledugro5 Vaccmyr3 Vaccvit1
Forb	1	<1%	Epilang10
Graminoid			
Lichen	10	4%	Cladgra3 Cladmit2 Cladcor1 Claddef1 Parmhyp1 Vulppin1
Bryophyte	7	13%	Pleusch9 Dicrpol1

*Only including species that constitute 10% or more by composition.

RF1 - D **Regenerating forest deciduous – tree dominated** (n=4)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.0	Low
	Mean snag diameter (cm)		
	Mean snag height (m)		
	Mean snag decay Class		
Course Woody Debris >10cm	Mean frequency of CWD	0.75	Moderate
	Mean CWD diameter (cm)	11.0	
	Mean CWD decay class	4.0	
Mean Percent Ground Cover	Litter Cover	80.7	High
	Litter Depth (cm)	3.4	High
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	3.0	Moderate
	Sand	0.0	Low
	Open Water	0.0	Low

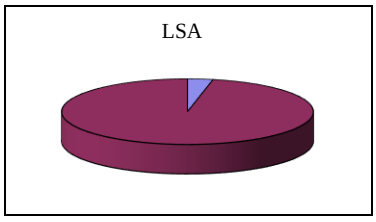


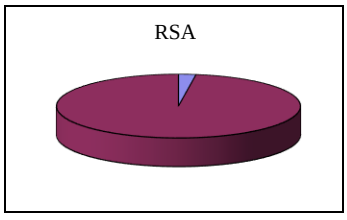
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	1.4	High
Species richness	16	Moderate
Unique species	0	Low
Provincially listed species	0	Low
Unique species observed: None		
Provincially listed species observed: None		

Ecosite Supply

Areas occupied by RF1-D comprised 133.7 ha (3.3%) of the LSA and 919.8 ha (2.3%) of the RSA.

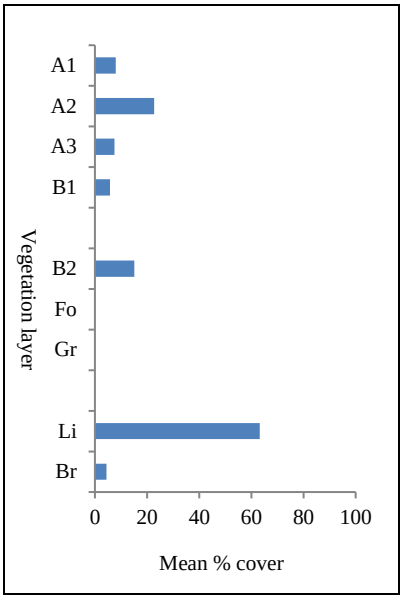




Ecological Interpretation

RF1-D ecosites have a high structural diversity and moderate species richness. They closely resemble the RF2 ecosite but RF1 sites have a greater structural diversity and canopy closure. RF1 can be considered to be in a more advanced successional stage than RF2, and will (if wild fires are absent) succeed towards a BS14 over time.

BP2 Jack pine/lichen: Moderately fresh sand (n=4)



Ecosite Description

BP2 ecosites have a characteristically pure canopy of jack pine, a scattered ericaceous shrub understory, a near-continuous carpet of green reindeer and other lichens, and a significant cover of needle litter. The average age of this ecosite is 60 years in the study area. Similar to BS3 jack pine/blueberry/lichen ecosite in the Boreal Shield.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 21 (17, 24)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=4):	2	8%	12.0 m	14.5 cm	Pj10	1950
A2 (n=5):	2	23%	8.7 m	9.5 cm	Pj10	1957
A3 (n=3):	1	8%	5.8 m	6.7 cm	Pj10	1952

Lower Vegetation Layer info:

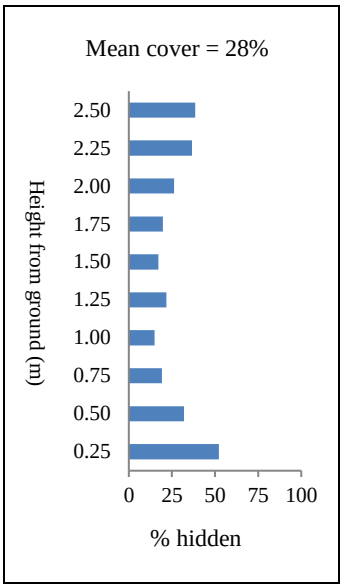
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	5	6%	Alnucri5 Pinuban3 Picemar1
B2	4	15%	Vaccvit5 Vaccmyr4 Arctuva1
Forb			
Graminoid			
Lichen	21	63%	Cladmit7 Cladunc1 Cladgra1
Bryophyte	5	4%	Pleusch7 Dicrpol2 Ptilcil1

*Only including species that constitute 10% or more by composition.

BP2 Jack pine/lichen: Moderately fresh sand (n=4)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.25	Low
	Mean snag diameter (cm)	10.4	
	Mean snag height (m)	4.2	
	Mean snag decay Class	2.0	
Course Woody Debris >10cm	Mean frequency of CWD	0.25	Low
	Mean CWD diameter (cm)	11.0	
	Mean CWD decay class	2.0	
Mean Percent Ground Cover	Litter Cover	30.9	Moderate
	Litter Depth (cm)	0.8	Moderate
	Bare Soil	0.0	Low
	Bare Rock	0.2	Low
	CWD <10cm	0.0	Low
	Sand	0.4	Low
	Open Water	0.0	Low



Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

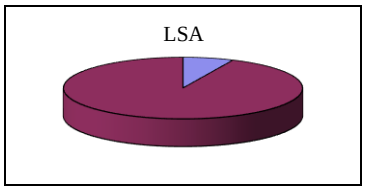
Attribute	Value	Rating
Structural diversity	1.4	High
Species richness	21	High
Unique species	4	Moderate
Provincially listed species	0	Low

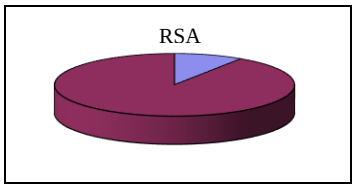
Unique species observed:
Concentric ring lichen (*Arctoparmelia centrifuga*), Apple Pelt (*Peltigera malacea*), Green Map Lichen (*Rhizocarpon geographicum*), Wolly foam lichen (*Stereocaulon tomentosum*)

Provincially listed species observed:
None

Ecosite Supply

Areas occupied by Jack pine /lichen forests comprised 282.3 ha (6.9%) of the LSA and 3729.2 ha (9.3%) of the RSA. It is the most common ecosite in the area.

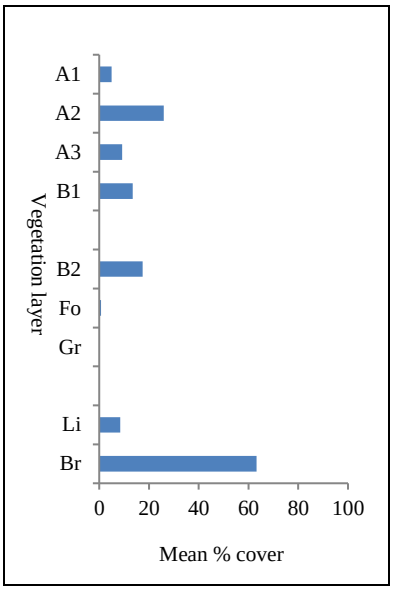




Ecological Interpretation

BP2 ecosites have the lowest species richness and lowest tree productivity (as measured by site index) of all the jack pine or conifer ecosites in the Boreal Plain ecozone. Following disturbance, these ecosites will usually return to their former condition. In the absence of disturbance, these ecosites may still resemble their former species composition but the canopy closure will likely decrease and shrub species may become more prominent.

BP3 Jack pine/feathermoss: Moderately fresh loamy sand (n=4)



Ecosite Description

BP3 ecosites are dominated by a relatively consistent canopy of jack pine. Approximately 75% of the sites encountered are pure jack pine. The remainder may have up to 10% inclusion of trembling aspen, however spruce is also possible. The understory of BP3 ecosite consists mainly of ericaceous shrubs and green alder. The forest floor is predominantly feathermoss (Schreber's moss). The age of this ecosite is approximately 70 years old. Similar to BS4 jack pine/ black spruce/ feathermoss ecosite in the Boreal Shield.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 18 (14, 21)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=5):	2	5%	13.3 m	15.9 cm	Pj9 Sb1	1941
A2 (n=6):	2	26%	9.7 m	11.0 cm	Pj9 Sb1	1950
A3 (n=5):	3	9%	8.5 m	9.1 cm	Pj4 Sb3 Bw3	1941

Lower Vegetation Layer info:

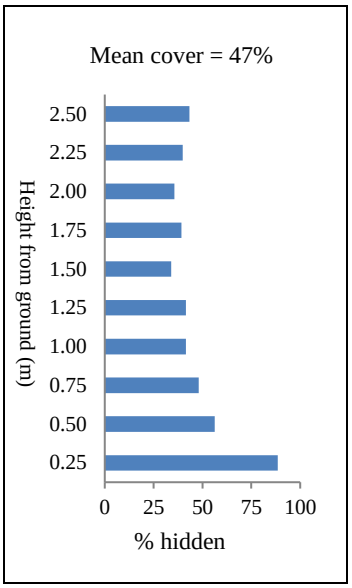
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	3	14%	Alnucri8 Betupap2
B2	5	17%	Vaccmyr5 Vaccvit5
Forb	2	<1%	Geocliv10
Graminoid			
Lichen	11	9%	Cladmit5 Cladgra2 Claddef1 Cladcor1
Bryophyte	8	63%	Pleusch9

*Only including species that constitute 10% or more by composition.

BP3 Jack pine/feathermoss: Moderately fresh loamy sand (n=4)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	1.5	Moderate
	Mean snag diameter (cm)	13.3	
	Mean snag height (m)	7.2	
	Mean snag decay Class	4.3	
Course Woody Debris >10cm	Mean frequency of CWD	0.25	Low
	Mean CWD diameter (cm)	10.0	
	Mean CWD decay class	1.0	
Mean Percent Ground Cover	Litter Cover	28.2	Moderate
	Litter Depth (cm)	0.7	Low
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	0.0	Low

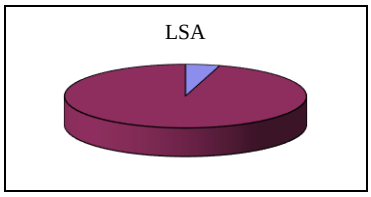


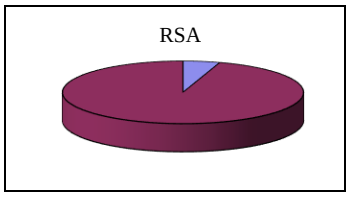
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	1.5	High
Species richness	18	High
Unique species	2	Low
Provincially listed species	0	Low
Unique species observed: Naugehyde liverwort (*Ptilidium pulcherrimum*), Greater sulphur-cup (*Cladonia sulfurina*)		
Provincially listed species observed: None		

Ecosite Supply

Areas occupied by jack pine/ feathermoss comprised 187.8 ha (4.6%) of the LSA and 1972.4 ha (4.9%) of the RSA.

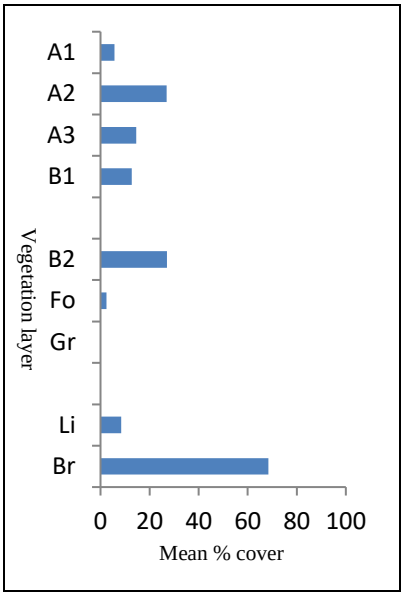




Ecological Interpretation

BP3 ecosites have high structural diversity. They have relatively low vascular plant richness but relatively high non-vascular species richness. They may occasionally have trembling aspen present but not to the extent seen in BP4. Following disturbance, these sites may more closely resemble the composition of BP4 or even BP5. In the absence of disturbance, stand openings will likely become more common and shrub layer development may become more pronounced but the ecosite will likely remain the same.

BP14 Black spruce/Labrador tea/feathermoss: Very moist sandy clay loam (n=4)



Ecosite Description

BP14 ecosite canopies are predominantly black spruce but may contain jack pine, white spruce, or trembling aspen. Over 80% of the sites will be conifer. The understory is generally limited to ericaceous shrubs but low-bush cranberry and green alder may occasionally be found. While a great variety of herbs is associated with this ecosite, only a few species occur with constancy. The forest floor generally has a continuous carpet of feathermoss mixed with abundant needle and leaf litter. While moist mineral soils are associated with this ecosite, the occurrence of an organic soil is possible, but not common. The average age of this ecosite in the study area is 90 years. Similar to BS9 black spruce/ jack pine/ feathermoss in the Boreal Shield.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 17 (14, 20)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=4):	2	6%	14.6 m	20.5 cm	Sb8 Pj2	1920
A2 (n=5):	2	27%	9.8 m	11.4 cm	Sb9 Pj1	1927
A3 (n=9):	3	15%	6.3 m	6.7 cm	Sb8 Bw2	1964

Lower Vegetation Layer info:

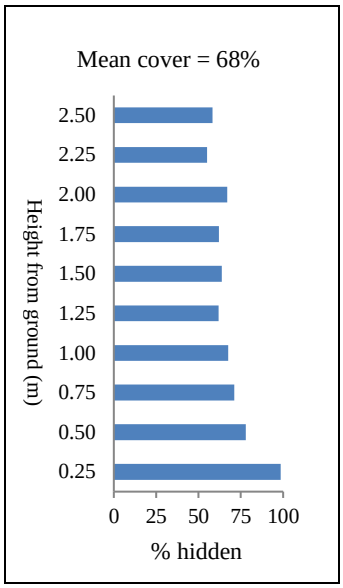
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	5	13%	Picemar4 Betupap2 Alnurug2 Alnucri1 Saliser1
B2	5	27%	Ledugro6 Vaccvit3
Forb	6	3%	Corncan6 Equisyl2 Geocliv1
Graminoid			
Lichen	12	8%	Cladste6 Cladmit2 Peltneo1
Bryophyte	4	69%	Pleusch9

*Only including species that constitute 10% or more by composition.

BP14 Black spruce/Labrador tea/feathermoss: Very moist sandy clay loam (n=4)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	5.0	High
	Mean snag diameter (cm)	14.4	
	Mean snag height (m)	8.0	
	Mean snag decay Class	3.7	
Course Woody Debris >10cm	Mean frequency of CWD	0.5	Low
	Mean CWD diameter (cm)	12.5	
	Mean CWD decay class	4.0	
Mean Percent Ground Cover	Litter Cover	20.7	Moderate
	Litter Depth (cm)	0.6	Low
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	0.0	Low

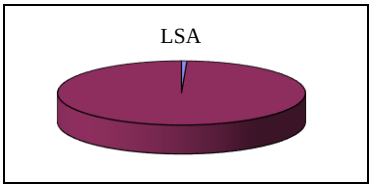


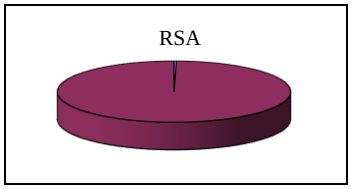
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	1.5	High
Species richness	17	Moderate
Unique species	1	Low
Provincially listed species	0	Low
Unique species observed: Stiff clubmoss (*Lycopodium annotinum*)		
Provincially listed species observed: None		

Ecosite Supply

Areas occupied by black spruce/ Labrador tea/ feathermoss forests comprised 28.8 ha (0.7%) of the LSA and 132.2 ha (0.3%) of the RSA.

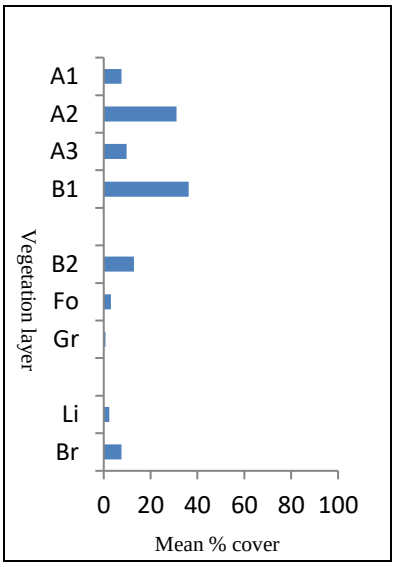




Ecological Interpretation

BP14 ecosites have a high structural diversity and a moderate species richness. They tend to be rather moist. It is not unusual to find them adjacent to treed bogs (BP19). Following disturbance, these sites may retain their pre-disturbance tree composition provided they were in a pure conifer condition or they may move toward a BP19 ecosite condition if the site's moisture regime was affected. For BP14 ecosites with a hardwood component they may exhibit similarities to the BP6 or BP7 ecosites if the aspen component was high; however, the moisture regime may lessen the likelihood of this shift. In the absence of disturbance, the BP14 ecosite may not change dramatically in condition or composition, though the jack pine component will eventually decrease.

BS14 White birch/lingonberry/Labrador tea: Moderately dry sand (n=4)



Ecosite Description

BS14 ecosites are readily recognized by the pure or nearly pure white birch canopy. This ecosite may also contain black spruce, white spruce, jack pine, or trembling aspen in the canopy but always with white birch as the leading and dominant species. The understory of BS14 ecosites is mostly ericaceous shrubs and scattered green alder and sometimes willow, rose, or pin cherry. A moderate herbaceous layer can usually be observed in combination with patches of Schreber's moss and scattered lichens. The abundance of birch contributes considerably to the high leaf litter cover in the ground. The average age of this ecosite type is 50 years in the study area. Similar to BP11 white birch/white spruce/ balsam fir ecosite in the Boreal Plain.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 17 (15, 20)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=4):	2	8%	11.1 m	14.8 cm	Bw8 Sb2	1944
A2 (n=10):	5	31%	8.1 m	8.6 cm	Bw8 Sb2	1969
A3 (n=5):	4	10%	7.0 m	6.4 cm	Bw4 Salisco4 Sb1 Alnurug1	1978

Lower Vegetation Layer info:

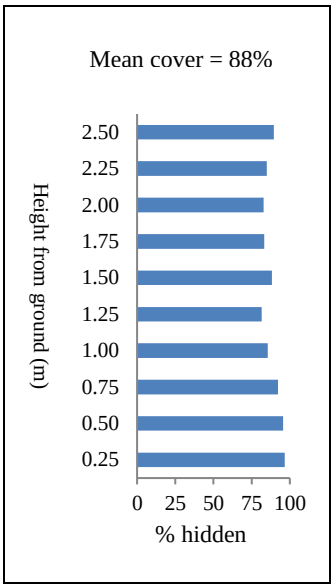
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	7	36%	Alnurug3 Betupap2 Salisco2 Picemar1 Saliser1
B2	6	13%	Ledugro7 Picemar1 Vaccvit1
Forb	8	3%	Corncan3 Equisyl3 Geocliv1 Pyrosec1 Rubupub1
Graminoid	3	<1%	Careros6 Calacan3
Lichen	6	2%	Peltaph4 Cladgra4 Claddef1 Cladcor1
Bryophyte	7	8%	Pleusch4 Hylospl3 Tomenit2 Ptilcil1

*Only including species that constitute 10% or more by composition.

BS14 White birch/lingonberry/Labrador tea: Moderately dry sand (n=4)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.75	Low
	Mean snag diameter (cm)	12.3	
	Mean snag height (m)	5.9	
	Mean snag decay Class	4.0	
Course Woody Debris >10cm	Mean frequency of CWD	0.25	Low
	Mean CWD diameter (cm)	13.0	
	Mean CWD decay class	6.0	
Mean Percent Ground Cover	Litter Cover	90.5	High
	Litter Depth (cm)	3.7	High
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	0.0	Low



Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

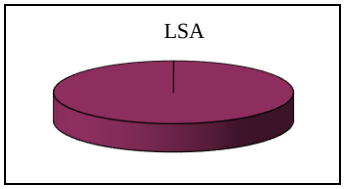
Attribute	Value	Rating
Structural diversity	1.7	High
Species richness	17	Moderate
Unique species	5	Moderate
Provincially listed species	0	Low

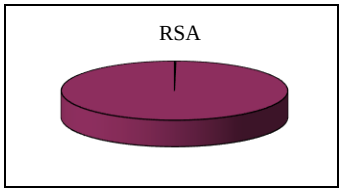
Unique species observed:
Golden moss (*Tomenthypnum nitens*), Wild sarsaparilla (*Aralia nudicaulis*), One-sided pyrola (*Pyrola secunda*), Beaked sedge (*Carex rostrate*), Common freckle pelt (*Peltigera aphthosa*)

Provincially listed species observed:
None

Ecosite Supply

Areas occupied by BS14 comprised 0.8 ha (0.02%) of the LSA and 74.6 ha (0.2%) of the RSA.

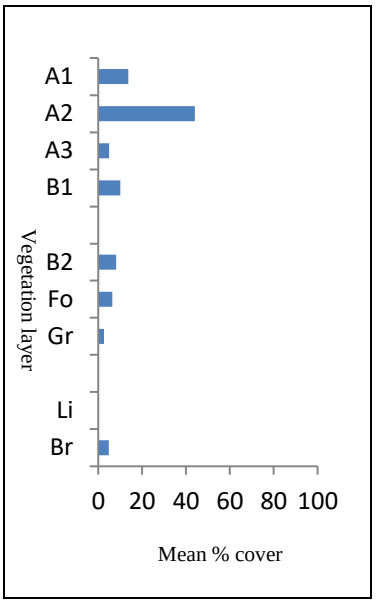




Ecological Interpretation

BS14 ecosites have high structural diversity and a high richness of plant and tree species. These ecosites usually consist of a closed canopy of white birch on rapidly drained soils. In the absence of disturbance this ecosite may transition towards the BS10 ecosite condition. Following disturbance this ecosite may return to its former composition.

