Regional Forest Landscape Assessment

North Saskatchewan Region

Prepared for:

Forest Management Branch
Alberta Environment and Sustainable Resource Development

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EXECUTIVE SUMMARY

The North Saskatchewan Region is one of the seven land-use regions defined in Alberta's Land-use Framework. It spans the central portion of the province from border to border, and includes the North Saskatchewan River watershed.

The majority of the Region is cultivated land. Forest land, identified from suitable inventories, covers only 18% of the Region. The majority of the forest land is west of Highway 22 which runs north-south through the Region at about 115^{o}W longitude. Over the remaining 82% there is significant urban development along with associated transportation infrastructure (roads and railways).

The forested area of the Region is managed under four Forest Management Agreement Areas, which are primarily conifer focused. The Crown-managed forest management units along the Green/White Area boundary are large in area, but there are no published allowable harvest volumes. Conventional well sites and pipelines are abundant, primarily in the White Area.

Banff National Park makes up 8% of the area of the Region and provides expansive landscapes of undisturbed forest. The Park provides recreation and tourism opportunities in addition to the variety of other provincial parks, wildland and recreation areas throughout the Region. A second national park, Elk Island National Park also provides recreational opportunities as well as being the home to native prairie bison. In total, parks and protected areas cover 10% of the Region.

The topography of the Region is diverse; from the Rocky Mountains in the west to the undulating plains in the east. The Region's climate and soil have resulted in the development of primarily coniferous forests in the western areas, leading to a small transition zone of mixedwood and deciduous stands in the lower elevation areas of the northwest. Scattered pure deciduous stands are found primarily along the northern and eastern border of the Region.

Forests are mostly in the mature stage of seral stage development (7% of the Region) and this is evidenced also by the age class distribution which indicates that 10% of the Region's forests are in the 100 year (or greater) age class.

Historical threats to the forest come from natural populations of several pests, although the Region has not experienced severe infestations of any one agent. The greatest forest threat continues to be due to wildfire events, but the median size of such events has been steadily decreasing over time.

NOTICES AND DATA SOURCES

The information presented in this report is current as of the report date. For further information, please contact the Government of Alberta, Department of Environment and Sustainable Resource Development.

The source of data for each topic is referenced with the use of end notes. The full data list is presented in APPENDIX III with appropriate references included in each section. All data source references are identified by the format (1) where '1' represents the reference in a numerical sequence, listed in APPENDIX III . All initialisms used in the report are defined in the glossary. Maps included herein reflect a broad representation of each metric, and are not intended for operational use. For more detailed examination of map information, double click on the legend of any map. This will open a separate window where you may zoom into the map.

Where areas are presented, they are expressed as hectares and were calculated using the projection known as "NAD_1983_10TM_AEP_Forest" which is a Transverse Mercator projection using the1983 North American Datum. For this reason, some area estimates may not agree with other published information. The presentation of area estimates to the nearest hectare may result in the tabulated sums of some tables to appear to not total correctly; however, this is simply due to rounding.

Information is compiled at the Land-use Framework regional level and as such represent broad estimates over the Region. Extrapolation or interpolation of results at other levels of resolution (e.g.: forest management unit, municipal district) are not appropriate without further analysis. The information which relies on forest inventory data is summarized only over the areas for which there is available forest inventory data and for which Alberta has provincial forest management responsibilities. This excludes Federal lands, First Nations and Metis settlement areas.

The Minister and the Crown provides this information without warranty or representation, as to any matter including but not limited to whether the data/information is correct, accurate or free from error, defect, danger or hazard and whether it is otherwise useful or suitable for any use the user may make of it.

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1. Administrative Boundaries

1.1 North Saskatchewan Region

The North Saskatchewan Region (1), one of seven land-use regions defined in Alberta's Land-use Framework (Alberta, 2008), spans the central portion of Alberta, running easterly from the Alberta-British Columbia border to the Alberta-Saskatchewan border (see Figure 1-1). The western part of the Region contains Banff National Park. Elk Island National Park is located in the centre (east of the city of Edmonton). The Region contains a significant amount of urban and industrial development, agriculture, natural resource development as well as large areas of protected lands for the purposes of conservation.