BP15 Balsam poplar/white spruce/feathermoss: Very moist silty loam (n=4)



Ecosite Description

BP15 ecosites generally have a canopy that has balsam poplar leading in combination with white and/or black spruce. Trembling aspen, white birch, and/or balsam fir may occasionally also occur in the canopy. Both the shrub and herb layers tend to be diverse and a conspicuous layer of feathermosses is apparent above the layer of leaf litter. The average age of this ecosite is 30 years old. Similar to BS16 black spruce/ balsam poplar river alder swamp ecosite in the Boreal Shield.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 12 (9, 14)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=5):	3	14%	9.8 m	12.8 cm	Pb9 Bw1	1989
A2 (n=8):	6	44%	7.7 m	8.2 cm	Alnurug4 Bw3 Alnucri2 Salisco1	1986
A3 (n=1):	1	5%	5.8 m	4.8 cm	Bw10	1997

Lower Vegetation Layer info:

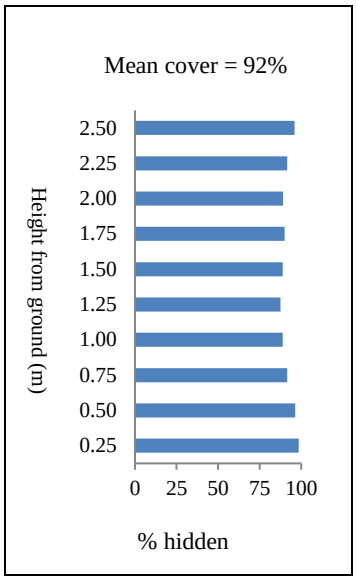
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	9	10%	Salisco7 Alnurug1 Betupap1 Saliser1
B2	10	8%	Ribeoxy6 Ribehud2 Picemar1 Ledugro1
Forb	10	6%	Athyfil4 Corncan3 Galitri1
Graminoid	1	3%	Calacan10
Lichen			
Bryophyte	7	5%	Plagell3 Scorrev2 Drepadu2 Cincsty1 Hypnrev1

*Only including species that constitute 10% or more by composition.

BP15 Balsam poplar/white spruce/feathermoss: Very moist silty loam (n=4)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.5	Low
	Mean snag diameter (cm)	17.5	
	Mean snag height (m)	9.5	
	Mean snag decay Class	4.0	
Course Woody Debris >10cm	Mean frequency of CWD	1.5	High
	Mean CWD diameter (cm)	12.8	
	Mean CWD decay class	6.0	
Mean Percent Ground Cover	Litter Cover	88.4	High
	Litter Depth (cm)	6.5	High
	Bare Soil	0.0	Low
	Bare Rock	2.0	Moderate
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	4.9	Moderate



Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

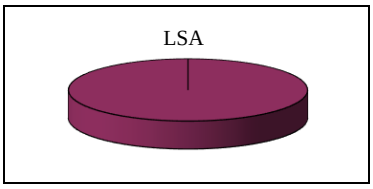
Attribute	Value	Rating
Structural diversity	1.7	High
Species richness	12	Low
Unique species	16	High
Provincially listed species	1	Low

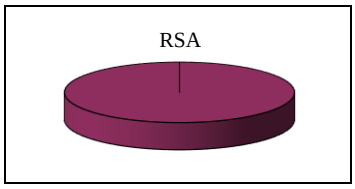
Unique species observed: Lurid cupola moss (*Cinclidium stygium*), Drepanocladus moss (*Drepanocladus aduncus*), Revolute hypnum moss (*Hypnum revolutum*), Elliptic plagiomnium moss (Plagiomnium ellipticum), Sickle-leaved Hook Moss (*Sanionia uncinate*), Limprichtia Moss (*Scorpidium revolvens*), Subarctic ladyfern (*Athyrium filix-femina ssp. angustatum*), Woodland strawberry (*Fragaria vesca*), Wild strawberry (*Fragaria virginiana*), Marsh skullcap (*Scutellaria galericulata*), Kidney-leaved violet (*Viola renifolia*), Balsam poplar (*Populus balsamifera*), Skunk currant (*Ribes glandulosum*), Northern black currant (*Ribes hudsonianum*), Wild gooseberry (*Ribes oxyacanthoides*), Raspberry (*Rubus idaeus*)

Provincially listed species observed:
Subarctic ladyfern (*Athyrium filix-femina ssp. angustatum*)

Ecosite Supply

Areas occupied by balsam poplar/ white spruce/ feathermoss ecosite comprised 0.6 ha (<0.1%) of the LSA, and 33.2 ha (0.1%) of the RSA.

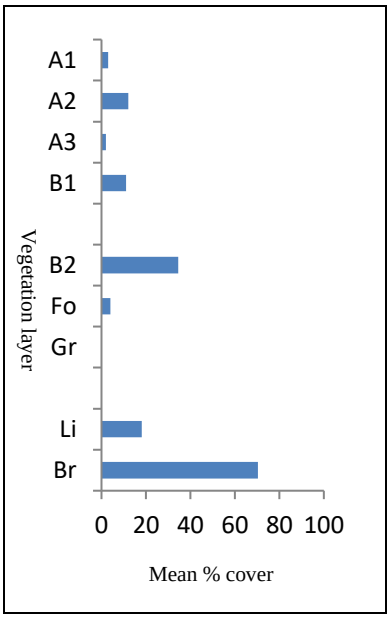




Ecological Interpretation

This ecosite has a consistently high diversity of shrub and herb species and will also support a wide variety of tree species. Richness of graminoid and lichen species is generally low. Following disturbance, these ecosites may return to their former condition though they may also resemble BP6 or BP7 if their previous stand condition had sufficient aspen. In the absence of disturbance, these ecosites may more closely resemble BP9 or BP13 as succession unfolds.

BP19 Black spruce treed bog: Moderately wet fibric organic (n=4)



Ecosite Description

BP19 ecosites consistently have a somewhat open canopy of all-aged black spruce. Tamarack also occurs on about half of the sites but with relatively little cover. The understory is largely ericaceous shrub (mostly Labrador tea) and the ground cover is represented by an even distribution of *Sphagnum* moss interspersed with the occasional stair-step moss. The average age of this ecosite in the study area is 80 years. Synonymous to BS17 black spruce treed bog ecosite in the Boreal Shield.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 21 (18, 24)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=3):	1	3%	9.5 m	11.4 cm	Sb10	1881
A2 (n=4):	1	12%	6.6 m	9.3 cm	Sb10	1936
A3 (n=1):	1	2%	5.8 m	6.1 cm	Sb10	1936

Lower Vegetation Layer info:

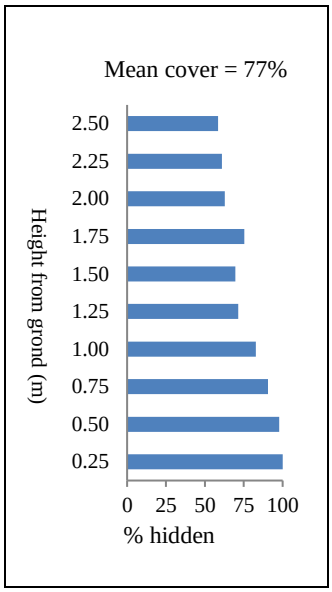
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	2	11%	Picemar10
B2	7	35%	Ledugro6 Chamcal2 Picemar1 Vaccvit1
Forb	3	4%	Rubucha8 Drosrot1 Smiltri1
Graminoid	1	<1%	Eriovag10
Lichen	12	18%	Cladmit7 Cladran2
Bryophyte	12	70%	Sphafus6 Pleusch2 Sphaang1 Sphacap1

*Only including species that constitute 10% or more by composition.

BP19 Black spruce treed bog: Moderately wet fibric organic (n=4)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.0	Low
	Mean snag diameter (cm)		
	Mean snag height (m)		
	Mean snag decay Class		
Course Woody Debris >10cm	Mean frequency of CWD	0.0	Low
	Mean CWD diameter (cm)		
	Mean CWD decay class		
Mean Percent Ground Cover	Litter Cover	11.9	Low
	Litter Depth (cm)	0.6	Low
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	0.0	Low

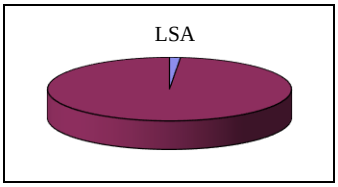


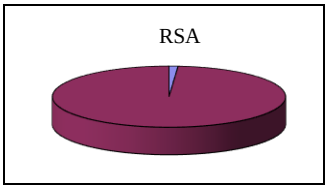
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	1.3	Moderate
Species richness	21	High
Unique species	1	Low
Provincially listed species	1	Low
Unique species observed: Jensen's sphagnum (*Sphagnum jensenii*)		
Provincially listed species observed: None		

Ecosite Supply

Areas occupied by black spruce treed bog comprised 59.4 ha (1.4%) of the LSA and 499.1 ha (1.2%) of the RSA.

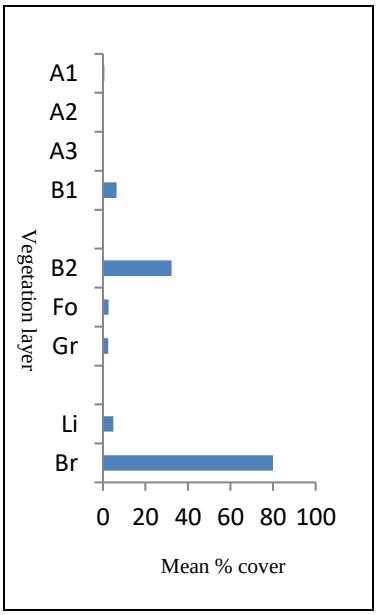




Ecological Interpretation

BP19 ecosites have low tree and shrub species richness, but often contain a high diversity of moss and lichen species. Overall structural diversity is moderate. The black spruce on these sites usually represents all ages as the *Sphagnum* moss on the site encourages vegetative reproduction by branch layering. *Sphagnum* is also a suitable seed bed for spruce germination provided that the moss isn't Girgensohn's or another fast-growing peat moss which can outcompete and smother black spruce germinants. Despite the wet conditions, black spruce can remain free from rot for long periods. In the absence of disturbance these sites will likely remain as a treed bog. Following disturbance these sites may more closely resemble BP20 or BP22.

BP20 Labrador tea shrubby bog: Wet fibric organic (n=3)



Ecosite Description

BP20 is dominated by ericaceous shrubs, notably leatherleaf and Labrador tea. Occasionally black spruce and/or tamarack may occur in tree form (i.e., >2 m) but the cover is usually low (i.e., <10%). Aside from the expected absence of trees, shrubby bogs tend to have a greater proportion of Sphagnum moss than would be found on treed bogs (BP19). Synonymous with BS18 Labrador tea shrubby bog ecosite in the Boreal Shield.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 19 (16, 21)

Tree Vegetation Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=2):	1	<1%	5.4 m	7.5 cm	Sb10	1963
A2 (n=0):						
A3 (n=0):						

Lower Layer info:

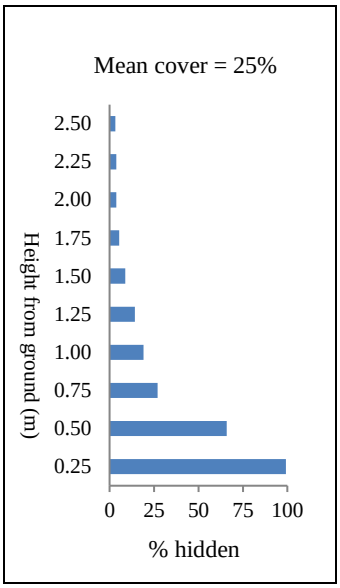
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	3	6%	Picemar9
B2	8	32%	Picemar3 Ledugro3 Oxycmic1 Rhodtom1 Kalmpol1 Chamcal1
Forb	3	3%	Smiltri8 Drosrot2
Graminoid	2	3%	Eriovag6 Eriosch4
Lichen	10	5%	Cladmit6 Cladgra2
Bryophyte	7	80%	Sphafus9

*Only including species that constitute 10% or more by composition.

BP20 Labrador tea shrubby bog: Wet fibric organic (n=3)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.0	Low
	Mean snag diameter (cm)		
	Mean snag height (m)		
	Mean snag decay Class		
Course Woody Debris >10cm	Mean frequency of CWD	0.0	Low
	Mean CWD diameter (cm)		
	Mean CWD decay class		
Mean Percent Ground Cover	Litter Cover	15.1	Low
	Litter Depth (cm)	0.7	Low
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	0.0	Low

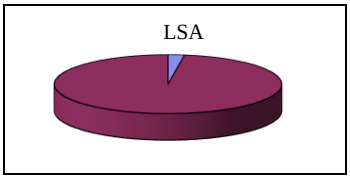


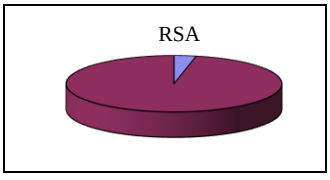
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	1.0	Low
Species richness	19	High
Unique species	2	Low
Provincially listed species	1	Moderate
Unique species observed: Split-peg lichen (*Cladonia cariosa*), Dwarf raspberry (*Rubus acaulis*)		
Provincially listed species observed: White cotton grass (*Eriophorum scheuchzeri*)		

Ecosite Supply

Areas occupied by Labrador tea shrubby bog comprised 95.6 ha (2.3%) of the LSA and 1321.2 ha (3.3%) of the RSA.

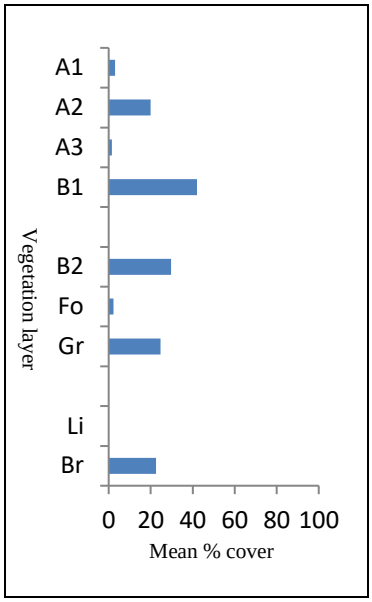




Ecological Interpretation

Shrubby bogs are relatively common in the Boreal Plain ecozone but less so than in other ecozones. They possess a low structural diversity but contain high shrub and moss species richness. Being wetter than treed bogs, they tend to be associated with Fibrisol and Mesisol organic soils orders. Like the other forms of bogs, most of the moisture they receive is the result of precipitation. Shrubby bogs, unlike treed bogs, are more likely to be found on level sites. Since the water table associated with shrubby bogs is usually below the site surface, they are also susceptible to disturbance from fire. Fires with a long enough duration or intensity may kill shrub species and the bog may transition into an open (BP22) or graminoid dominated (BP21) condition.

BP23 Tamarack treed fen: Wet fibric organic (n=2)



Ecosite Description

BP23 ecosite has tamarack as the dominant tree species, though black spruce may also occur. Many of the shrub and herb species encountered in fens are commonly associated with wet conditions. It is not uncommon for treed fens to have a water table at or near the surface. Treed fens are usually associated with an organic substrate but mineral soil substrates may also be encountered. Synonymous with BS21 tamarack treed fen ecosite in the Boreal Shield.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 15 (11, 18)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=1):	1	3%	11.0 m	11.2 cm	Lt10	1966
A2 (n=2):	1	20%	7.0 m	6.8 cm	Lt10	1974
A3 (n=2):	2	2%	6.0 m	6.4 cm	Sb7 Bw3	1980

Lower Vegetation Layer info:

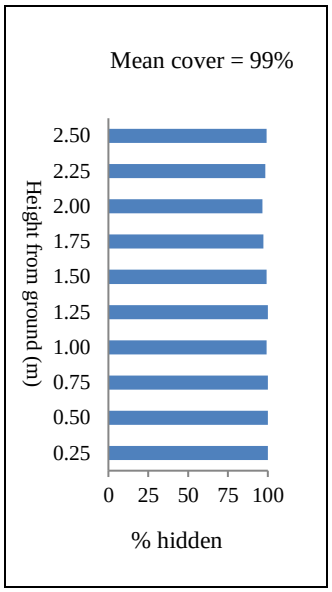
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	7	42%	Saliser5 Larilar2 Salisp.1
B2	7	30%	Chamcal9 Vaccvit1
Forb	3	2%	Potepal7 Smiltri2 Rubupub1
Graminoid	2	25%	Calacan6 Careaqu4
Lichen Bryophyte	5	23%	Sphaang9 Meeslon1

*Only including species that constitute 10% or more by composition.

BP23 Tamarack treed fen: Wet fibric organic (n=2)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.0	Low
	Mean snag diameter (cm)		
	Mean snag height (m)		
	Mean snag decay Class		
Course Woody Debris >10cm	Mean frequency of CWD	0.0	Low
	Mean CWD diameter (cm)		
	Mean CWD decay class		
Mean Percent Ground Cover	Litter Cover	63.4	Moderate
	Litter Depth (cm)	4.4	High
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	7.0	Moderate

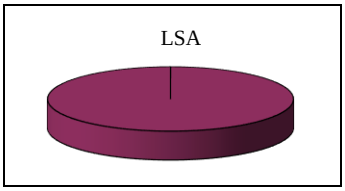


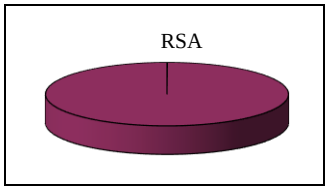
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	1.7	High
Species richness	15	Moderate
Unique species	0	Low
Provincially listed species	0	Low
Unique species observed: None		
Provincially listed species observed: None		

Ecosite Supply

Areas occupied by Tamarack treed fen comprised <0.1% of the LSA and 21.1 ha (0.1%) of the RSA.

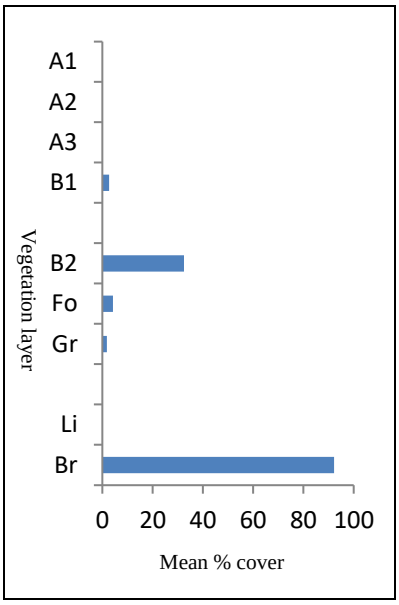




Ecological Interpretation

BP23 ecosites have high structural diversity and moderate species richness. They are typically not as common as black spruce treed bogs (BP19). They tend to occur in association with shrubby fens (BP24) and resemble ribbons in the landscape along drainage ways. Following disturbance, these ecosites could be expected to become a shrubby fen (BS22). In the absence of disturbance these ecosites will likely remain in their current condition.

BP24 Leatherleaf shrubby poor fen: Wet fibric organic (n=3)



Ecosite Description

Leatherleaf, dwarf birch, and dwarf bog-rosemary are the dominant shrub species on this ecosite. Scattered tamarack or black spruce may also occur. Many of the shrub and herb species encountered in fens are commonly associated with wetter conditions than those found in bogs. Shrubby poor fens frequently have a water table that is at or near the surface. The substrate for these ecosites is usually organic. Synonymous with BS22 leatherleaf shrubby poor fen in the Boreal Shield.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 11 (8, 14)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=0):						
A2 (n=0):						
A3 (n=0):						

Lower Vegetation Layer info:

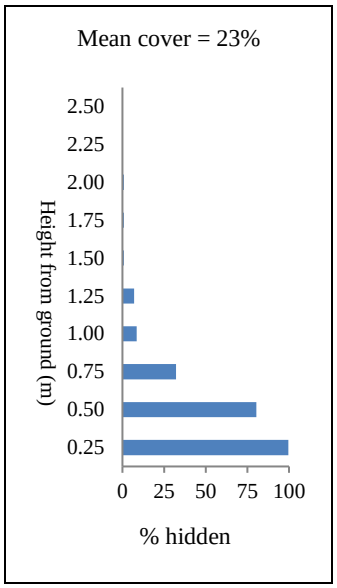
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	3	3%	Picemar4 Betugla4 Larilar2
B2	6	33%	Chamcal8 Kalmpol1
Forb	3	4%	Smiltri9 Schepal1
Graminoid	4	2%	Eriosch6 Carelim1 Careaqu1 Calacan1
Lichen Bryophyte	7	92%	Spharip3 Sphamag3 Sphafus2 Sphaang2

*Only including species that constitute 10% or more by composition.

BP24 Leatherleaf shrubby poor fen: Wet fibric organic (n=3)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.0	Low
	Mean snag diameter (cm)		
	Mean snag height (m)		
	Mean snag decay Class		
Course Woody Debris >10cm	Mean frequency of CWD	0.0	Low
	Mean CWD diameter (cm)		
	Mean CWD decay class		
Mean Percent Ground Cover	Litter Cover	8.0	Low
	Litter Depth (cm)	0.5	Low
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	0.0	Low

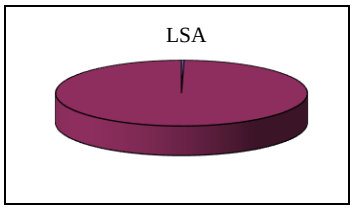


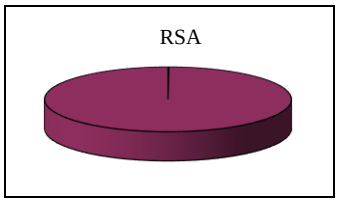
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	0.8	Low
Species richness	11	Low
Unique species	1	Low
Provincially listed species	1	Low
Unique species observed: Straw-coloured Water Moss (*Straminergon stramineum*)		
Provincially listed species observed: White cotton grass (*Eriophorum scheuchzeri*)		

Ecosite Supply

Areas occupied by leatherleaf shrubby poor fen comprised 12.9 ha (0.3%) of the LSA and 54.1 ha (0.1%) of the RSA.

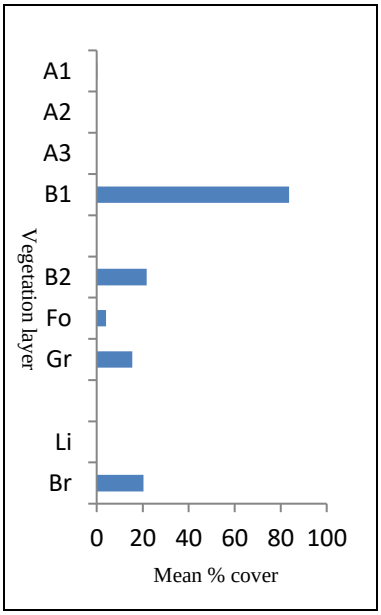




Ecological Interpretation

Shrubby poor fens are relatively low in both species richness and diversity. They are similar to tamarack treed fen (BP23) conditions and frequently occur adjacent to them. However, leatherleaf shrubby poor fens tend to be wetter than treed fens, and as such, will have lesser amounts of lingonberry and Schreber's moss but a higher proportion of swamp horsetail. Following disturbance, these ecosites could be expected to return to a shrubby fen condition or possibly to a BP26 or BP27 condition. As with all fens, the water on these sites is largely of ground water origin and relatively mineral-rich.

BP25 Willow shrubby rich fen: Wet humic organic (n=3)



Ecosite Description

BP25 has high cover values of willows. The typical willows associated with this site are pussy willow and flat-leaved willow. Other shrubs that could be found include dwarf birch, northern gooseberry, northern red current and alder-leaved buckthorn. Shrubby rich fens also tend to have more open water at the surface than shrubby poor fens (BP24). In the Boreal Plain ecozone, willow shrubby rich fens commonly occur on organic soils. Synonymous with BS23 willow shrubby rich fen ecosite in the Boreal Shield.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 18 (16, 22)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=1):	1	<1%	6.2 m	7.2 cm	Bw10	1991
A2 (n=0):						
A3 (n=0):						

Lower Vegetation Layer info:

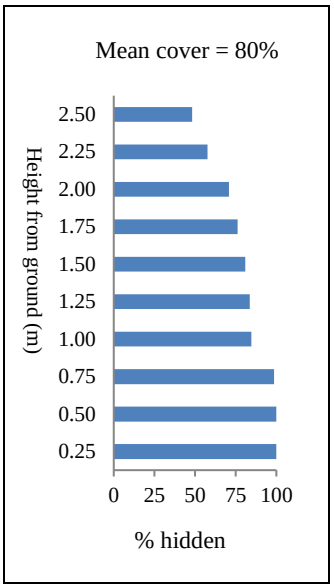
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	10	84%	Betupum3 Myrigal2 Saliser2 Saliped1 Salipla1
B2	9	22%	Chamcal4 Myrigal3 Betupum1 Saliser1
Forb	15	4%	Potepal2 Rubuarc1 Hippvul1 Caltpal1 Callpal1
Graminoid	3	16%	Calacan5 Caredis3 Careaqu2
Lichen	2	<1%	Parmamb5 Vulppin5
Bryophyte	9	20%	Sphaang9 Marcpol1

*Only including species that constitute 10% or more by composition.

BP25 Willow shrubby rich fen: Wet humic organic (n=3)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.0	Low
	Mean snag diameter (cm)		
	Mean snag height (m)		
	Mean snag decay Class		
Course Woody Debris >10cm	Mean frequency of CWD	0.0	Low
	Mean CWD diameter (cm)		
	Mean CWD decay class		
Mean Percent Ground Cover	Litter Cover	59.1	Moderate
	Litter Depth (cm)	4.3	High
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	19.2	High



Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

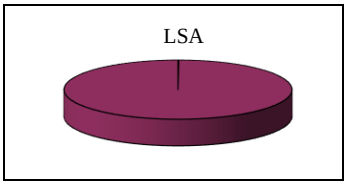
Attribute	Value	Rating
Structural diversity	1.2	Moderate
Species richness	18	High
Unique species	9	High
Provincially listed species	1	Low

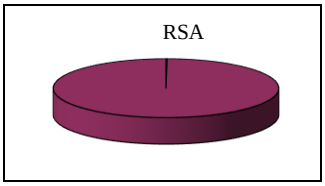
Unique species observed:
Green-tongue Liverwort (*Marchantia polymorpha*), Thin-leafed peat moss (*Sphagnum teres*), Glaucus willowherb (*Epilobium glaberrimum*), Water horsetail (*Equisetum fluviatile*), Common mare's-tail (*Hippuris vulgaris*), Lesser duckweed (*Lemna minor*), Dwarf raspberry (*Rubus arcticus ssp. acaulis*), Two-seeded sedge (*Carex disperma*), Bog willow (*Salix pedicellaris*)

Provincially listed species observed:
Lesser duckweed (*Lemna minor*)

Ecosite Supply

Areas occupied by willow shrubby rich fen comprised 4.8 ha (0.1%) of the LSA and 68.9 ha (0.2%) of the RSA.

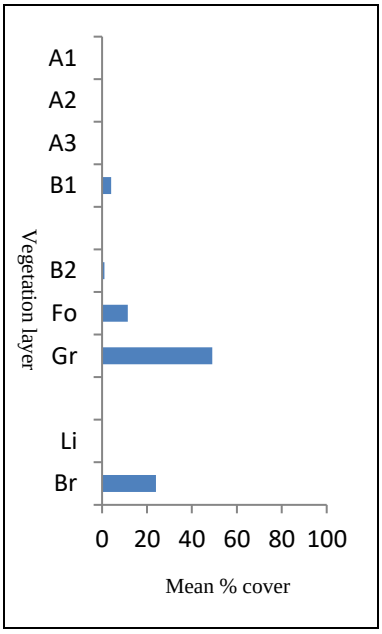




Ecological Interpretation

BP25 ecosites have a moderate structural diversity and a high species richness, particularly of shrubs and herbs. They differ considerably from leatherleaf shrubby poor fens (BP24). Rich fen ecosites often occur adjacent to streams and lakes. They may also occur as part of a swale or draw. In the absence of disturbance these ecosites are self-sustaining. Following disturbance they will likely return to their former composition or may more closely resemble an open fen (BP27) condition.

BP26 Graminoid fen: Wet humic organic (n=3)



Ecosite Description

Graminoid fens often have various sedge species and sometimes marsh reed grass. They generally lack trees and shrubs. Graminoid fens usually have water at or near the surface which accounts for the presence of water smartweed, yellow marsh marigold, and marsh skullcap. While graminoid fen ecosites are usually associated with organic soils, they may also occur with mineral substrates. Synonymous with BS24 graminoid fen in the Boreal Shield.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 11 (10, 14)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=0):						
A2 (n=0):						
A3 (n=0):						

Lower Vegetation Layer info:

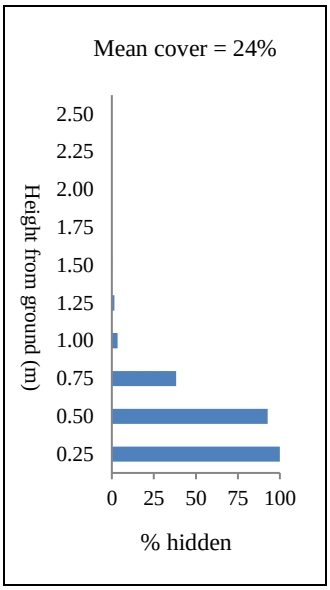
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	4	4%	Betugla4 Salisp.2 Betupum2 Larilar2
B2	2	1%	Myrigal9 Salisp.1
Forb	9	12%	Potepal8 Utriint1
Graminoid	5	49%	Careaqu6 Careutr4
Lichen Bryophyte	5	24%	Sphaang7 Spharip2 Callgig1

*Only including species that constitute 10% or more by composition.

BP26 Graminoid fen: Very wet humic organic (n=3)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.0	Low
	Mean snag diameter (cm)		
	Mean snag height (m)		
	Mean snag decay Class		
Course Woody Debris >10cm	Mean frequency of CWD	0.0	Low
	Mean CWD diameter (cm)		
	Mean CWD decay class		
Mean Percent Ground Cover	Litter Cover	68.1	Moderate
	Litter Depth (cm)	6.9	High
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	6.8	Moderate



Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	1.1	Moderate
Species richness	11	Low
Unique species	6	Moderate
Provincially listed species	0	Low

Unique species observed:

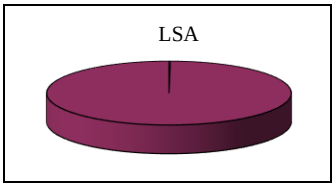
Giant calliergon moss (*Calliergon giganteum*), Peat moss (*Sphagnum girgensohnii*), Marsh willowherb (*Epilobium palustre*), Water dock (*Rumex orbiculatus*), Northwest territory sedge (*Carex utriculata*), Common Great Bulrush (*Scirpus lacustris*)

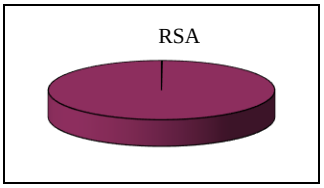
Provincially listed species observed:

None

Ecosite Supply

Areas occupied by graminoid fen comprised 7.7 ha (0.2%) of the LSA and 45.1 ha (0.1%) of the RSA.

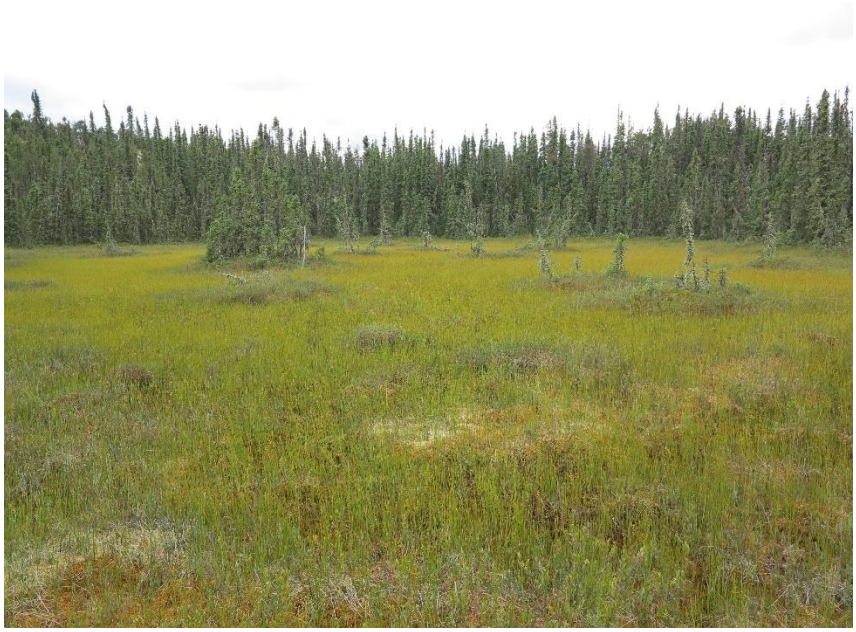


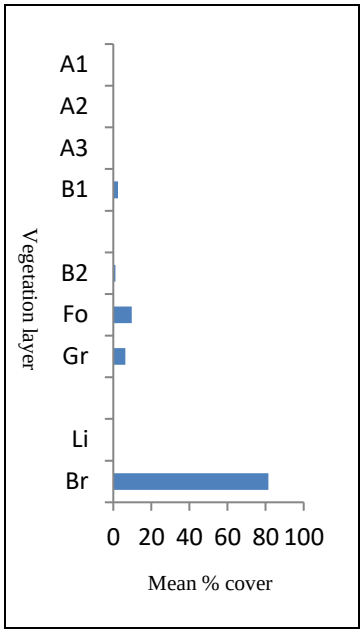


Ecological Interpretation

BP26 ecosites have an overall low species richness, primarily composed of forbs and grasses. Structural diversity is low to moderate. They are occasionally found across the Boreal Plain ecozone. They are often in close proximity to lake shorelines but can also form a relatively continuous wet meadow. These sites deviate little from their original condition either in the presence of or absence from disturbance.

BP27 **Open fen: Wet fibric organic** (n=2)





Ecosite Description

BP27 is conspicuous by the lack of any dominant form of vegetation with the exception of mosses. It is not uncommon for open fens to exhibit many of the vegetation species found in adjacent ecosites. However, while the diversity of species may be relatively high, the cover values are low. In terms of substrate, open fens can either have a mineral or organic substrate. Synonymous with BS25 open fen ecosite in the Boreal Shield.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 15 (14, 16)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=0):						
A2 (n=0):						
A3 (n=0):						

Lower Vegetation Layer info:

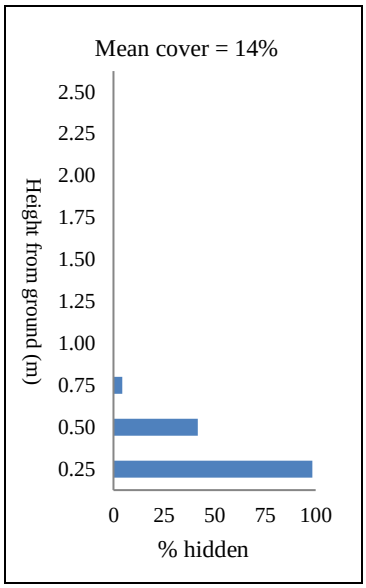
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	1	3%	Picemar10
B2	3	1%	Andrpol6 Kalmpol3 Oxycmic1
Forb	5	10%	Schepal4 Menytri4 Drosang2
Graminoid	2	6%	Juncnod7 Carelim3
Lichen Bryophyte	5	82%	Sphang6 Sphamag3 Dicrfus1

*Only including species that constitute 10% or more by composition.

BP27 Open fen: Wet fibric organic (n=2)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.0	Low
	Mean snag diameter (cm)		
	Mean snag height (m)		
	Mean snag decay Class		
Course Woody Debris >10cm	Mean frequency of CWD	0.0	Low
	Mean CWD diameter (cm)		
	Mean CWD decay class		
Mean Percent Ground Cover	Litter Cover	0.0	Low
	Litter Depth (cm)	N/A	Low
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	0.0	Low
	Sand	0.0	Low
	Open Water	18.3	High



Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

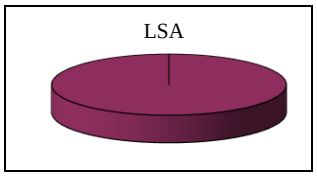
Attribute	Value	Rating
Structural diversity	0.7	Low
Species richness	15	Moderate
Unique species	4	Moderate
Provincially listed species	1	Low

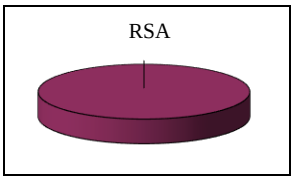
Unique species observed:
Dicranum moss (*Dicranum fuscum*), Brown moss (*Drepanocladus unciatus*), Buckbean (*Menyanthes trifoliata*), Knotted Rush (*Juncus nodosus var. nodosus*)

Provincially listed species observed:
English sundew (*Drosera anglica*)

Ecosite Supply

No areas with the BP27 ecosite were located in the LSA, however 55.6 ha (0.1%) of the RSA were occupied by this ecosite.

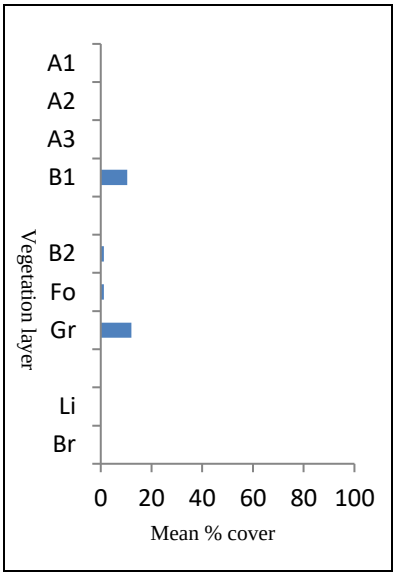




Ecological Interpretation

BP27 ecosites have low structural diversity and moderate species richness. While open fens appear uncommon across the Boreal Plain ecozone, this is an artifact of their existence as small pockets nested within other fen ecosites. Rarely do open fens exist as large expanses. Following disturbance these ecosites could be expected to return to open fens, but over time it is likely that they would become part of the more extensive adjacent fen ecosite types.

BS26 Rush Sandy Shore: very moist sand (n=2)



Ecosite Description

BS26 ecosites are characterized by having a relatively low cover of rushes, grasses, and sedges and little else. The ground cover is mostly exposed soil; usually just sand.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 7 (3, 11)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=0):						
A2 (n=0):						
A3 (n=0):						

Lower Vegetation Layer info:

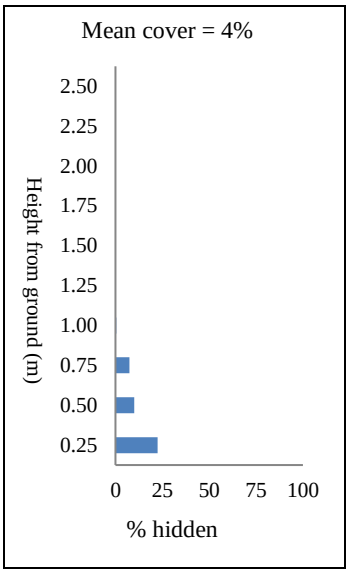
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	2	11%	Alnurug7 Betupap3
B2	3	1%	Salibeb6 Myrigal3 Vaccmyr1
Forb	2	1%	Potenor9 Epilang1
Graminoid	4	12%	Agrosca6 Festrub2 Calacan1
Lichen			
Bryophyte			

*Only including species that constitute 10% or more by composition.

BS26 Rush Sandy Shore: very moist sand (n=2)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.0	Low
	Mean snag diameter (cm)		
	Mean snag height (m)		
	Mean snag decay Class		
Course Woody Debris >10cm	Mean frequency of CWD	0.0	Low
	Mean CWD diameter (cm)		
	Mean CWD decay class		
Mean Percent Ground Cover	Litter Cover	1.7	Low
	Litter Depth (cm)	0.5	Low
	Bare Soil	0.0	Low
	Bare Rock	0.0	Low
	CWD <10cm	0.0	Low
	Sand	83.3	High
	Open Water	0.0	Low

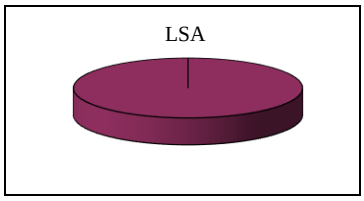


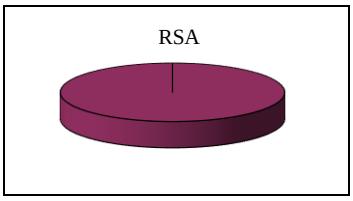
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	1.0	Low
Species richness	7	Low
Unique species	2	Low
Provincially listed species	0	Low
Unique species observed: Rough cinquefoil (*Potentilla norvegica)*, Short sedge (*Carex brunnescens*)		
Provincially listed species observed: None		

Ecosite Supply

Areas occupied by rush sandy shores comprised <0.1% of the LSA and 16.9 ha (<0.1%) of the RSA.

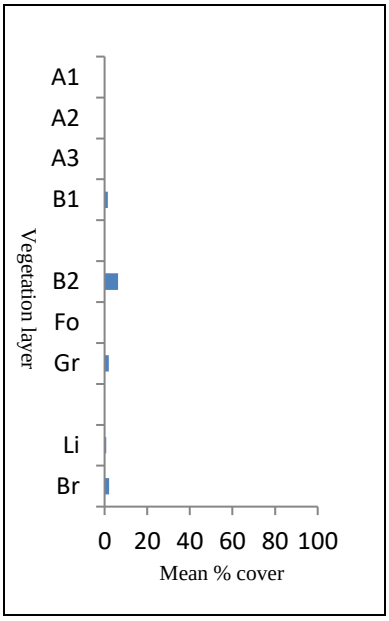




Ecological Interpretation

Rush sandy shores are low in both species richness and diversity. They are almost always narrow linear features adjacent to lakes or ponds. This particular ecosite was defined based on data almost exclusively from the Athabasca Dunes ecodistrict.

DL1 Disturbed lands - vegetated (n=3)



Ecosite Description

DL1 ecosite type is characterized by previous removal of naturally occurring vegetation (and in some cases soil) and the absence of a tree layer. Some sites include an open shrub layer including by willows, green alder, and jack pine. Graminoids and forbs are also present, however, mainly consisting of planted or invasive species. A cover of mosses can also be found on the ground, but bare soil is a predominant feature in this ecosite type.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 9 (6, 12)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=0):						
A2 (n=0):						
A3 (n=0):						

Lower Vegetation Layer info:

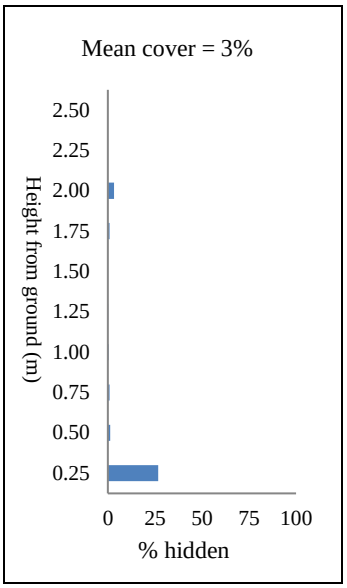
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1	3	2%	Alnucri4 Pinuban4 Salipla1
B2	5	6%	Vaccmyr5 Arctuva4
Forb	1	<1%	Rubucha10
Graminoid	3	2%	Agrosca6 Festrub2 Carehoo1
Lichen	4	<1%	Claddef4 Cladmit3 Cladgra2
Bryophyte	2	2%	Polyjun9 Polypil1

*Only including species that constitute 10% or more by composition.

DL1 Disturbed lands - vegetated (n=3)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.0	Low
	Mean snag diameter (cm)		
	Mean snag height (m)		
	Mean snag decay Class		
Course Woody Debris >10cm	Mean frequency of CWD	0.0	Low
	Mean CWD diameter (cm)		
	Mean CWD decay class		
Mean Percent Ground Cover	Litter Cover	39.9	Moderate
	Litter Depth (cm)	0.6	Low
	Bare Soil	19.7	High
	Bare Rock	3.7	Moderate
	CWD <10cm	0.0	Low
	Sand	30.7	High
	Open Water	0.0	Low

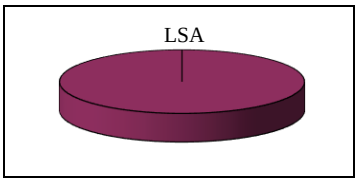


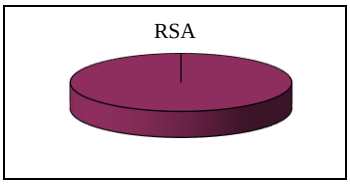
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	1.2	Moderate
Species richness	9	Low
Unique species	1	Low
Provincially listed species	0	Low
Unique species observed: Hooker's Sedge (*Carex hookerana*)		
Provincially listed species observed: None		

Ecosite Supply

Areas occupied by disturbed land - vegetated were absent from the LSA and comprised <0.1% of the RSA.