The North Saskatchewan is the third largest of the seven regions, with an area of approximately 8,578,706 hectares.

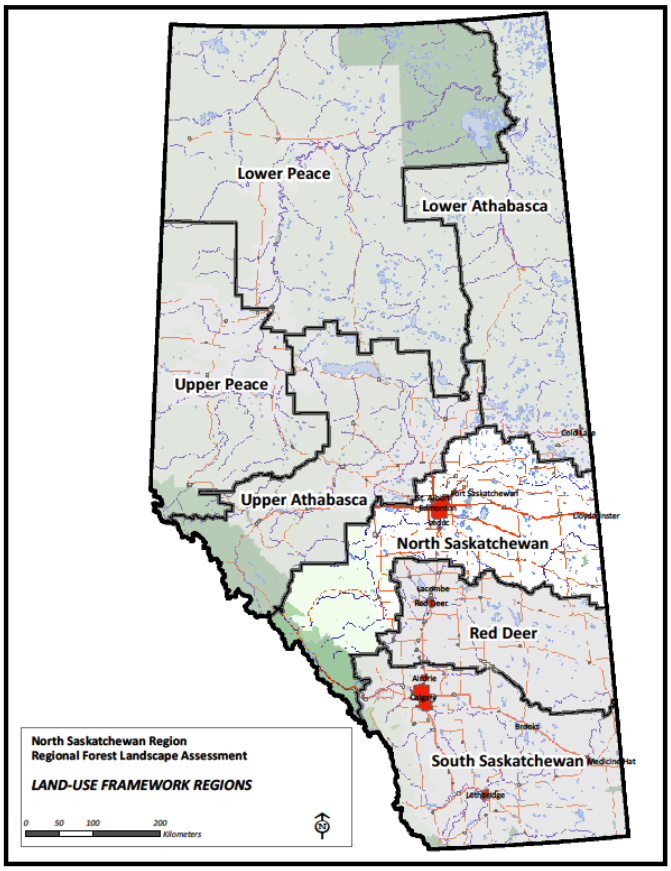


Figure 1-1 North Saskatchewan Region

1.2 Green / White Area

In 1948, the Province divided Alberta into two zones for the purposes of land use decision making. This resulted in the creation of the two areas commonly known as the Green and White Areas (2). The White Area is primarily made up of private land holdings related to agricultural use. Land ownership in the Green Area is primarily by the Crown, and managed for natural resource development, recreation and conservation.

As summarized in Table 1-1, approximately 69% of the North Saskatchewan Region is White Area, 21% is Green Area and the remaining 10% is occupied by lands managed by Canada. These consist of First Nation lands, military bases and national parks, and are described in sections of this report to follow. Note that while Federal lands are included in the land use framework regions, they are typically not included in the Green / White Area designations (see Figure 1-2).

Table 1-1 Green / White Area summary

Area Name	Area (ha)	Percentage (%)
Green Area	1,775,939	21
White Area	5,929,751	69
Federal Land	873,017	10
Total	8,578,706	100

As shown in Figure 1-2, the Green Area occupies the western portion of the Region, and the White Area occupies the broad expanse, eastward from approximately Hwy 22 to the Saskatchewan border.