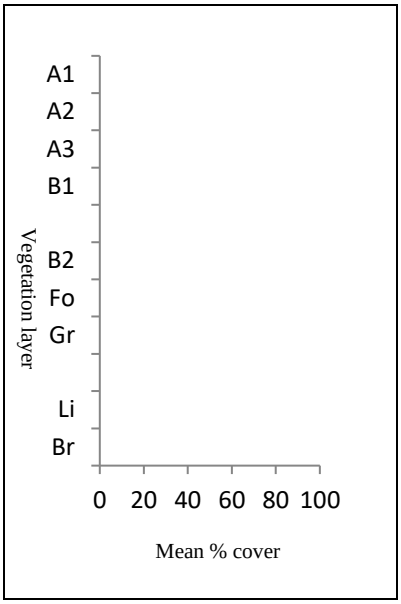




Ecological Interpretation

DL1 ecosites are poor in species diversity and richness. They do have a moderate number of unique species, however, these species are generally actively seeded (such as red fescue) or invasive (such as narrow-leaved hawk's beard and dandelion). The ecosites are the result of previously cleared developed sites (e.g. road right-of-ways and airstrips) where some kind of natural revegetation has taken place, as well as areas where active reclamation has occurred.

DL2 Disturbed lands – non-vegetated (n=2)



Ecosite Description

DL2 ecosite type is characterized by previous removal of naturally occurring vegetation (and in some cases soil) and the absence of a tree layer. Shrubs, forbs, and lichen/mosses are virtually absent. Bare rock and sand cover are high.

Species and Vegetation Layer Info

Average number plant and lichen species per plot (min, max): 0 (0, 0)

Tree Layer Info:

Tree Layer	Total # Species	Crown Closure	Mean Height	Mean DBH	Species Composition	Year of Origin
A1 (n=0):						
A2 (n=0):						
A3 (n=0):						

Lower Vegetation Layer info:

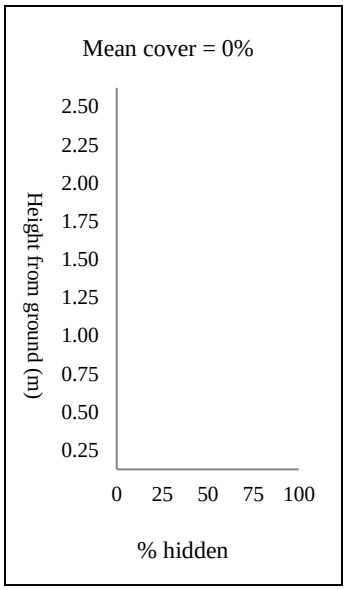
Vegetation Layer	Total # Species	Percentage Cover	Species Composition*
B1			
B2			
Forb			
Graminoid			
Lichen			
Bryophyte			

*Only including species that constitute 10% or more by composition.

DL2 Disturbed lands – non-vegetated (n=2)

Structural Attributes and Relative Rating

Structural Component	Attribute	Value	Rating
Snags	Mean # of snags/plot	0.0	Low
	Mean snag diameter (cm)		
	Mean snag height (m)		
	Mean snag decay Class		
Course Woody Debris >10cm	Mean frequency of CWD	0.0	Low
	Mean CWD diameter (cm)		
	Mean CWD decay class		
Mean Percent Ground Cover	Litter Cover	1.4	Low
	Litter Depth (cm)	0.3	Low
	Bare Soil	0.0	Low
	Bare Rock	21.5	High
	CWD <10cm	0.0	Low
	Sand	76.1	High
	Open Water	0.0	Low

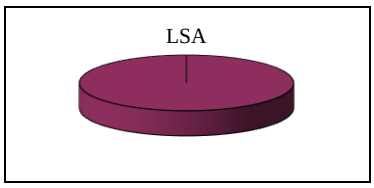


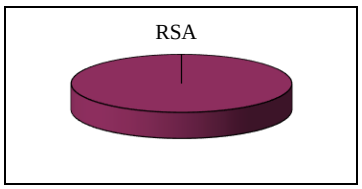
Structural Diversity, Species Richness, and Unique and Rare Species Occurrence Evaluation

Attribute	Value	Rating
Structural diversity	0.0	Low
Species richness	4	Low
Unique species	0	Low
Provincially listed species	0	Low
Unique species observed: None		
Provincially listed species observed: None		

Ecosite Supply

Areas occupied by disturbed land – non-vegetated comprised <0.1% of the LSA and <0.1% of the RSA.





Ecological Interpretation

DL2 ecosites are poor in species diversity and richness. The ecosites are the result of previously cleared developed sites (e.g. road right-of-ways and airstrips) where natural regeneration has not taken place.

7.0 LINEAR FEATURE NATURAL REGENERATION ASSESSMENT

Environment Canada (EC) (2012b) assessed the capacities of caribou ranges to maintain self-sustaining local populations of boreal caribou across Canada, and utilized a methodology that linked calf recruitment to levels of disturbance within specific ranges. The objective was to identify range-specific disturbance based on management thresholds. For the Boreal Shield of Saskatchewan (SK1), in 2018, ECCC indicated that to ensure sustainable caribou populations, total buffered anthropogenic disturbance should not exceed five percent and that total disturbance (natural + buffered anthropogenic) should not exceed 40%. Currently, under this scheme, there is approximately 82% buffered anthropogenic disturbance in the LSA and approximately 49% in the RSA (Section 3.3). Linear disturbances, in the form of seismic/exploration lines, trails, and roads, were most common.

The increase in linear disturbances has the potential to increase the hunting opportunities and efficiencies of wolves (James et al. 2004; Dickie et al. 2017) and black bears (Latham et al. 2011a; Tigner et al. 2014; DeMars and Boutin 2017). Dickie et al. (2017) demonstrated that wolves move faster and farther on right-of-ways (ROW), especially wider ROWs, than in interior forests. Latham et al. (2011b) observed that legacy seismic lines in Alberta were the most important movement corridors for wolves during the snow-free season, and Tigner et al. (2014) also found that black bears used linear features more frequently than undisturbed forest interior. This increased carnivore use of linear features could lead to higher levels of woodland caribou mortality.

Additive footprint from the proposed Project would result in an increase to baseline disturbance levels and prolong the natural recovery timeline of the Project-related and existing disturbances. However, not all mapped existing anthropogenic disturbances should still be considered disturbed because natural succession has likely begun on many older features.

Visual or physical obstruction by vegetation is thought to be an important functional habitat attribute for wildlife, either as hiding cover, or as a factor affecting movement. Ungulate flight responses are likely governed by several factors and the amount of hiding cover is likely one important factor (Nudds 1977). This section presents two approaches used to investigate current visual and physical obstruction as well as one approach to investigate potential future visual and physical obstruction on linear features. The approaches for current visual obstruction included measurements of hiding cover (percentage hidden) and vegetation regrowth (percent cover or stem count by vegetation layer). The approach for examining potential future visual obstruction involved investigating regeneration of ericaceous shrub and tree species. Ericaceous shrubs, such as blueberry, Labrador tea, and leatherleaf will generally not grow taller than 1 m and will not contribute considerably in terms of line blocking, neither physical blocking or visual (line of sight) (McLaughlan et al. 2010). Tree species (such as jack pine and black spruce) conversely will, given there are no fires or human traffic, grow tall enough to block line of sight. The abundance of tree species regeneration on a linear feature, even if currently less than 1 m tall, would be an important predictor of future regrowth and visual obstruction potential on a linear feature.

7.1 Study Objectives

The objectives of linear feature natural regeneration assessment field surveys were to:

- identify levels of natural vegetation recovery in anthropogenic features of different types, in different habitats, and with varying level of human use; and
- use this data to inform future potential reclamation efforts.

7.2 Methods

7.2.1 Sample Site Selection

Field sampling was conducted between 21 and 28 August 2019 at a time of full vegetation green-up. Sampling sites were stratified by lowland or upland sites and then by mature or regenerating forest classes. Sample sites were stratified randomly using a 1:20,000 anthropogenic feature and vegetation cover type map (see Figures 3.3-1 and 5.3-1). In addition, due to the relatively homogeneous vegetative characteristics of the study area, specific sites with higher levels of linear feature regeneration were intentionally selected to provide adequate representation. All sample sites chosen were accessed safely by all-terrain vehicle (ATV). Sampled disturbance types included hand cut exploration lines (1 m to 2 m wide), machine cut lines (2.5 m to 10 m wide), temporary trails (1.5 m to 8 m wide) and roads (5 m to 10 m wide).

Paired reference transects were run along the same bearing and parallel to linear feature transects in suitable interior (undisturbed) habitat 30 m away. A total of 60 sites were sampled. The locations of the transects are provided in Figure 7.2-1. Transect details are provided in Appendix B.

7.2.2 Sample Site Layout and Sampling Design

Each sampling site consisted of a 30 m transect along which five 20 cm x 50 cm sub-plots, five 1 m x 1 m sub-plots, and three 2 m x 5 m sub-plots were systematically distributed at 5 m intervals (Figure 7.2-2). A series of vegetative and structural attributes were estimated or measured. Visual estimates along a continuous scale to the nearest percent were made at each sub-plot as described in British Columbia Ministry of Forests (1998). The percent cover of bare soil, rock/stones, litter, mulch, terrestrial lichen, feather moss, and sphagnum moss were recorded in the five 20 cm x 50 cm sub-plots. The depth of litter and mulch were also recorded. In each of the 1 m x 1 m sub-plots, the 10 most abundant low shrubs (<1 m in height) were recorded and given a rank order from 1 (most abundant) to 10 (least abundant). Forbs, grasses, and sedges/rushes were grouped together and recorded and ranked in the same manner. Total percent cover and median height of low shrubs, forbs, grasses, sedges/rushes, and standing water was recorded for each sub-plot. Tall shrub saplings were surveyed in the 2 m x 5 m sub-plot. Saplings were divided into two groups: 1 m to <3-m and ≥3 m to 5-m heights. Species and height was recorded for each sapling. Structural data included frequency of occurrence of coarse woody debris and hiding cover. Coarse woody debris was recorded along the length of the 30 m transect. The total number of intercepts, the diameter, and the decay class (1-7) of all pieces >10 cm were measured or estimated (Lee et al. 1995).

Horizontal and vertical visual obstruction from vegetation was estimated in both east and west directions from the transect centre and along each disturbance and corresponding reference transects adapting methods by Nudds (1977). A red and white colour-coded cloth measuring 2.5 m in height was held upright 15 m from the observer at the transect centre (Figure 6.2-4). The observer viewed the cloth from both caribou and wolf eye levels (1.7 m and 1.2 m above ground respectively, as per Kansas et al. 2016). An estimate of percent obstructed/hidden (by vegetation) was recorded for each of the ten 25 cm x 25 cm squares.

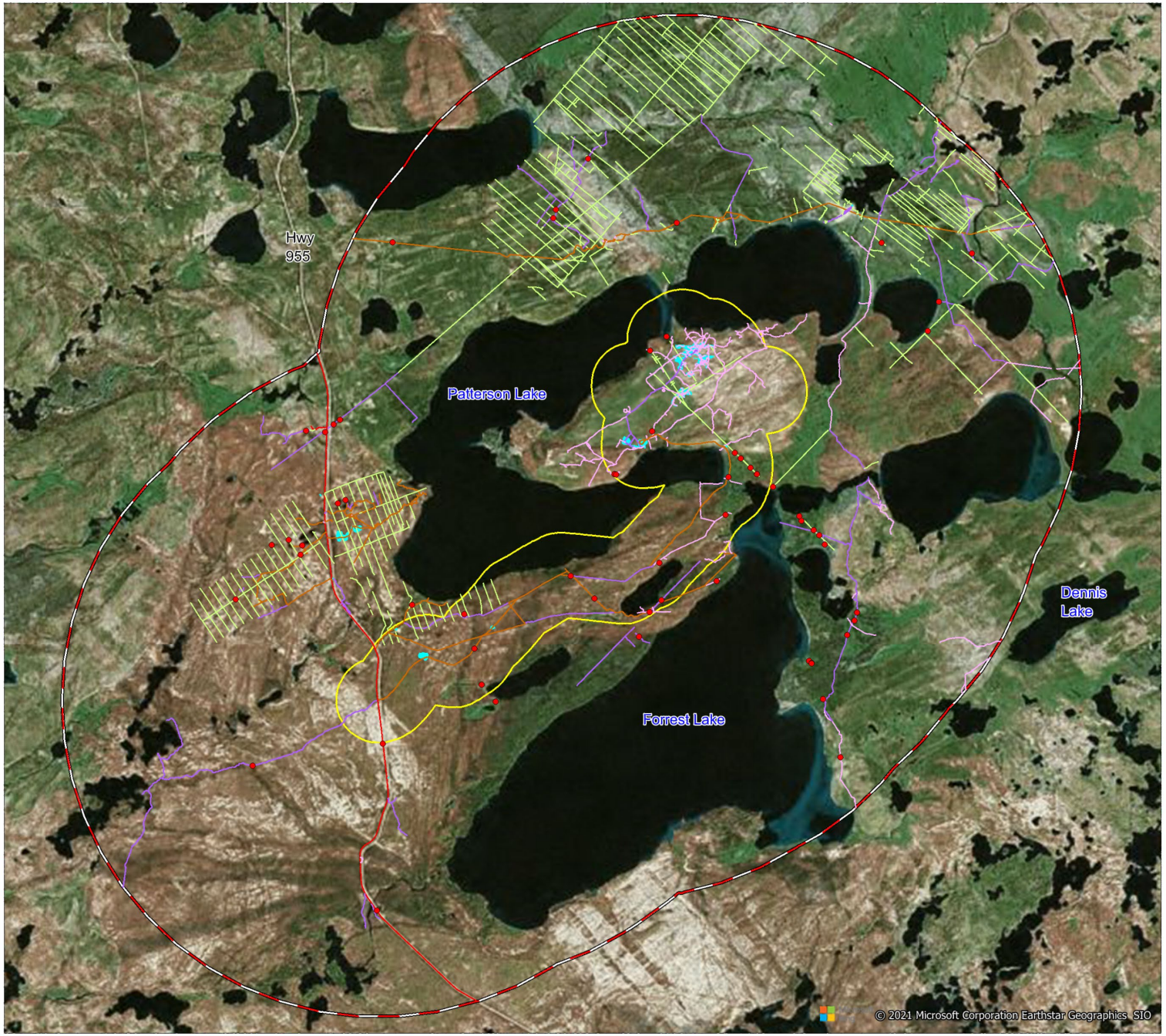


Figure 7.2-1 Linear Feature Natural Regeneration Transect Locations

Legend

- Assessment Transect Location

Disturbance Type - Width

- Cutline (1.75m)
- ROW (2.5m)
- Trail (4m)
- Rough Road (5.5m)
- Road (12m)
- Clearing
- Regional Study Area (RSA)
- Local Study Area (LSA)

N
W E
S

0 5 10

kilometers
Scale = 1 : 90,000

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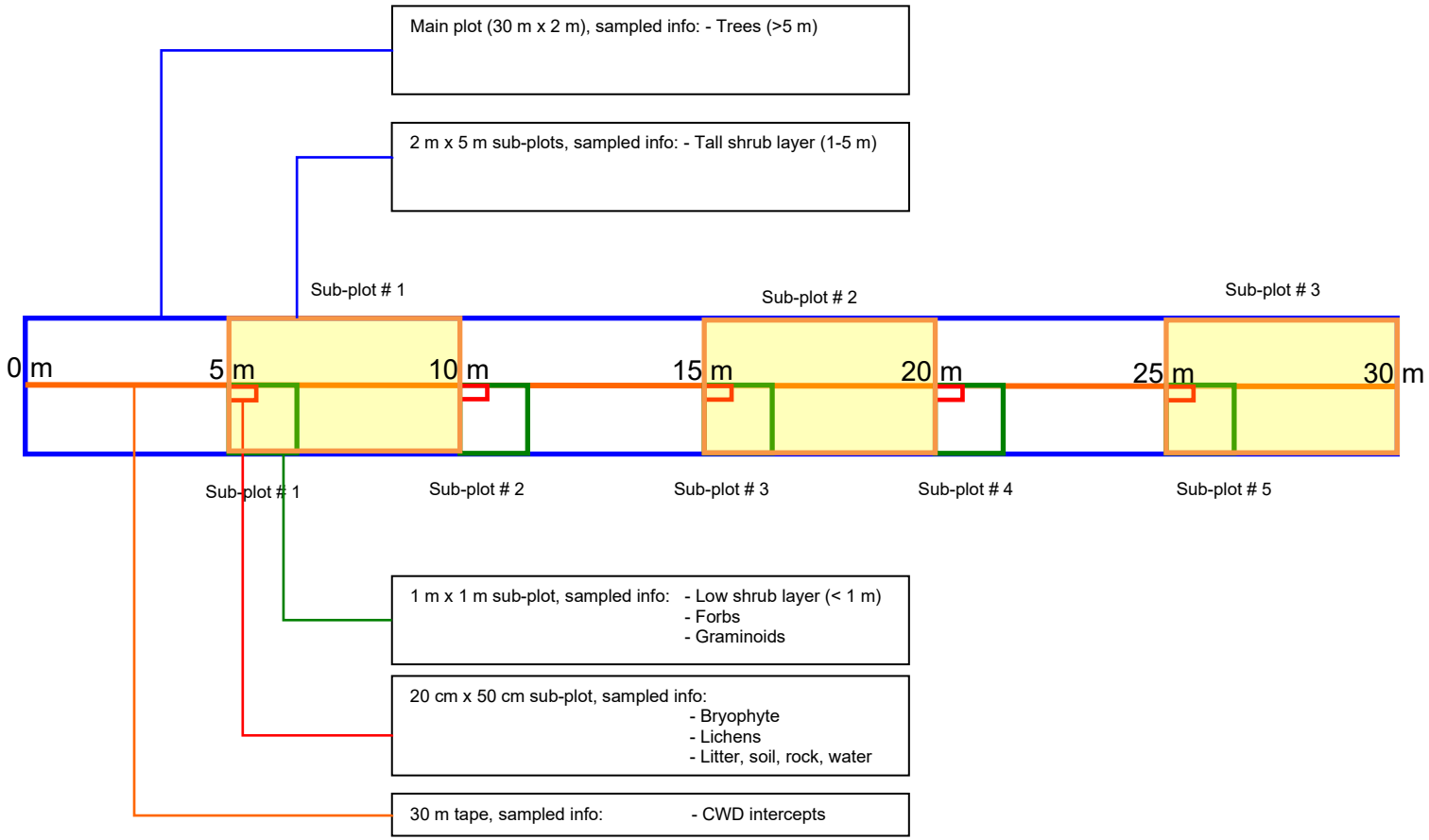
Figure 7.2-2 Linear Feature Natural Regeneration Assessment Ground Sampling Plot Layout



7.2.3 Analysis

Three types of analyses were completed to assess natural regeneration of disturbed linear features and paired reference transects, including:

1) level of visual obstruction provided by vegetation on linear features;
2) level of vegetation regrowth (percentage cover or stem counts); and
3) analysis of low shrub cover focusing on dominant species type (ericaceous shrub or tree) to determine the percentage of species that has the potential to reach caribou eye level and beyond (to predict whether a line is likely to be naturally revegetated over time).

For each of these three analyses, four classes of features were investigated, including features:

1) that have burned after creation (Appendix C, Photograph 7.2-1) versus those that have not burned since creation (Appendix C, Photograph 7.2-2);
2) in upland (e.g., jack pine forest) (Appendix C, Photograph 7.2-3) versus lowland (e.g., bogs and fens) (Appendix C, Photograph 7.2-4) areas;
3) in old (> 40 years since fire) (Appendix C, Photograph 7.2-3) versus young forest (<= 40 years since fire) (Appendix C, Photograph 7.2-2); and
4) with varying degree of human use, ranging from none (Appendix C, Photograph 7.2-5), low (Appendix C, Photograph 7.2-6), low/moderate (Appendix C, Photograph 7.2-7), moderate (Appendix C, Photograph 7.2-8), moderate/high (Appendix C, Photograph 7.2-9), and high (Appendix C, Photograph 7.2-10). Level of use was based on observations in the field including flattened vegetation, percentage of bare soil, presence and extent of tire tracks, etc.

Seven different vegetation cover/stem density metrics (lichens, mosses, forbs, graminoids, shrubs < 1 m, shrubs 1 m to 2 m, and shrubs 3 m to 5 m) and two vegetation structure metrics (wolf hiding cover and caribou hiding cover) were analyzed. The average values for all vegetation layers as well as the average values for visual obstruction up to 2 m height from both caribou and wolf eye levels for the sampling by stratified sites were calculated in both the linear feature transects (treatment) and the paired adjacent natural transects (reference).

For the low shrub layer, the 10 most abundant shrub species (<1 m in height) were recorded and given a rank order from 1 (most abundant) to 10 (least abundant) for each sub-plot. The ranks were converted to a numerical value (1 = 100, 2 = 90, 3 = 80, …, 10 = 10), and the values from each sub-plot were added to provide a total amount for each transect, thereby taking into consideration both ranking and occupancy for the sub-plots. This value was then normalized so each species received a value between 0 (not observed in any sub-plot) to 100 (overall highest ranking and most commonly recorded in sub-plots).

Using this information, two levels of analysis were undertaken. First, a comparison between disturbance and reference for each site type (e.g., upland – disturbed vs. upland - reference) was analysed. Second, a comparison of the level of natural regeneration between disturbed areas in different site types (e.g., upland – disturbed vs. lowland – disturbed) was analysed. To investigate the variation between reference and disturbance transects (rather than the variation within each of these groups), the precision of the mean value was quantified by calculating standard error of the mean.

For the first level analysis, paired t-tests were run to verify if differences in mean values between compared variables were statistically significant (probability [P] <0.05). For the second level analysis, two-sample t-tests, not assuming equal variance, were run to verify if differences in mean values between compared variables were statistically significant (P<0.05). All data was analyzed using Minitab v. 17.3.1 (Minitab Inc., State College, PA, USA).

7.2.4 Assumptions and Limitations

Natural vegetation recovery, at any given site, will depend on a variety of factors. No information has been made available as for when linear features were created, how they were created, how they were used and for how long they may have been used, among other factors. Therefore, the analyses did not take age of disturbance into consideration. For each of the four classes of features analysed, several additional assumptions and limitations were identified:

1) Burned before or after creation of linear disturbance.
    - Since there was no information available on when linear features were created, the designation of burned before or after line creation was based on evidence observed during the field trip, such as presence of stumps and/or deadfall from tree felling.
    - It is likely that, overall, lines created after fire may tend to be younger than lines created before fire (e.g., in any given fire polygon, a line cut after the fire will always be younger than a line cut before the fire). As we do not have information on when lines were created, we can not control for this. Nevertheless, being adapted to a fire driven environment, jack pine has serotinous cones (protected by a waxy coating) that require the heat of fire to release their seeds, and fire also produces favourable conditions for the seeds of these pines to germinate. Nutrients are released in the soil, mineral soil is exposed, competing species are eliminated and the amount of sunlight on the forest floor is increased. As such, jack pine therefore depends on fire to regenerate, and fires initiate natural regeneration. This will not happen, to the same extent, when a line is cut, and it is therefore expected that recovery on lines burned after creation will recover faster than lines burned before creation.
    - Transects included in this analysis are all:
        i. no/low human use (to investigate effect of fire only);
        ii. trail, handcut, or cutline (as roads had minimal natural recovery irrespective of fire age); and
        iii. in young upland regenerating forest (to compare similar ages of fire).

2) Upland versus lowland comparisons include transects that:
    - have no/low human use (to investigate effect of moisture only);
    - are trail, handcut, or cutline (as roads have minimal recovery irrespective of moisture regime); and
    - represent areas of between 30 to 100 years since fire, since there is most overlap for these ages).

3) Old versus young comparisons include transects that:
    - are upland areas only (very limited young lowland transects);
    - have not burned since the line was cut;
    - are divided into young (<=40 years since fire) and old (>40 years since fire);
    - have no/low human use (to investigate effect of age only); and
    - are trail, handcut, or cutline (as roads had minimal recovery irrespective of fire age).

4) Levels of human use, transects that include:
    - all landcover types (uplands and lowlands);
    - all ages;
    - all types of features; and
    - all categories of human use.

7.3 Results

The key findings and trends for each of the three analyses, including *Visual Obstruction, Vegetation Recovery and Ericaceous shrubs vs. Tree Species* are provided in Table 7.3-1. Detailed results for each analysis are described below.

7.3.1 Visual Obstruction

Line Cut Before versus After Fire

No significant differences in visual obstruction in any layers were observed between disturbed versus reference transects for areas that had burned after the line was cut (Figure 7.3-1A). In situations where lines were cut after fires, wolf visual obstruction was significantly higher for reference transects for all layers except 0.25 m to 0.75 m ($P<0.05$), and caribou visual obstruction was significantly higher for reference transects for all layers except 0.25 m and 0.50 m ($P<0.05$), indicating poor vegetation regrowth in areas cut after fire (Figure 7.3-1B). The differences in observed visual obstruction between disturbances created before and after fire indicate that, for trails and hand cuts and in absence of continued human use, wildfires substantially accelerate natural recovery processes such that vegetation conditions are more similar on and off disturbance than on disturbances that have not burned.

Upland versus Lowland

Lowlands generally had a slightly higher visual obstruction in the lower height layers compared with uplands. In lowlands, there were no significant differences between disturbed areas and reference areas in any of the layers (Figure 7.3-2A). In uplands, both caribou and wolf visual obstruction was significantly lower in disturbed areas compared to reference areas for all layers, except 0.25 m above ground ($P<0.05$) (Figure 7.3-2B). With respect to disturbed areas for lowlands versus uplands, a higher visual obstruction in the lowest height layer occurred in lowlands compared to uplands, as both wolf and caribou visual obstruction were significantly higher for lowlands than uplands in the 0.25 m layer, but displayed no significant difference between lowlands and uplands in any of the higher layers (Figure 7.3-2C).

Young Forest versus Old Forest

For young forests, overall hiding cover (all layers combined) was significantly different between disturbed and reference for both wolf and caribou. Caribou hiding cover was significantly different in all height layers except the 0.25 m layer ($P<0.05$), and wolf hiding cover was significantly different in all layers except for layers 0.25 m to 0.75 m (Figure 7.3-3A). Although old forests had lower hiding cover overall (both in disturbed areas and reference areas), the difference between disturbed and reference areas were similar to young forests. Both wolf and caribou hiding cover were significantly different in all height layers except the 0.25 m layer ($P<0.25$) (Figure 7.3-3B). There was a strong trend (statistically significant in the 0.25 m and 0.5 m layer for caribou, and 0.5 m and 1.0 m for wolf) towards higher recovery in young forests compared to old forests (Figure 7.3-3C), suggesting young forests are likely to recover faster, when compared to reference sites, than old forests post disturbance.

Level of Human Use

Human use significantly affected vegetation regrowth (based on visual obstruction) (Figures 7.3-4A to 7.3-4D). There was no significant difference between no use, low use, and moderate use for the 0.25 m layer; however, areas in these use categories had significantly higher visual obstruction than areas with high human for this layer (Figure 7.3-4E). For all other layers (0.50 - 2.00 m) there was significantly higher

visual obstruction in areas with no vs. low/moderate/high human use. As such, it appears that any level of human use of features has a substantial impact on natural vegetation recovery.

Table 7.3-1 Key Findings and Trends for Each Analysis of Disturbed Areas.

Variable	Main Findings/Trends for Disturbed Areas
Visual Obstruction	
Line Cut Before vs. After Fire	Areas burned after line cutting: No significant differences in visual obstruction in any layers were observed between disturbed versus reference transects. Areas burned before line was cut: Wolf visual obstruction significantly higher for reference transects for all layers except 0.25 m to 0.75 m ($P<0.05$); caribou visual obstruction significantly higher for reference transects for all layers except 0.25 m and 0.50 m ($P<0.05$), indicating poor vegetation regrowth in areas cut after fire.
Upland vs. Lowland	Significantly higher visual obstruction in lowlands vs. uplands for the 0.25 m layer.
Young Forest vs. Old Forest	Significantly higher visual obstruction in young forest vs. old forest for the 0.25 m to 0.50 m layer (caribou) and the 0.50 m to 1.00 m (wolf).
Level of Human Use	No significant difference between no, low and moderate use for the 0.25 m layer, and these are all significantly different from high use. For all other layers, significantly higher visual obstruction in areas with no vs. low/moderate/high human use.
Vegetation Recovery	
Line cut before vs. after fire	Significantly higher stem counts of Shrubs (3 m to 5 m) and strong trend towards higher stem counts of shrubs (1 m to 3 m) in areas burned after vs. before line creation. No difference between disturbed and reference in areas burned after line creation.
Upland vs. Lowland	Significantly higher forb and moss cover, and lower lichen cover in lowlands vs. uplands.
Young forest vs. Old Forest	Strong trends toward higher lichen cover in old vs. young forest ($p=0.06$), as well as higher stem counts of shrubs (1 m to 3 m) in young vs. old forest ($p=0.055$).
Level of Human Use	Significantly higher vegetation recovery in areas with no/low vs. moderate/high human use.
Tree Species Abundance	
Line cut before vs. after fire	Higher tree species occurrence in areas burned after vs. before line creation.
Upland vs. Lowland	Similar relative abundance of tree species in lowlands and uplands.
Young forest vs. Old Forest	Similar relative abundance of tree species in young and old forest.
Level of Human Use	Higher tree species occurrence in areas with no/low/moderate vs. high human use.

Figure 7.3-1A Visual Obstruction in Areas Burned *After* Line was Cut

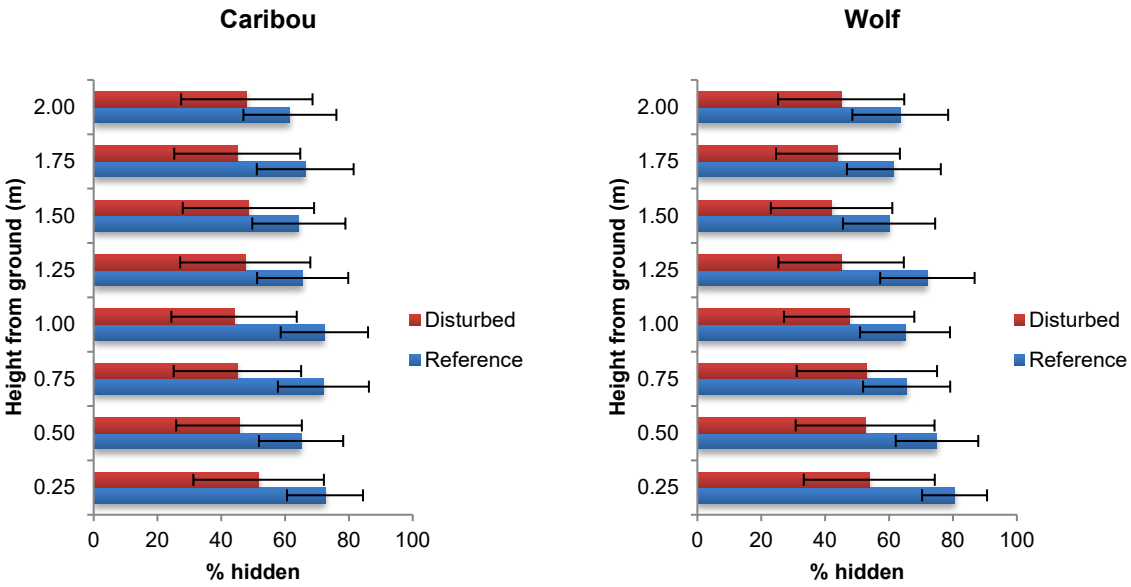
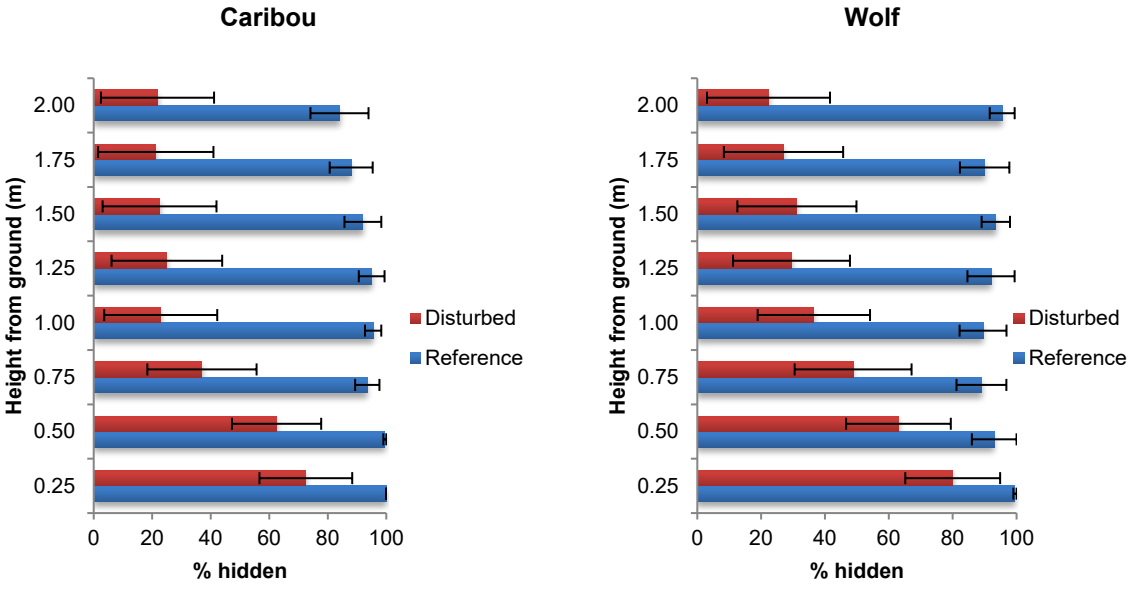


Figure 7.3-1B Visual Obstruction in Areas Burned B*efore* Line was Cut



Note: The error bars are standard errors around the means; fire occurred 2 to 29 years ago.

Figure 7.3-2A Visual Obstruction in Lowland (Bogs/Fens)

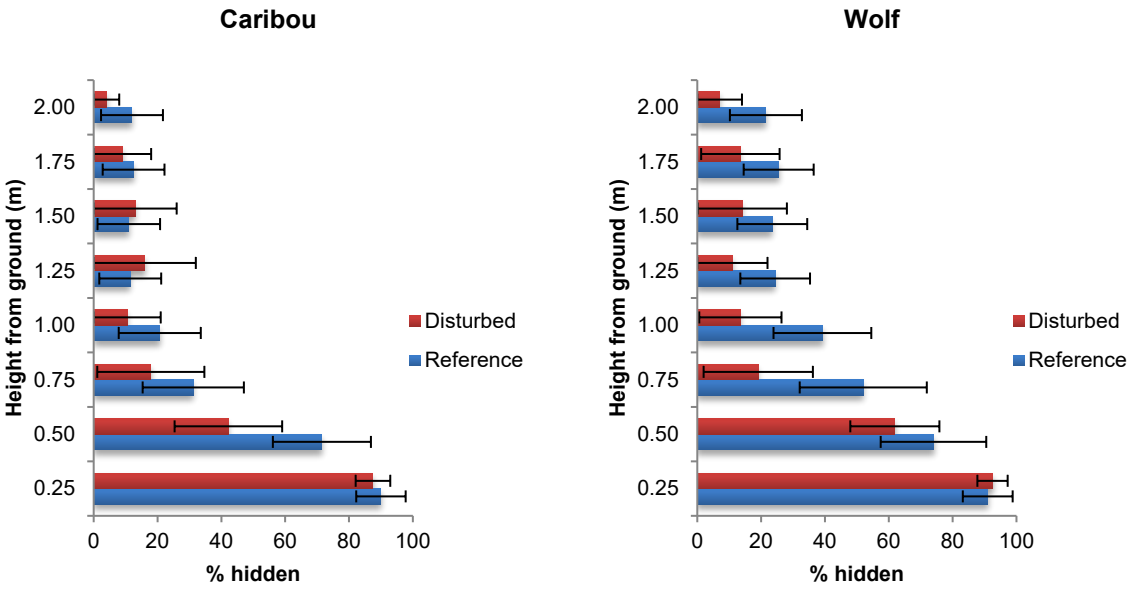


Figure 7.3-2B Visual Obstruction in Upland

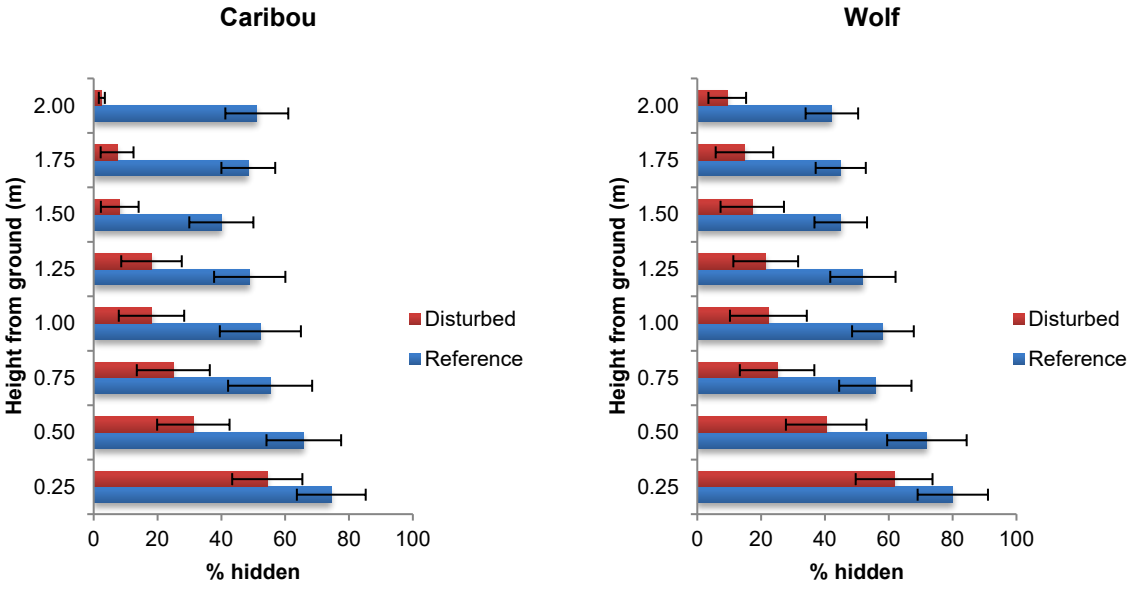
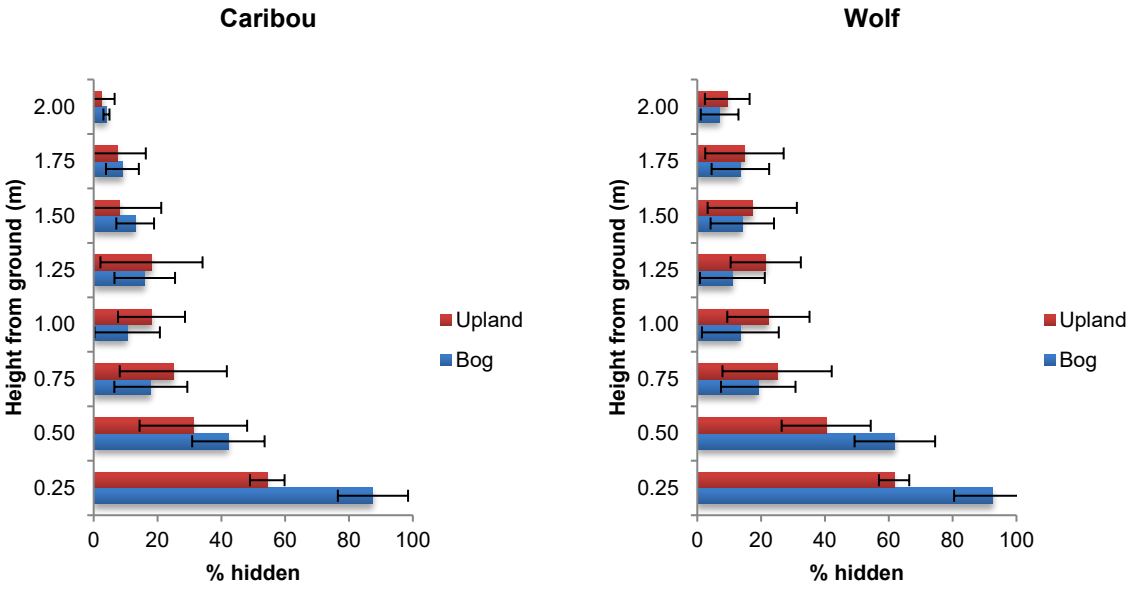


Figure 7.3-2C Visual Obstruction: Lowland (Bogs/Fens) versus Upland in Disturbed Areas



Note: The error bars are standard errors around the means.