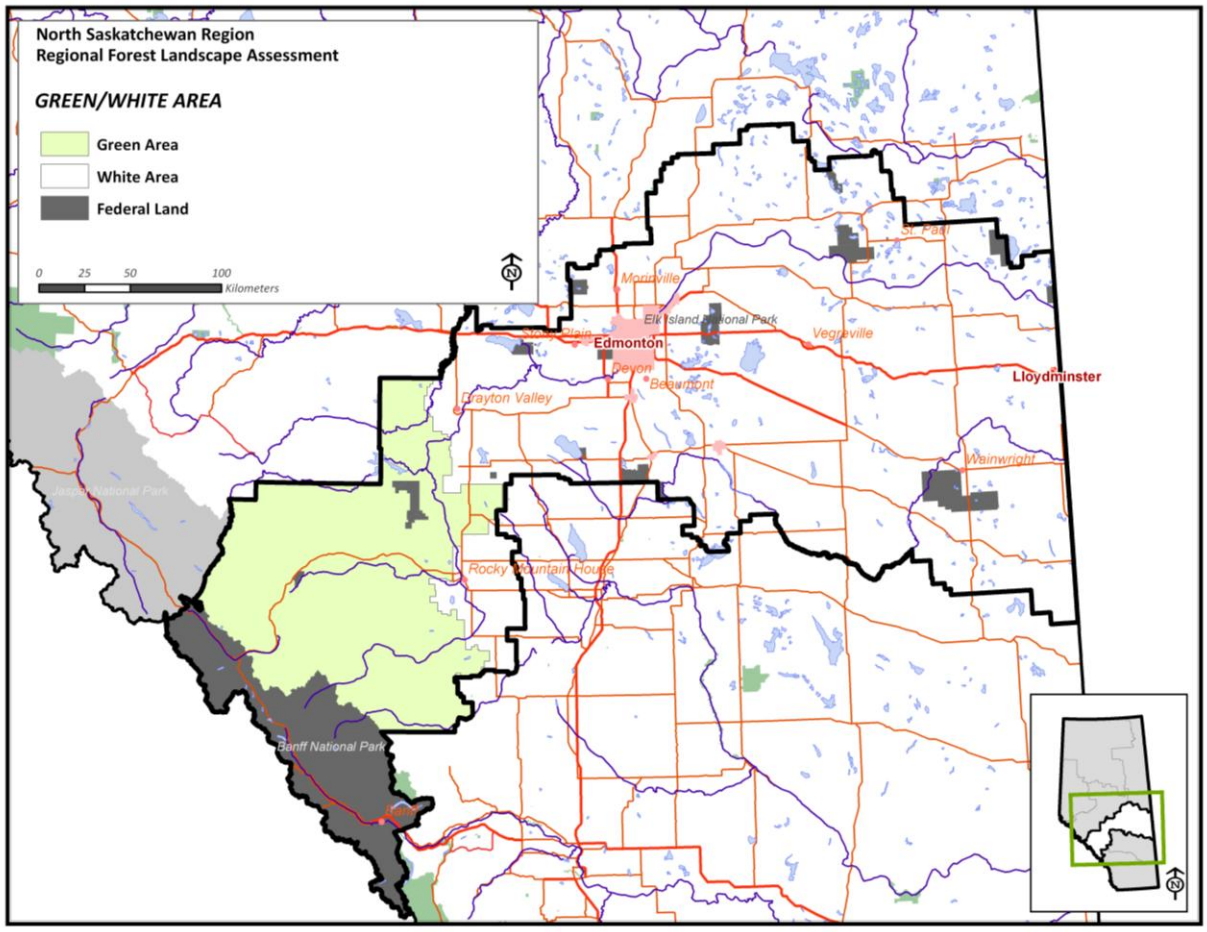


Figure 1-2 Green/White Area Distribution

1.3 Forest Management Agreement Areas

Only 13% of the North Saskatchewan Region is covered by a Forest Management Agreement (3) (FMA). There are 4 FMA holders with timber allocations in this Region. FMA boundaries are not coincident with the land use framework region boundaries. Table 1-2 lists the FMAs which have lands inside the North Saskatchewan Region, the percent of each FMA which is inside the Region, as well as the proportion of the North Saskatchewan Region which is covered by the respective FMA.

Figure 1-3 shows the location of the respective FMAs and their distribution over the Region.