Figure 7.3-3A Visual Obstruction in Young Forest (< 40 Years Old)

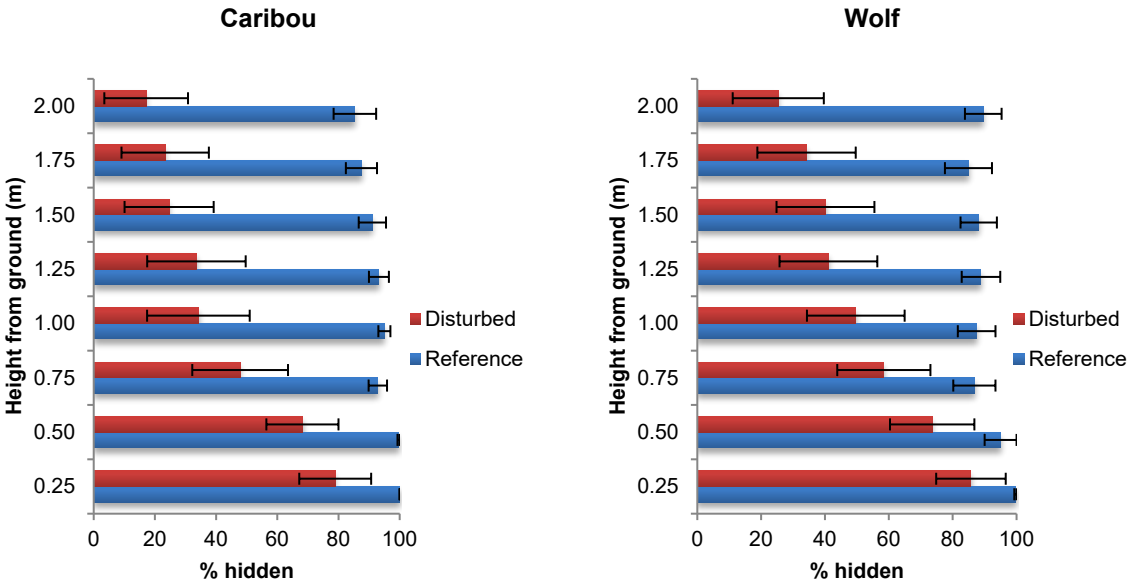


Figure 7.3-3B Visual Obstruction in Old Forest (> 40 Years Old)

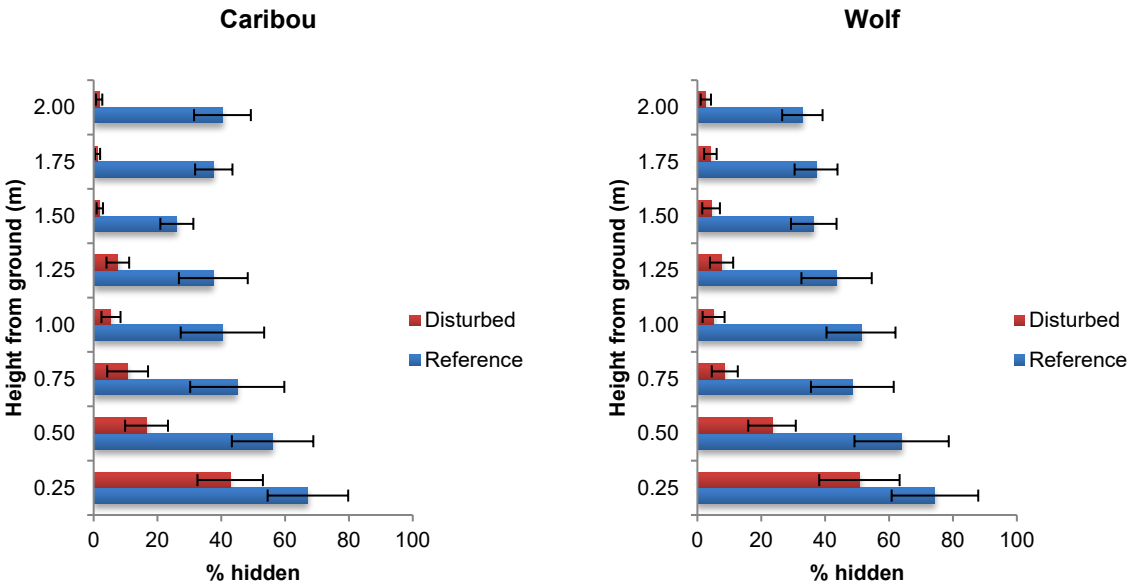


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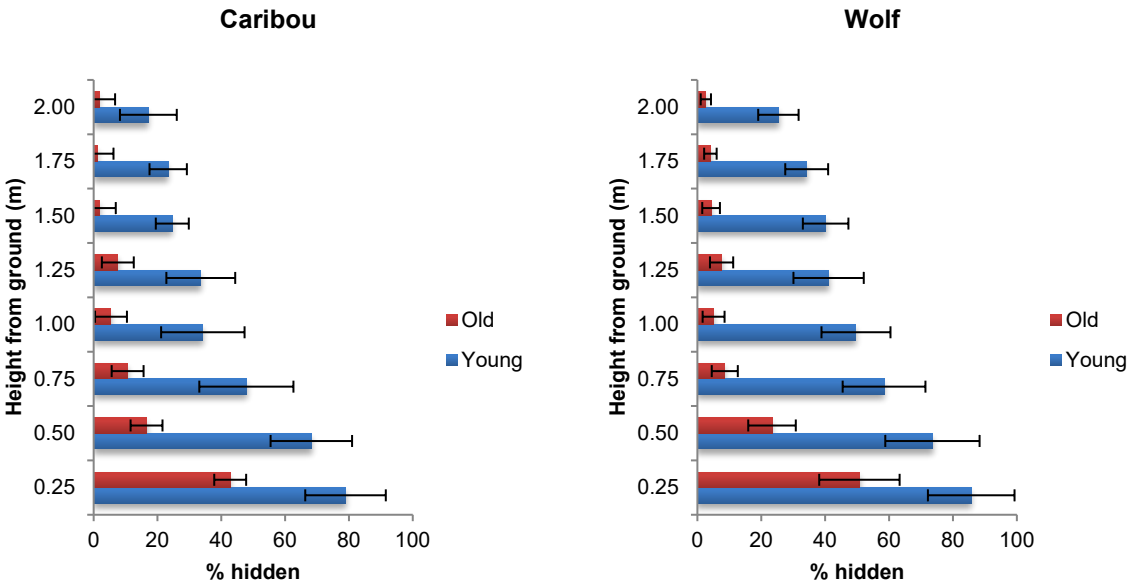
Figure 7.3-3C Visual Obstruction: Old versus Young Forest in Disturbed Areas



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Note: The error bars are standard errors around the means.

Figure 7.3-4A Visual Obstruction in Areas with No Human Use

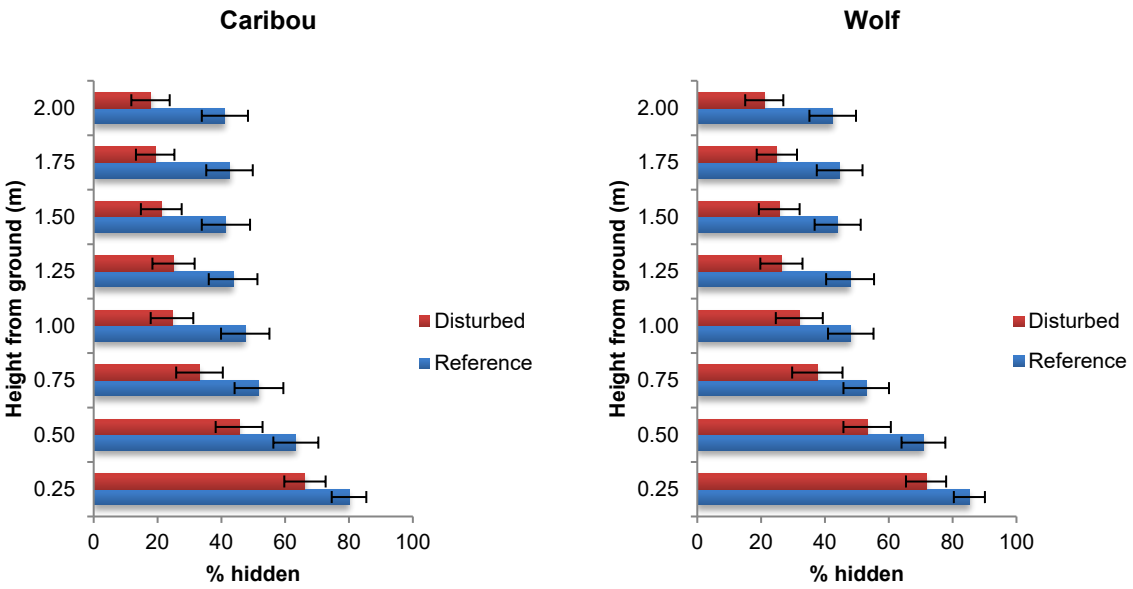


Figure 7.3-4B Visual Obstruction in Areas with Low Human Use

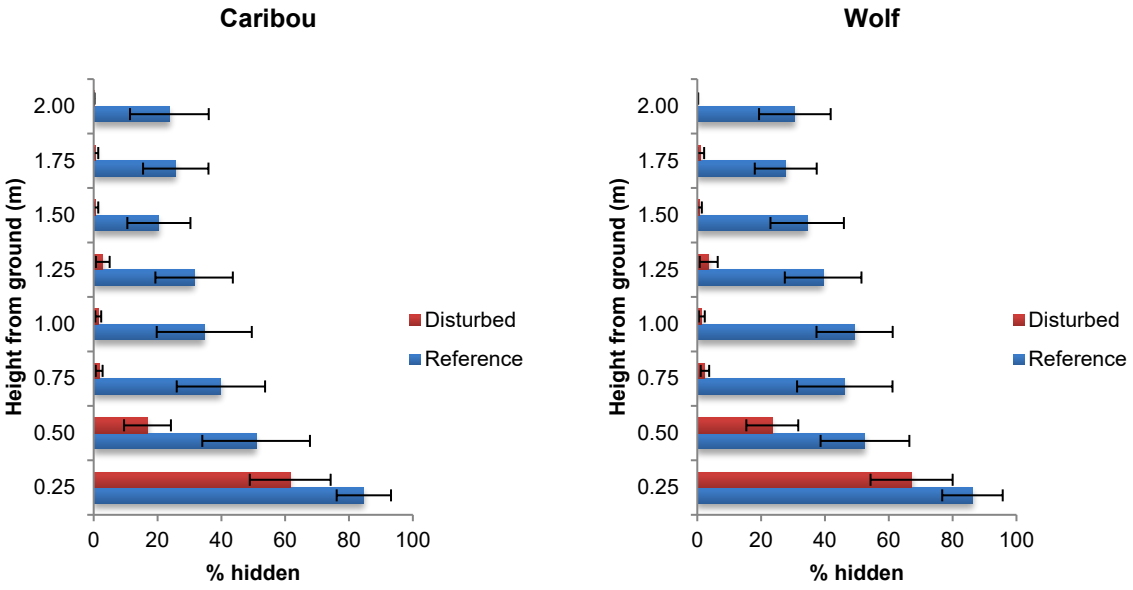


Figure 7.3-4C Visual Obstruction in Areas with Moderate Human Use

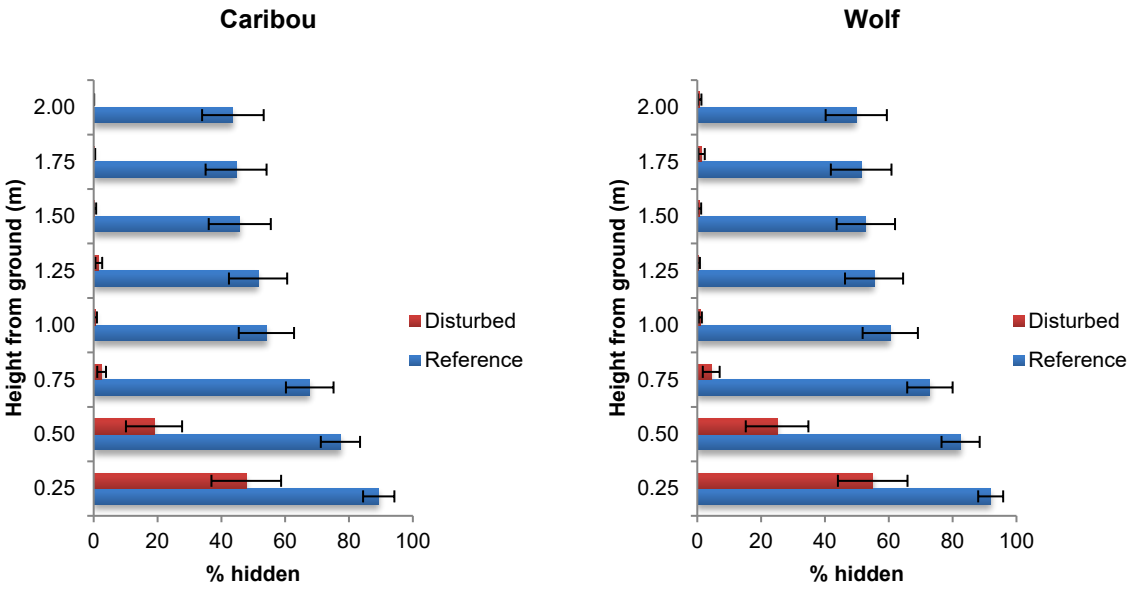


Figure 7.3-4D Visual Obstruction in Areas with High Human Use

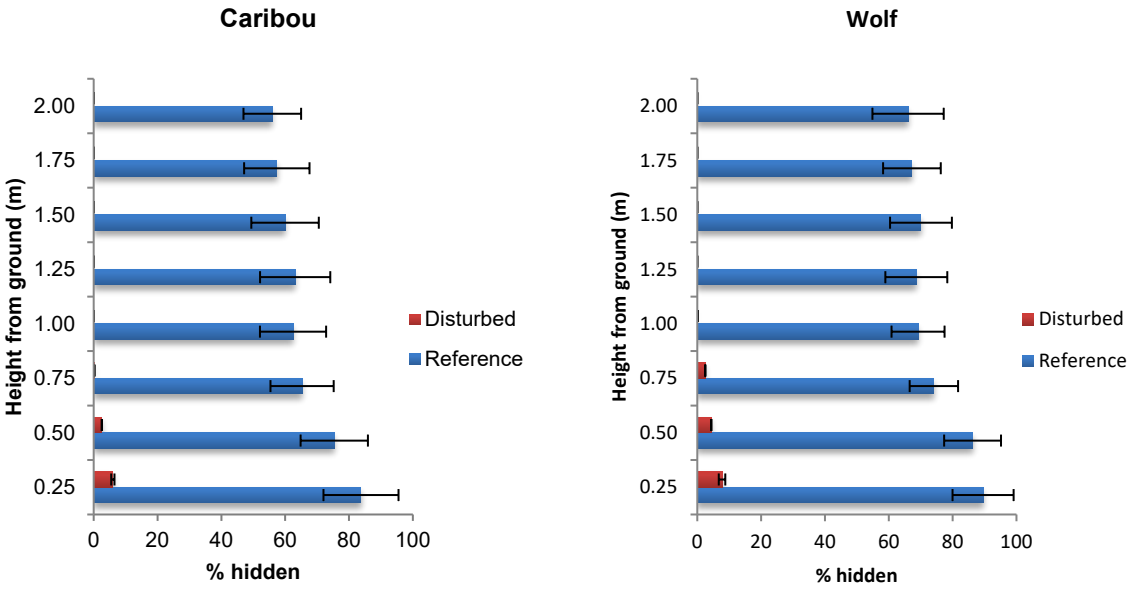
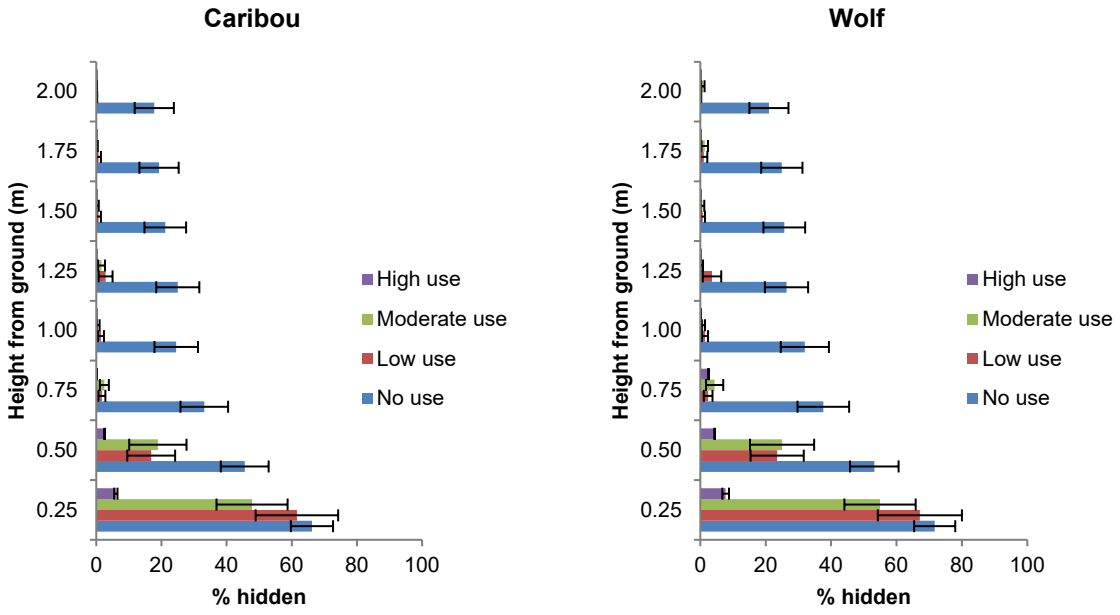


Figure 7.3-4E Visual Obstruction in Areas of Varying Degrees of Human Use



Note: The error bars are standard errors around the means.

7.3.2 Vegetation Recovery

Line Cut Before Versus After Fire

Areas burned before line creation had significantly higher shrub (3 m to 5 m) cover (P=0.02) and a strong trend towards higher shrub (1 m to 3 m) cover (P=0.17) in the reference compared to disturbed areas (Figure 7.3-5A). However, the average cover of lichens, mosses, and low shrubs were similar in reference and disturbed areas for areas burned before and after line creation. Also, areas that had burned after line creation had no significant difference in disturbed versus reference areas (Figure 7.3-5B), emphasizing the importance of fires for initiating regrowth on disturbed linear features.

Upland versus Lowland

Lowlands generally had higher moss and forb cover, and a lower lichen cover than uplands (Figure 7.3-6). This is likely due to site conditions (e.g., soil moisture) rather than as a result of disturbance since there were no significant differences between reference and disturbed areas for either the lowland or upland transects.

Young Forest versus Old Forest

There was a trend (P=0.062) towards higher cover of lichen in old forests compared to young forests regardless of disturbance levels (Figure 7.3-7). There was also a strong trend (P=0.055) for higher shrub cover (1 m to 3 m) in young forests, an indication that young forests are likely to recover faster than old forests post disturbance.

Figure 7.3-5A Vegetation Cover/ Stem Counts in Areas Burned Before Line was Created

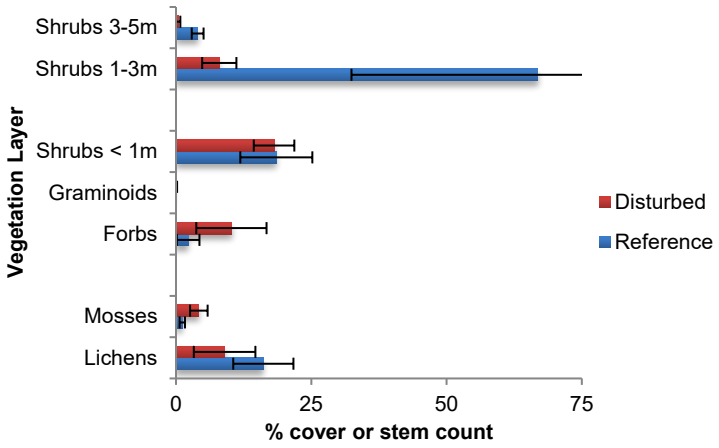
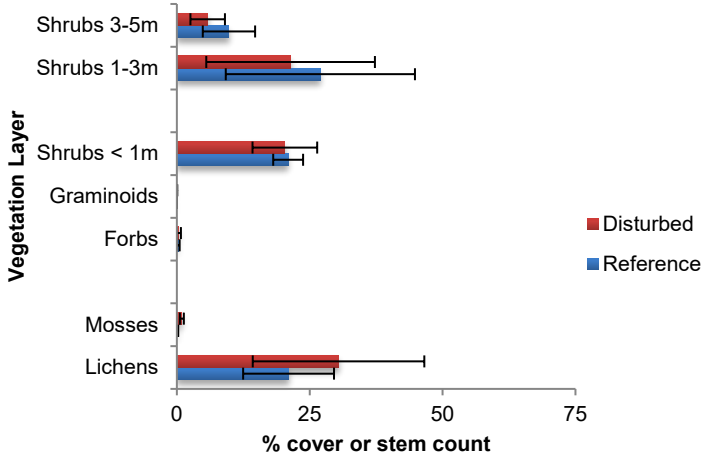
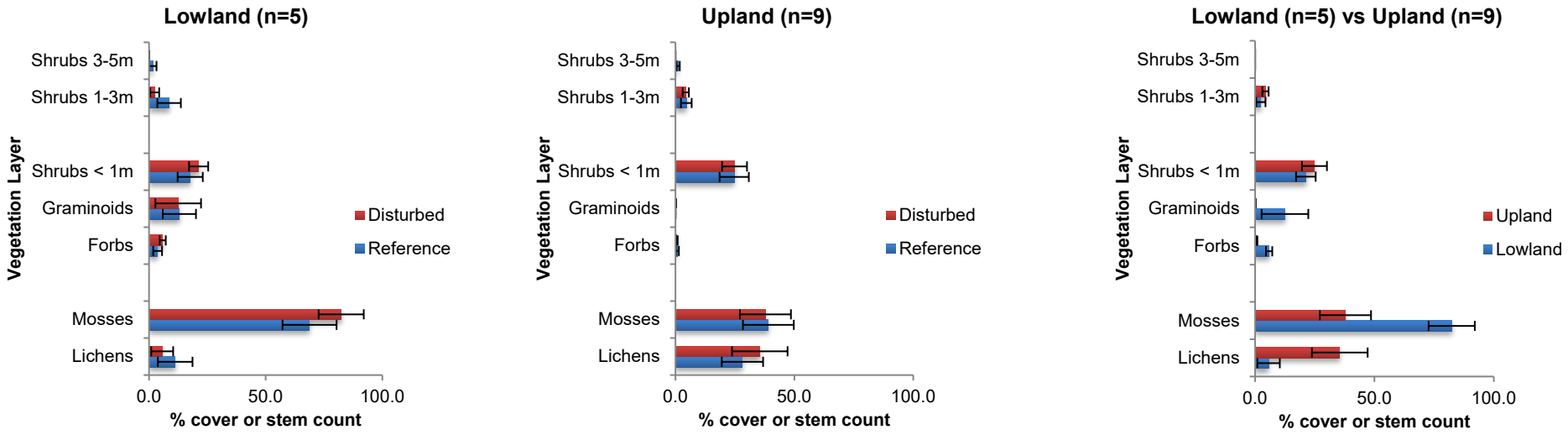


Figure 7.3-5B Vegetation Cover/ Stem Counts in Areas Burned After Line was Created



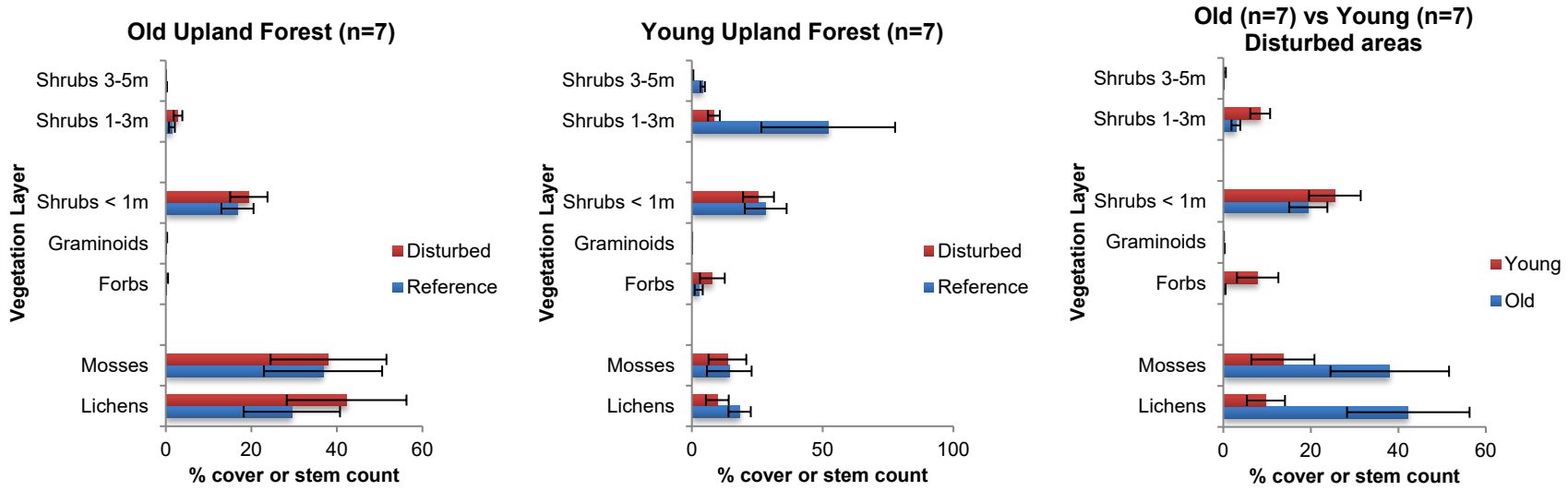
Note: 2-29 years since fire (n=5). Error bars are standard errors around the means.