Table 1-2 Forest Management Agreement Area summary

FMA Label	Company Name	Entire FMA	Portion of FMA located in North Saskatchewan		Proportion of North Saskatchewan occupied by FMA
		Area (ha)	Area (ha)	FMA	% of North Saskatchewan
SPRAY LAKES	Spray Lake Sawmills (1980) Ltd.	122,529	21,423	17	0
SUNDANCE	Sundance Forest Industries Ltd.	225,718	48,538	22	1
SUNPINE	Sundre Forest Products Inc.	553,458	542,697	98	6
PEMBINA	Weyerhaeuser Company Limited (Pembina Timberland)	834,520	469,374	56	5
Sub-total		1,736,224	1,082,031		13
No Forest Management Agreement Area			7,496,675		87
Total			8,578,706		100

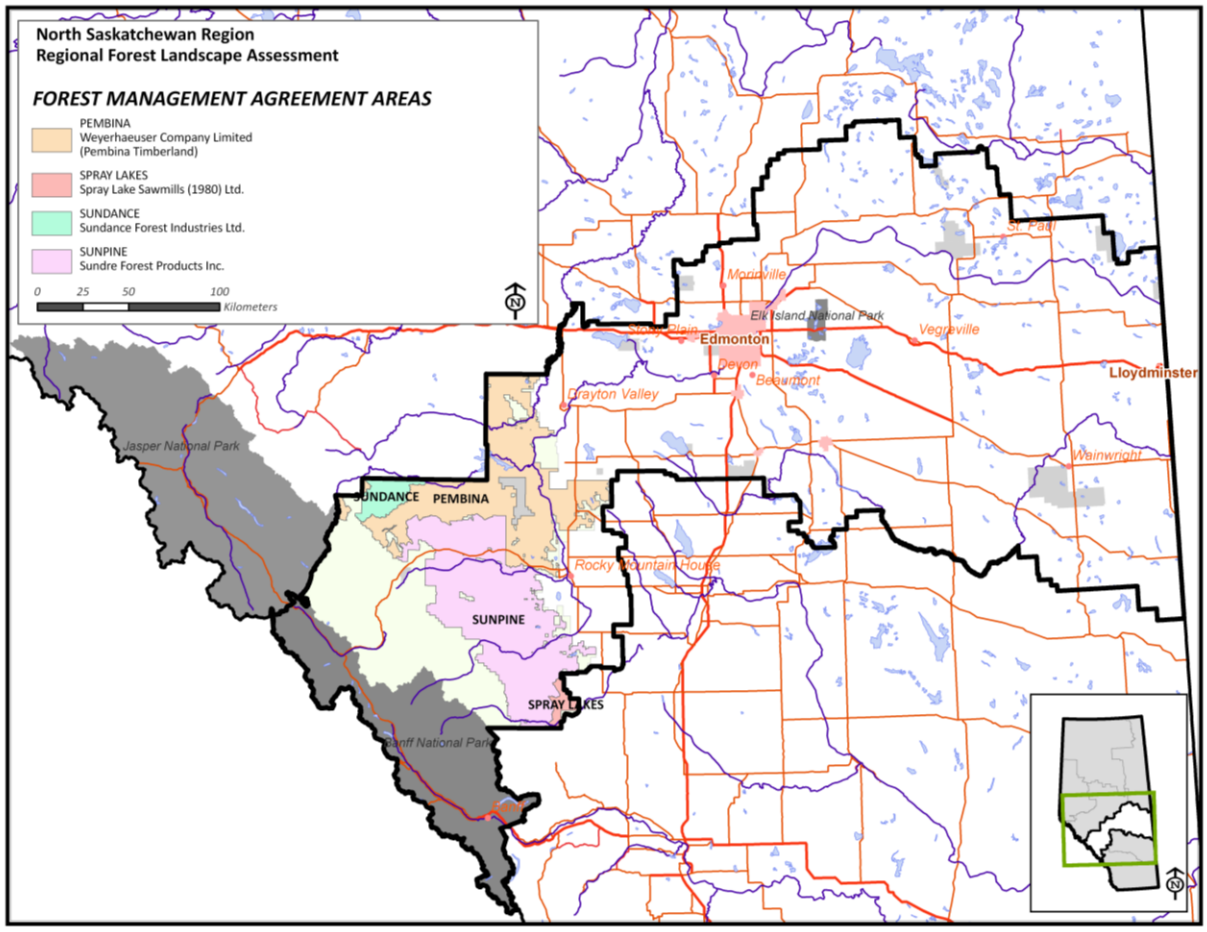


Figure 1-3 Forest Management Agreement Areas

1.4 Forest Management Units

The North Saskatchewan Region contains 13 Forest Management Units (FMU) (4). Only one FMU is fully contained inside the Region (Table 1-3). Another two units (R10 and R11) are essentially contained within the Region since over 97% of their areas are inside the North Saskatchewan Region.

The largest FMU in the Region is LO1 which makes up 12% of the North Saskatchewan. Of the 13 FMUs, 6 are managed by the Crown and 5 are managed under a Forest Management Agreement (see section 1.3). Unit B9 is managed by both an FMA holder and the Crown. The FMU "M7" is coincident with the Metis Settlements of Buffalo Lake and Kikino (see section 1.8) and is not available for the purposes of provincial forest management.

The largest Crown-managed units (LO1 and RO1) are located in the White Area. The largest FMA managed FMU is R10 (Sundre Forest Products Inc.).

A map of the FMUs within the North Saskatchewan Region appears as Figure 1-4.

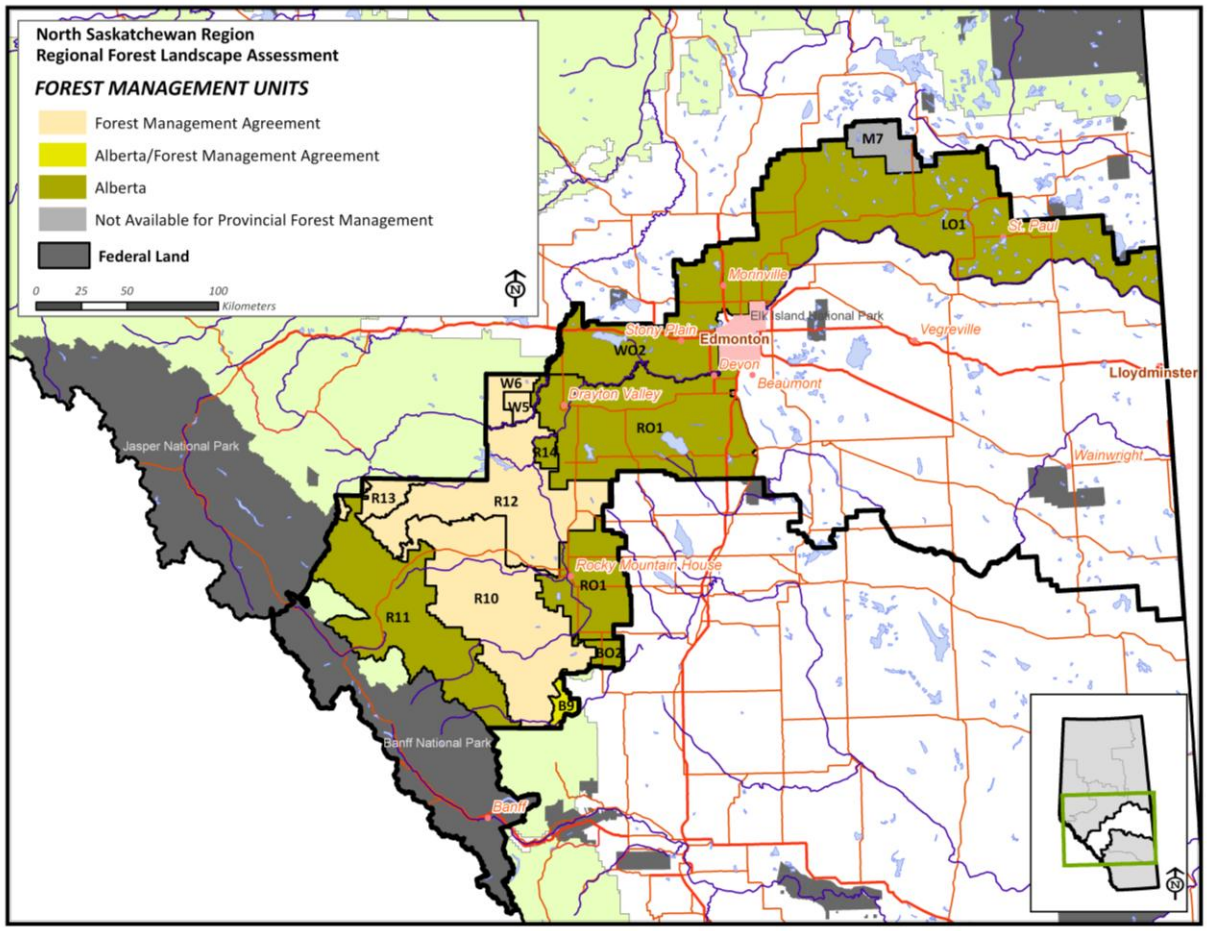


Figure 1-4 Forest Management Units

Table 1-3 Forest Management Units

FMU Name	Managed by	Entire FMU Area (ha)	Portion of FMU located in North Saskatchewan Area (ha)	% of FMU	Proportion of North Saskatchewan occupied by FMU % of North Saskatchewan
Available for Provincial Forest Management					
LO1	Crown	2,579,926	1,058,723	41	12
RO1	Crown	1,326,694	836,560	63	10
R10	FMA	587,327	571,242	97	7
R11	Crown	521,547	508,805	98	6
R12	FMA	533,183	464,666	87	5
WO2	Crown	1,113,035	371,908	33	4
W6	FMA	233,762	49,790	21	1
R13	FMA	268,089	48,541	18	1
BO2	Crown	546,554	29,971	5	0
B9	Crown & FMA	173,659	24,111	14	0
W5	FMA	72,059	21,844	30	0
R14	Crown	21,093	21,093	100	0
Sub-total		7,976,929	4,007,256		47
Not Available for Provincial Forest Management					
M7		80,967	80,791	100	1
Sub-total		80,967	80,791		1
No Forest Management Unit Area			4,490,659		52
Total			8,578,706		100

1.5 Natural Subregions

In Alberta, a landscape classification system referred to as the Natural Regions and Subregions of Alberta (5) is widely used for land management programs (e.g., parks and protected areas network, ecologically-based forest management tools). The system was originally developed in 1994 (Alberta 1994). A project to refine and update the classification was initiated in the fall of 