Figure 7.3-6 Vegetation Recovery: Lowland (Bogs/Fens) versus Upland



Note: Error bars are standard errors around the means.

Figure 7.3-7 Vegetation Recovery: Old Forest versus Young Forest



Note: Error bars are standard errors around the means.

Level of Human Use

Similar to the analysis of visual obstruction, human use significantly affected vegetation regrowth. There was no significant difference between reference and disturbance for the no use areas. Moderate use areas had some regrowth in the shrub layers, and high use areas had minimal regrowth (Figure 7.3-8). This highlights the harmful effects on natural regrowth resulting from continued human use of disturbance features.

7.3.3 Tree Species Composition

Line Cut Before versus After Fire

Features that had burned after the line was created showed a higher abundance of jack pine (22[2]) than areas that had not burned after line creation (15), despite opposite abundance values for control areas (Table 7.3-2). This supports the findings of visual obstruction and vegetation regrowth that wildfire effects on trails and hand cuts, in absence of continued human use, substantially accelerate natural recovery. Further, this indicates that recovery post fire is similar on and off disturbances.

Upland versus Lowland

Both Lowland and Upland areas had a low abundance of tree species in disturbed areas (Table 7.3-3) indicating that, at the time of sampling, there was minimal natural recovery where no fire disturbance has occurred.

Young Forest versus Old Forest

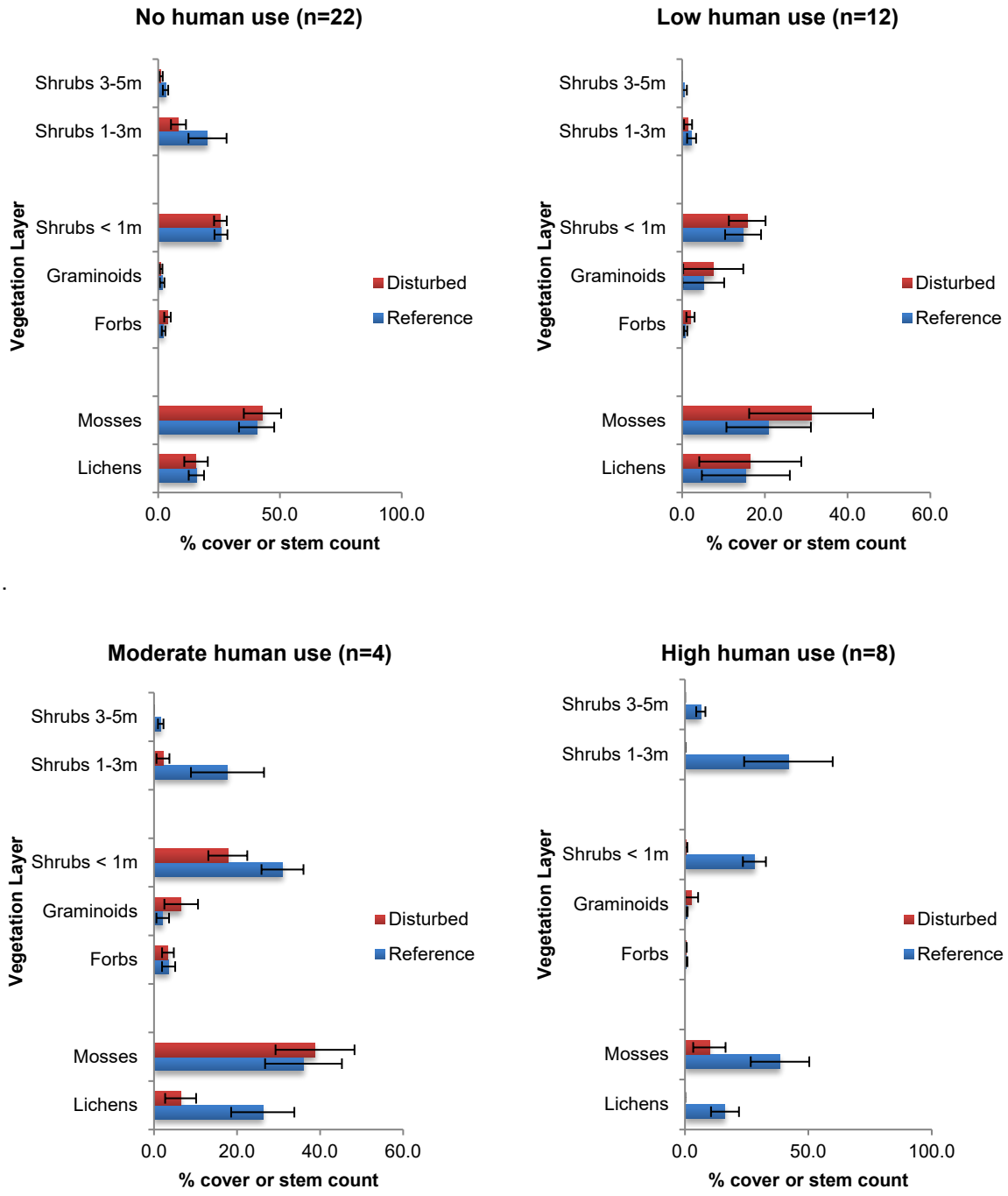
Both Old and Young areas had a low abundance of tree species in disturbed areas (Table 7.3-4) indicating that, at the time of sampling, there is minimal natural recovery in areas where no fire disturbance has occurred. Given the reproductive nature of the dominant upland conifer species (jack pine) and the necessity for disturbance by fire for serotinous cones, this result is not a surprise.

Level of Human Use

Areas with no, low, and moderate human had a much higher abundance of tree species regeneration compared to high use areas (Table 7.3-5). This highlights the deleterious effects of continued human use of disturbance features on natural regrowth.

[2] This is not a percent cover value, but a normalized relative abundance of each species compared to other species (values: 0-100).

Figure 7.3-8 Vegetation Recovery: Level of Human Use



Note: Error bars are standard errors around the means.

Table 7.3-2 Species (< 1 m tall) Ranking and Compositional Information: Areas Burned Before and After Line was Cut.

	Area burned before line was created 2-29 years since fire (n=5)	
Rank	Reference	Disturbed
1	Vaccmyr (83)	Vaccmyr (75)
2	Vaccvit (31)	Vaccvit (60)
3	Pinuban (30)	Rhodgro (29)
4	Alnucri (19)	Pinuban (15)
5	Rhodgro (16)	Vibuedu (11)
6	Betupap (4)	Alnucri (11)
7	Arctuva (3)	Rosaaci (10)
8		Betupap (7)
9		Ribegla (4)
10		Poputre (4)

Area burned after line was created 2-29 years since fire (n=5)	
Reference	Disturbed
Vaccmyr (100)	Vaccmyr (83)
Vaccvit (31)	Vaccvit (34)
Rhodgro (26)	Pinuban (22)
Arctuva (23)	Junihor (21)
Chamcal (17)	Chamcal (15)
Pinuban (15)	Rhodgro (15)
Alnucri (12)	Arctuva (6)

Coniferous tree species
Ericaceous shrub species
Deciduous shrub species

Note: Values in brackets show abundance of each species. This is not a percentage cover value, but a normalized relative abundance of each species compared to other species (values: 0-100). Species code details can be found in Appendix A.

Table 7.3-3 Species (< 1 m tall) Ranking and Compositional Information: Lowland & Upland.

	Lowland (n=5)	
Rank	Reference	Disturbed
1	Rhodgro (68)	Chamcal (75)
2	Chamcal (63)	Rhodgro (60)
3	Kalmpol (49)	Kalmpol (52)
4	Picemar (40)	Oxycmic (36)
5	Oxycmic (36)	Vaccvit (24)
6	Andrpol (20)	Picemar (20)
7	Vaccvit (18)	Andrpol (16)
8	Rhodtom (10)	Betupum (16)
9	Myriga (5)	Myriga (13)
10	Betupum (5)	Salibeb (8)

Upland (n=9)	
Reference	Disturbed
Vaccmyr (100)	Vaccmyr (91)
Vaccvit (87)	Vaccvit (87)
Rhodgro (54)	Rhodgro (52)
Alnucri (23)	Alnucri (20)
Arctuva (12)	Pinuban (9)
Kalmpol (11)	Picemar (8)
Chamcal (9)	Arctuva (5)
Picemar (2)	Salisco (5)
	Kalmpol (2)

Coniferous tree species
Ericaceous shrub species
Deciduous shrub species

Note: Values in brackets show abundance of each species. This is not a percentage cover value, but a normalized relative abundance of each species compared to other species (values: 0-100). Species code details can be found in Appendix A.

Table 7.3-4 Species (< 1 m tall) Ranking and Compositional Information: Old and Young Forest.

	Old Upland Forest (n=7)	
Rank	Reference	Disturbed
1	Vaccmyr (100)	Vaccvit (93)
2	Vaccvit (99)	Vaccmyr (88)
3	Rhodgro (42)	Rhodgro (53)
4	Arctuva (15)	Alnucri (13)
5	Alnucri (15)	Picemar (10)
6	Picemar (3)	Pinuban (9)
7		Arctuva (6)
8		Salisco (6)
9		
10		

Young Upland Forest (n=7)	
Reference	Disturbed
Vaccmyr (98)	Vaccmyr (91)
Rhodgro (42)	Vaccvit (87)
Vaccvit (40)	Rhodgro (52)
Alnucri (30)	Alnucri (20)
Pinuban (24)	Pinuban (9)
Kalmpol (15)	Vibuedu (8)
Chamcal (12)	Rosaaci (5)
Betupap (3)	Betupap (5)
Arctuva (3)	Ribegla (2)

Coniferous tree species
Ericaceous shrub species
Deciduous shrub species

Note: Values in brackets show abundance of each species. This is not a percentage cover value, but a normalized relative abundance of each species compared to other species (values: 0-100). Species code details can be found in Appendix A.

Table 7.3-5 Species (< 1 m tall) Ranking and Compositional Information: Level of Human Use.

Rank	No Human Use (n=28)	
	Reference	Disturbed
1	Vaccmyr (76)	Vaccmyr (70)
2	Rhodgro (64)	Vaccvit (63)
3	Vaccvit (56)	Rhodgro (62)
4	Chamcal (54)	Chamcal (46)
5	Kalmpol (30)	Kalmpol (26)
6	Oxycmic (26)	Oxycmic (26)
7	Picemar (20)	Picemar (17)
8	Rhodtom (16)	Pinuban (14)
9	Alnucri (16)	Rhodtom (13)
10	Andrpol (14)	Andrpol (12)

Low Human Use (n=7)	
Reference	Disturbed
Rhodgro (100)	Rhodgro (88)
Vaccmyr (51)	Chamcal (52)
Vaccvit (51)	Vaccvit (48)
Chamcal (45)	Kalmpol (41)
Kalmpol (26)	Vaccmyr (41)
Oxycmic (13)	Picemar (24)
Picemar (13)	Oxycmic (20)
Arctuva (12)	Myriga (12)
Alnucri (7)	Betupum (8)
Myriga (4)	Salibeb (8)

Moderate Human Use (n=13)	
Reference	Disturbed
Rhodgro (79)	Chamcal (70)
Chamcal (58)	Rhodgro (61)
Vaccvit (46)	Picemar (52)
Vaccmyr (42)	Kalmpol (36)
Oxycmic (40)	Oxycmic (31)
Picemar (39)	Vaccmyr (26)
Pinuban (17)	Vaccvit (18)
Arctuva (15)	Andrpol (16)
Betupum (13)	Salibeb (12)
Kalmpol (9)	Betupap (11)

High Human Use (n=12)	
Reference	Disturbed
Vaccmyr (91)	Chamcal (12)
Vaccvit (89)	Rhodgro (10)
Pinuban (44)	Salibeb (5)
Rhodgro (43)	Vaccvit (4)
Chamcal (29)	Vaccmyr (3)
Arctuva (23)	Betupap (3)
Oxycmic (22)	Kalmpol (2)
Picemar (15)	Oxycmic (2)
Kalmpol (12)	Andrpol (0)
Alnucri (9)	Arctuva (0)

Coniferous tree species
Ericaceous shrub species
Deciduous shrub species

Note: Values in brackets show abundance of each species. This is not a percentage cover value, but a normalized relative abundance of each species compared to other species (values: 0-100). Species code details can be found in Appendix A.

7.3.4 Key Findings

- Wildfires (in absence of continued human use), can substantially accelerate natural regeneration of trails and hand cuts, and instigate a post fire recovery that is more similar on and off disturbance features than in the absence of fire.
- Natural vegetation recovery of tree/shrub height and abundance on disturbed features is somewhat greater in lowland habitats.
- Human use is an important factor affecting natural vegetation regrowth. Eliminating Access to trails could enhance natural recovery.
- Results indicate that natural vegetation recovery on disturbances is lower in mature upland habitats.

8.0 SUMMARY

The Rook I Project (Project) is a proposed new uranium mining and milling operation that is 100% owned by NexGen Energy Ltd. (NexGen). The Project is located in northwestern Saskatchewan, approximately 40 km east of the Alberta-Saskatchewan border, 130 km north of the town of La Loche, and 640 km northwest of the city of Saskatoon.

Omnia Ecological Services collected terrestrial (wildlife and vegetation resources) baseline data in support of the proposed development of the Project.

The objectives of the Omnia terrestrial baseline surveys were to, using available peer reviewed research and applicable professional protocols:

- characterize the existing terrestrial environment in the region (natural and anthropogenic elements);
- inform environmental effects and technical assessments;
- ensure the baseline studies meet all provincial and federal regulatory requirements for the effects assessment;
- capture information from community engagements and stakeholder considerations;
- establish a framework to facilitate future environmental effects monitoring; and
- support the development of project specific mitigation strategies.

This report documents and summarizes baseline (current) anthropogenic and natural disturbance, ecosite characterization, and a linear feature natural regeneration assessment based on data obtained during field programs completed in 2018 and 2019.

The Omnia terrestrial baseline surveys were established using three nested study areas to guide effects assessments of Project-specific and cumulative impacts on potential wildlife valued components (VC) including: a local study area (LSA); a regional study area (RSA); and a caribou regional study area (CRSA).

Using the refined anthropogenic disturbance map product (unbuffered), the total amount of anthropogenic disturbance was 0.8 km^2 (2.0%) in the LSA and 2.1 km^2 (0.5%) in the RSA. Industrial clearings, rough roads, and right-of-ways (ROW) were the most common anthropogenic disturbance types in the LSA. A comparison of the refined anthropogenic disturbance mapping versus the unbuffered EC (2012a) linear feature data set found the refined LSA map had a linear feature density 8.3 times higher than the EC (2012a) data set. Comparatively, the refined RSA anthropogenic map had a linear feature density that was 7.6 times greater than EC (2012a). Refined anthropogenic mapping indicated five linear feature types (road, rough road, trail, cutline, and ROW) in the LSA and RSA, while the EC (2012a) data set only detected one type (road). This difference was as a result of the approach and scale (1:30,000) of the mapping completed by EC (2012a).

Based on Saskatchewan Ministry of Environment mapping, a total of 19 fires have occurred in the Project CRSA since 1945. The age of these fires ranges from recent (2018) to 51 years. In the terrestrial part of the LSA, RSA, and CRSA, 85.9%, 90.4%, and 94.3%, respectively, has burned in the last 40 years.

Predictive Ecosite Mapping data was obtained from the Saskatchewan Technical Branch, however the mapping does not describe land cover types less than 40 years old. Therefore, an Interpreted ecosite Map was created. The accuracy of the resulting ecosite map, taking into consideration the newly created regenerating forest ecosite types, was 80.2%, and included 27 different ecosite classifications.

A detailed description of each sampled ecosite type is provided in the form of a two-page fact sheet. The first page of the fact sheet contains information about species composition and vegetation layers. The second page provides information about structural attributes and ratings as well as biodiversity information and ecosite supply in the RSA.

For the linear feature natural regeneration assessment program, the key findings were:

- Wildfires (in absence of continued human use), can substantially accelerate natural regeneration of trails and hand cuts, and instigate a post fire recovery that is more similar on and off disturbance features than in the absence of fire. Natural vegetation recovery of tree/shrub height and abundance on disturbed features is somewhat greater in lowland habitats.
- Human use is an important factor affecting natural vegetation regrowth. Access to trails limits natural recovery in some areas.
- Results indicate that natural vegetation recovery on disturbances is lower in mature upland habitats.

9.0 REFERENCES

Acton, D.F., Padbury, G.A., Stushnoff, C.T., Gallagher, L., Gauthier, D., Kelly, L., Radenbaugh, T., and Thorpe, J. 1998. The ecoregions of Saskatchewan. Saskatchewan Environment and Resource Management, Canadian Plains Research Center, University of Regina, Regina, Sask.

British Columbia Ministry of Forests. 1998. Field manual for describing terrestrial ecosystems. B. C. Ministry of Environment, Lands, and Parks. B. C. Ministry of Forests, Land Management Handbook Number 25. ISSN 0229-1622.

Charlebois, M.L., Skatter, H.G., Kansas, J.L., and Crouse, D.P. 2015. Using LiDAR, Colour Infrared Imagery, and Ground Truth Data for Mapping and Characterizing Vegetation Succession on Disturbance Types: Implications for Woodland Caribou (*Rangifer tarandus caribou*) Habitat Management. Canadian Wildlife Biology and Management. 4(2): 119-136.

Council on Environmental Quality. 1993. Incorporating biodiversity considerations into environmental impact analysis under the National Environmental Policy Act. Council on Environmental Quality, Executive Office of the President. Washington, D.C. 29 pp.

Cristescu, B., G.B. Stenhouse, M. Symbaluk, S.E. Nielsen, and M.S. Boyce. 2016. Wildlife habitat selection on landscapes with industrial disturbance. Environmental Conservation. 43(4), pp. 327-336.

DeMars, C.A. and Boutin, S. 2017. Nowhere to hide: Effects of linear features on predator–prey dynamics in a large mammal system. Journal of Animal Ecology, 87(1), pp. 274-284.

Dickie, M., R. Serrouya, C. DeMars, J. Cranston, and S. Boutin. 2017. Evaluating functional recovery of habitat for threatened woodland caribou. Ecosphere 8(9):e01936. 10.1002/ecs2.1936.

Environment Canada (EC). 2012a. Anthropogenic disturbance footprint within boreal caribou ranges across Canada - As interpreted from 2008-2010 Landsat satellite imagery Updated to 2012 range boundaries. https://open.canada.ca/data/en/dataset/890a5d8d-3dbb-4608-b6ce-3b6d4c3b7dce.

Environment Canada (EC). 2012b. Recovery strategy for the woodland caribou (Rangifer tarandus caribou), Boreal population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Gatineau, Que.

Environment and Climate Change Canada (ECCC). 2015. 2015 - Anthropogenic disturbance footprint within boreal caribou ranges across Canada - As interpreted from 2015 Landsat satellite imagery. http://data.ec.gc.ca/data/species/developplans/2015-anthropogenic-disturbance-footprint-within-boreal-caribou-ranges-across-canada-as-interpreted-from-2015-landsat-satellite-imagery/.

Environment and Climate Change Canada (ECCC). 2018. Amended Recovery Strategy for the Woodland Caribou (Rangifer tarandus caribou), Boreal Population, in Canada. DRAFT. 18 pp.

Henkleman, J. and Johnstone, J. (Northern Plant Ecology Lab, Department of Biology, University of Saskatchewan). 2017. Predictive Ecosite Map for the Boreal Shield. Pre-release version 0.1. Data provided by the Saskatchewan Ministry of Environment.

James, A.R.C., S. Boutin, D.M. Hebert, and A.B. Rippin. 2004. Spatial separation of caribou from moose and its relation to predation by wolves. J. Wildl. Manage. 68(4): 799–809.

Jones, D. 2018. Geomatics Services Branch, Ministry of Environment and Ministry of Saskatchewan Environment, Wildfire Management Branch.

Kansas, J.L., Vargas, J., Skatter, H.G., Balicki, B., and McCullum K. 2016. Using Landsat imagery to backcast fire and post-fire residuals in the Boreal Shield of Saskatchewan – Implications for woodland caribou management. International Journal of Wildland Fire. 25(5) 597-607.

Kimmins, H. 1997. Balancing Act: Environmental issues in forestry. 2nd Edition. UBC Press, Vancouver, BC. 305pp.

Latham, A.D.M, M.C. Latham, and M.S. Boyce. 2011a. Habitat Selection and Spatial Relationships of Black Bear (Ursus americanus) with Woodland Caribou (Ranifer tarandus caribou) in Northeastern Alberta. Canadian Journal of Zoology 89: 267-277.

Latham, A. D. M., M. C. Latham, M. S. Boyce, and S. Boutin. 2011b. Movement responses by wolves to industrial linear features and their effect on woodland caribou in northeastern Alberta. Ecological Applications 21:2854–2865.

Lee, P.C, S. Crites, and J.B. Stelfox. 1995. Changes in forest structure and floral composition in a chronosequence of aspen mixedwood stands in Alberta. Pp. 29-48. *In* Relationships between stand age, stand structure, and biodiversity in aspen mixedwood forests in Alberta. J.B. Stelfox (editor). Alberta Environmental Centre and Canadian Forest Service, Edmonton, AB.

Lillesand, T.M. and R.W. Kiefer. 2000. Remote sensing and image interpretation. 4th edition. John Wiley & Sons, Inc.

McLaughlan, M.S., R.A. Wright and R.D. Jiricka. 2010. Field guide to the Ecosites of Saskatchewan's provincial forests. Saskatchewan Ministry of Environment, Forest Service. Prince Albert, Saskatchewan. 338pp.

McLoughlin, P.D., Stewart, K., Superbie, C., Perry, T., Tomchuk, P., Greuel, R., Singh, K., Truchon-Savard, A., Henkelman, J., and Johnstone, J.F. 2016. Population dynamics and critical habitat of woodland caribou in the Saskatchewan Boreal Shield. Interim Project Report, 2013–2016. Department of Biology, University of Saskatchewan, Saskatoon.

Meffe, G.K., C.R. Carroll and contributors. 1997. Principles of conservation biology 2nd edition. Sinauer Associates, Inc. Sunderland, MA. 729 pp.

Natural Resources Canada (NRCAN). 2017. CanVec Product Specifications., Natural Resources Canada, Earth Sciences Sector , Canada Centre for Mapping and Earth Observation
GeoGratis Client Services. 20pp.

Noss, R.F. 1990. Indicators for monitoring biodiversity: a hierarchical approach. Conservation Biology Vol.4 No. 4:355-364.

Nudds, T.D. 1977. Quantifying the vegetative structure of wildlife cover. Wildlife Society Bulletin. 5:113-117.

Saskatchewan Ministry of Environment (ENV) 2018. Hunting, Angling and Biodiversity Information of Saskatchewan (HABISask). Fish, Wildlife and Lands Branch. 3211 Albert Street, Regina, Saskatchewan. http://www.biodiversity.sk.ca/HABISask.htm.

Shannon, C. E. 1948. A mathematical theory of communication. The Bell System Technical Journal, 27, 379–423 and 623–656.

Skatter, H.G., Kansas, J.L., Charlebois, M.L., and Balicki, B. 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. 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 use of residual patches for calving in a high fire/low anthropogenic Boreal Shield of Saskatchewan. Canadian Journal of Zoology. 95: 975-984.

Tigner, J., E. M. Bayne and S. Boutin. 2014. Black bear use of seismic lines in Northern Canada. The Journal of Wildlife Management 78 (2): 282-292.

10.0 APPENDICES

Appendix A

Appendix A. Species Observations during Plant Structural Diversity, Species Richness Assessment and Ecosite Characterization Survey.

Scientific Name	Common Name	Species Code	SKCDC Rank
Trees			
Betula papyrifera	Paper birch	Betupap	
Larix laricina	Tamarack	Larilar	
Picea glauca	White spruce	Picegla	
Picea mariana	Black spruce	Picemar	
Pinus banksiana	Jack pine	Pinuban	
Populus balsamifera	Balsam poplar	Popubal	
Populus tremoloides	Trembling aspen	Popultre	
Shrubs			
Alnus crispa	Green alder	Alnucri	
Alnus rugosa	River alder	Alnurug	
Andromeda polifolia	Bog rosemary	Andrpol	
Arctostaphylos uva-ursi	Common bearberry	Arctuva	
Betula glandulosa	Bog birch	Betugla	
Betula pumila	Dwarf birch	Betupum	
Chamaedaphne calycaluta	Leatherleaf	Chamcal	
Kalmia polifolia	Bog laurel	Kalmpol	
Linnea borealis	Twinflower	Linnbor	
Myrica gale	Sweet gale	Myrigal	
Oxycoccus microcarpus	Small bog cranberry	Oxycmic	
Rhododendron tomentosum	Northern Labrador tea	Rhodtom	
Rhododendron groenlandicum	Labrador tea	Rhodgro	
Ribes glandulosum	Skunk currant	Ribegla	
Ribes hudsonianum	Northern black currant	Ribehud	
Ribes oxyacanthoides	Wild gooseberry	Ribeoxy	
Ribes triste	Wild red currant	Ribetri	
Rubus acaulis	Dwarf raspberry	Rubuaca	
Rubus idaeus	Raspberry	Rubuida	
Salix bebbiana	Bebb's willow	Salibeb	
Salix candida	Hoary willow	Salican	
Salix myrtillifolia	Billberry willow	Salimyr	
Salix pedicellaris	Bog willow	Saliped	
Salix planifolia	Diamondleaf willow	Salipla	
Salix scouleriana	Scouler's willow	Salisco	
Salix serissima	Autumn willow	Saliser	
Salix sp.	Unknown willow	Sali sp.	
Vaccinium myrtilloides	Blueberry	Vaccmyr	
Vaccinium vitis-idaea	Bog cranberry	Vaccvit	

Appendix A cont.

Forbs			
Aralia nudicaulis	Wild sarsaparilla	Aralnud	
Athyrium filix-femina ssp. angustatum	Subarctic ladyfern	Athyang	S3
Calla palustris	Wild calla lilly	Callpal	
Caltha palustris	Marsh marigold	Caltpal	
Cerastium sp.	-	Cera sp.	
Cornus canadensis	Bunchberry	Corncan	
Drosera anglica	Angle-leaved sundew	Drosang	S3
Drosera rotundifolia	Round-leaved sundew	Drosrot	
Epilobium angustiflorum	Fireweed	Epilang	
Epilobium glaberrimum	Glaucus willowherb	Epilgla	
Epilobium palustre	Marsh willowherb	Epilpal	
Epilobium sp.	-	Epil sp.	
Equisetum fluviatile	Water horsetail	Equiflu	
Equisetum sylvaticum	Woodland horsetail	Equisyl	
Fragaria vesca	Woodland strawberry	Fragves	
Fragaria virginiana	Wild strawberry	Fragvir	
Galium trifidum	Threepetal bedstraw	Galitri	
Geocaulon lividum	Bastard toadflax	Geocliv	
Hippuris vulgaris	Common mare's-tail	Hippvul	
Lemna minor	Lesser duckweed	Lemnmin	S1
Lycopodium annotinum	Stiff clubmoss	Lycoann	
Lycopodium complanatum	Ground cedar	Lycocom	
Maianthemum canadense	Wild lily-of-the-valley	Maiacan	
Melampyrum lineare	Cow wheat	Melalin	
Menyanthes trifoliata	Buckbean	Menytri	
Potentilla norvegica	Rough cinquefoil	Potenor	
Potentilla palustris	Swamp cinquefoil	Potepal	
Potentilla tridentata	Three-toothed cinquefoil	Potetri	
Pyrola secunda	One-sided pyrola	Pyrosec	
Rubus arcticus ssp. acaulis	Dwarf raspberry	Rubuaca	
Rubus chamaemorus	Cloudberry	Rubucha	
Rubus pubescens	Running raspberry	Rubupub	
Rumex orbiculatus	Water dock	Rumeorb	

Appendix A cont.

Forbs cont.			
Scheuchzeria palustris	Scheuchzeria	Schepal	
Scutellaria galericulata	Marsh skullcap	Scutgal	
Smilacina trifolia	Three-leaved Solomon's seal	Smiltri	
Symphyotrichum sp.	-	Symp sp.	
Unknown forb	Unknown forb	Unk forb	
Utricularia intermedia	Flatleaf bladderwort	Utriint	
Viola renifolia	Kidney-leaved violet	Violren	
Viola sp	Violet sp.	Viol sp.	
Graminoids			
Agrostis scabra	Rough bentgrass	Agrosca	
Calamagrostis canadensis	Blue-joint grass	Calacan	
Carex aquatilis	Water sedge	Careaqu	
Carex brunnescens	Short sedge	Carebru	
Carex concinna	Low northern sedge	Carecon	S3
Carex disperma	Two-seeded sedge	Caredis	
Carex foenea	Hay Sedge	Carefoe	
Carex hookerana	Hooker's Sedge	Carehoo	
Carex limosa	Mud sedge	Carelim	
Carex rostrata	Beaked sedge	Careros	
Carex sp.	Sedge sp.	Care sp.	
Carex utriculata	Northwest territory sedge	Careutr	
Eriophorum scheuchzeri	White cotton grass	Eriosch	S2
Eriophorum vaginatum	Sheated cottongrass	Eriovag	
Festuca rubra	Red fescue	Festrub	
Juncus nodosus var. nodosus	Knotted Rush	Juncnod	
Oryzopsis pungens	Northern rice grass	Oryzpun	
Scirpus lacustris	Common Great Bulrush	Scrilac	
Unknown graminoid	Unknown graminoid	Unk gram	
Mosses			
Calliergon giganteum	Giant calliergon moss	Callgig	
Cinclidium stygium	Lurid cupola moss	Cincsty	
Dicranum fuscum	Dicranum moss	Dicrfus	
Dicranum polysetum	Cushion moss	Dicrpol	
Dicranum scoparium	Broom fork moss	Dicrsco	
Dicranum sp.	Broom moss	Dicr sp.	
Drepanocladus aduncus	Drepanocladus moss	Drepadu	
Drepanocladus unciatus	Brown moss	Drepunc	

Appendix A cont.

Mosses cont.			
Hylocomium splendens	Stair-step moss	Hylospl	
Hypnum revolutum	Revolute hypnum moss	Hypnrev	
Jamesoniella autumnalis	Waldo Lake liverwort	Jameaut	S3
Jungermannia sp.	-	Jung sp.	
Lepidozia reptans	Creeping Fingerwort	Lepirep	S3
Leptodictyum sp.	-	Lept sp.	
Lophozia ventricosa	Lophozia liverwort	Lophven	S3
Marchantia polymorpha	Green-tongue Liverwort	Marcpol	
Meesia longiseta	Meesia moss	Meeslon	
Meesia triquetra	Three-ranked humpmoss	Meestri	
Mylia anomala	Anomalous flapwort	Myliano	S3
Plagiomnium ellipticum	Elliptic plagiomnium moss	Plagell	
Plagiomnium sp.	Leafy moss	Plag sp.	
Pleurozium schreberi	Schreber's moss	Pleusch	
Polytrichum juniperinum	Juniper hair-cap	Polyjun	
Polytrichum piliferum	Hair-cap moss	Polypil	
Ptilidium ciliare	Ptilidium liverwort	Ptilcil	
Ptilidium pulcherrimum	Naugehyde liverwort	Ptilpul	S3
Ptilium crista castrensis	Knight's plume moss	Ptilcas	
Sanionia uncinata	Sickle-leaved Hook Moss	Saniunc	
Scorpidium revolvens	Limprichtia Moss	Scorrev	
Sphagnum angustifolium	Poor Fen Peat Moss	Sphaang	
Sphagnum capillifolium	Acute-leaved Peat Moss	Sphacap	
Sphagnum fuscum	Rusty Peat Moss	Sphafus	
Sphagnum girgensohnii	Girgensohn's Peat Moss	Sphagir	
Sphagnum jensenii	Jensen's sphagnum	Sphajen	
Sphagnum magellanicum	Midway Peat Moss	Sphamag	
Sphagnum riparium	Shore-growing Peat Moss	Spharip	
Sphagnum teres	Thin-leafed peat moss	Sphater	
Straminergon stramineum	Straw-coloured Water Moss	Strastr	
Tomenthypnum nitens	Golden moss	Tomenit	
Unknown moss	Unknown moss	Unk moss	

Appendix A cont.

Lichens			
Arctoparmelia centrifuga	Concentric ring lichen	Arctcen	S2
Cetraria ericetorum	Iceland lichen	Cetreri	S3
Cetraria islandica	True Iceland lichen	Cetrisl	S3
Cladina mitis	Green reindeer lichen	Cladmit	
Cladina rangiferina	Gray reindeer lichen	Cladran	
Cladina stellaris	Star-tipped reindeer lichen	Cladste	
Cladonia sp.	Cladonia lichen	Clad sp.	
Cladonia borealis	Boreal pixie-cup	Cladbor	S3
Cladonia botrytes	Wooden soldiers	Cladbot	
Cladonia cariosa	Split-peg lichen	Cladcar	
Cladonia cenotea	Powdered funnel lichen	Cladcen	S3
Cladonia coniocraea	Common powderhorn	Cladcon	S2
Cladonia cornuta	Bighorn cladonia	Cladcor	
Cladonia crispata	Organ-pipe lichen	Cladcrisp	S3
Cladonia cristatella	British soldiers	Cladcrist	S3
Cladonia deformis	Lesser sulphur-cup	Claddef	S3
Cladonia gracilis spp. turbinata	Smooth cladonia	Cladtur	
Cladonia pleurota	Red-fruited pixie-cup	Cladple	S2
Cladonia sulfurina	Greater sulphur-cup	Cladsul	S2
Cladonia uncialis	Thorn cladonia	Caldunc	
Flavocetraria nivalis	Crinkled snow lichen	Flavniv	S3
Icmadophila ericetorum	Candy lichen	Icmaeri	
Parmeliopsis ambigua	Green starburst lichen	Parmamb	S3
Parmeliopsis hyperopta	Gray starburst lichen	Parmhyp	S3
Peltigera aphthosa	Common freckle pelt	Peltaph	S2
Peltigera malacea	Apple Pelt	Peltmal	S3
Peltigera neopolydactyla	Carpet pelt	Peltneo	
Rhizocarpon geographicum	Green Map Lichen	Rhizgeo	S2
Stereocaulon tomentosum	Woolly foam lichen	Stertom	
Vulpicida pinastri	Powdered sunshine lichen	Vulppin	

Appendix B

Appendix B. Transect Details for the Linear Feature Natural Regeneration Assessment

Transect #	Easting	Northing	Feature Type	Ecosite	Landcover Type	Age (years since fire)	Age Group	Burned after line was cut?	Human Use Class
1	605004	6388177	Trail	BP3	Upland	61-70	old	no	0
2	603690	6387686	Cutline	BP14	Upland	71-80	old	no	1
3	603419	6387392	Cutline	RF2-C	Upland	21-30	young	yes	0
4	603181	6386798	Cutline	BP2	Upland	71-80	old	no	0
5	602087	6387691	Trail	RF2-C	Upland	21-30	young	no	4
6	601496	6388211	Road	BP3	Upland	81-90	old	no	5
7	610926	6396181	Trail	RF4	Upland	1-10	young	yes	2
8	610162	6395003	Cutline	RF4-bog	Lowland	1-10	young	yes	1
9	609922	6394297	Cutline	RF4-bog	Lowland	1-10	young	yes	1
10	608758	6396381	Handcut	RF4-upland	Upland	1-10	young	yes	0
11	603826	6396722	Road	BP3	Upland	101-110	old	no	4
12	600867	6396763	Handcut	RF1-C	Upland	31-40	young	no	0
13	597033	6396087	Road	RF1-C	Upland	31-40	young	no	5
14	595517	6391514	Trail	BP2	Upland	31-40	young	no	3
15	595030	6388782	Handcut	RF2-C	Upland	21-30	young	no	0
16	594999	6388559	Trail	RF2-C	Upland	21-30	young	no	4
17	594699	6388909	Handcut	BP24	Lowland	N/A	-	no	0
18	594303	6388776	Handcut	BP20	Lowland	N/A	-	no	0
19	593464	6387462	Handcut	RF1-D	Upland	21-30	young	no	0
20	597709	6387422	Handcut	RF2-B	Lowland	21-30	young	yes	0
21	608401	6387516	Trail	BP26	Lowland	41-50	old	yes	2
22	608349	6387319	Trail	BP23	Lowland	81-90	old	no	2
23	608182	6386969	Trail	BP19	Lowland	91-100	old	no	2
24	608097	6384029	Trail	RF2-C	Upland	31-40	young	no	3
25	607642	6385417	Handcut	BP19	Lowland	61-70	old	no	0
26	607278	6386327	Handcut	BP21	Lowland	61-70	old	no	0
27	607337	6386271	Handcut	RF4-treed bog	Lowland	1-10	young	yes	0
28	607340	6386261	Trail	RF4-treed bog	Lowland	1-10	young	yes	1
29	595862	6389815	Handcut	BP20	Lowland	N/A	-	no	0
30	596048	6389897	Handcut	BP20	Lowland	61-70	old	no	0
31	593964	6383483	Trail	RF2-C	Upland	21-30	young	no	4
32	597082	6384081	Road	RF2-C	Upland	21-30	young	no	5
33	597032	6380073	Road	RF2-C	Upland	21-30	young	no	5
34	599423	6385550	Trail	BP26	Lowland	31-40	young	no	1
35	599768	6385158	Trail	RF2-bog	Lowland	21-30	young	no	2
36	603372	6391731	Trail	RF2-bog	Lowland	21-30	young	yes	4
37	603262	6393659	Trail	BP23	Lowland	81-90	old	no	4
38	603659	6393997	Handcut	BP14	Upland	91-100	old	no	0
39	602486	6390678	Trail	RF1-D	Upland	21-30	young	no	2
40	602532	6390665	Handcut	RF1-D	Upland	21-30	young	no	0
41	605184	6389768	Trail	RF2-bog	Lowland	21-30	young	yes	3
42	603621	6388578	Handcut	RF1-C	Upland	21-30	young	no	1
43	599229	6386410	Road	RF2-C	Upland	21-30	young	no	5
44	598968	6387236	Handcut	RF2-C	Upland	21-30	young	no	0
45	607312	6389460	Cutline	BP19	Lowland	91-100	old	yes	0
46	607009	6389679	Cutline	BP12	Upland	81-90	old	no	0
47	606954	6389790	Handcut	BP19	Lowland	61-70	old	no	0
48	607445	6389338	Cutline	RF4-treed bog	Lowland	1-10	young	yes	0
49	607578	6389124	Cutline	RF4-upland	Upland	1-10	young	yes	0
50	606305	6390473	Cutline	RF2-bog	Lowland	21-30	young	yes	0
51	605905	6390770	Cutline	RF2-bog	Lowland	21-30	young	yes	2
52	605749	6390913	Cutline	BP19	Lowland	101-110	old	no	2
53	605514	6391131	Cutline	RF2-bog	Lowland	21-30	young	yes	2
54	605370	6391263	Cutline	RF2-C	Upland	21-30	young	yes	0
55	600919	6396973	Cutline	RF1	Upland	31-40	young	no	0
56	601668	6398210	Handcut	BP2	Upland	91-100	old	no	0
57	595059	6391533	Trail	RF1-C	Upland	21-30	young	no	3
58	595864	6391813	Cutline	RF1-C	Upland	21-30	young	yes	0
59	595715	6391699	Cutline	BP2	Upland	81-90	old	no	1
60	605233	6390677	Road	BP19	Lowland	71-80	old	no	5

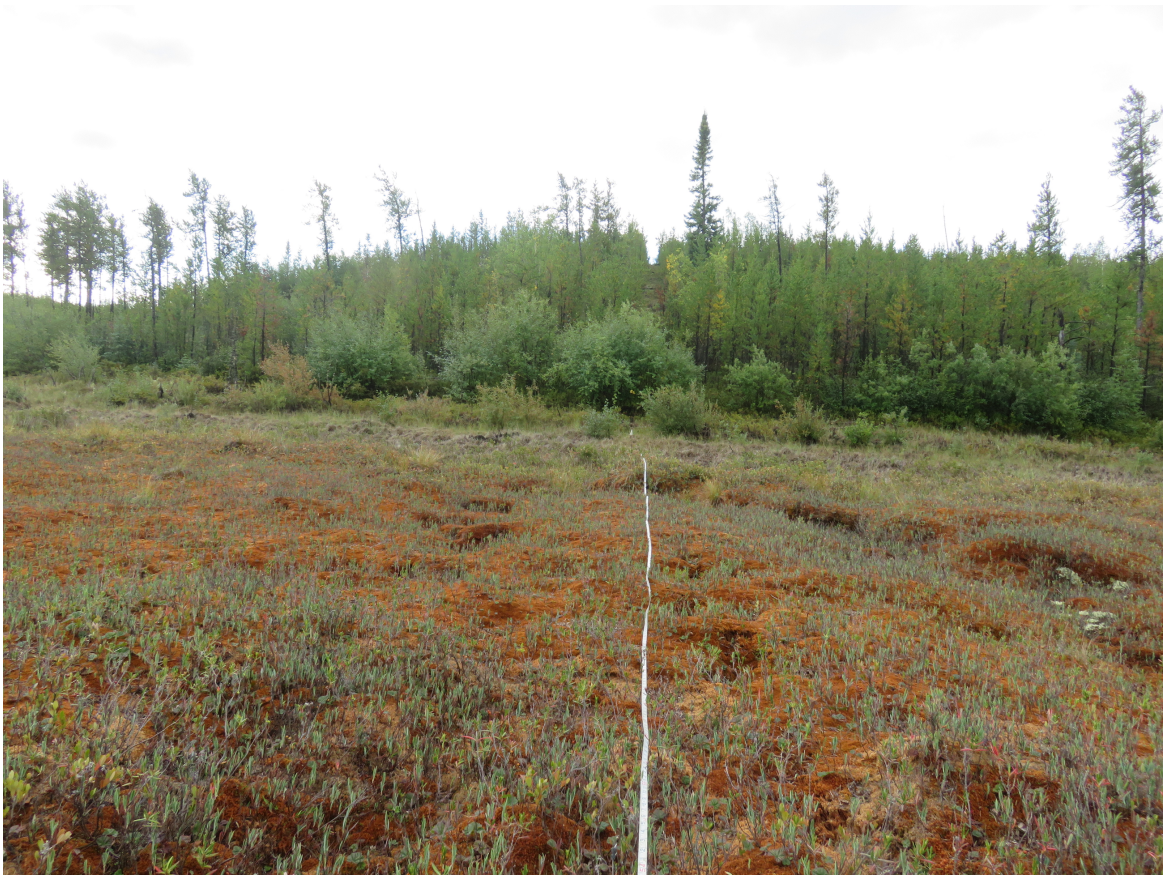
Appendix C

Appendix C. Example Photos from the Linear Feature Natural Regeneration Assessment.

Photograph 7.2-1. Area burned after line creation.

Photograph 7.2-2. Area burned before line creation.

Photograph 7.2-3. Mature upland.



Photograph 7.2-4. Lowland (bog).

Photograph 7.2-5. No human use (0).

Photograph 7.2-6. Low human use (1).

Photograph 7.2-7. Low/Moderate human use (2).

Photograph 7.2-8. Moderate human use (3).

Photograph 7.2-9. Moderate/High human use (4).

Photograph 7.2-10. High human use (5).