2000 to take advantage of GIS technology and an increased knowledge of the ecology of the province. Subregion descriptions that follow are based on the 2006 documentation (Natural Regions Committee 2006)

Natural Regions contain similar landforms, hydrology, geology, soils, climate, plants and wildlife. The Natural Regions are further divided into subregions, on the basis of similar landscape patterns. The North Saskatchewan Region contains portions of 8 subregions A summary of subregion distribution is in Table 1-4 (presented in order of prevalence in the North Saskatchewan Region) and a map showing the subregions in the North Saskatchewan Region appears as Figure 1-5.

Table 1-4 Natural Subregion Distribution

Natural Subregion	Area (ha)	Percentage (%)
Central Parkland	3,711,937	43
Dry Mixedwood	1,637,801	19
Lower Foothills	809,243	9
Alpine	644,488	8
Central Mixedwood	576,858	7
Subalpine	575,812	7
Upper Foothills	495,854	6
Montane	79,750	1
Northern Fescue	46,960	1
Total	8,578,702	100

The Central Parkland and Dry Mixedwood subregions together occupy well over half of the North Saskatchewan Region accounting for 62% of the Region (Table 1-4). The Lower Foothills, Alpine, Central Mixedwood, Subalpine and Upper Foothills subregions are the next most prevalent, each accounting for between 9% and 6% of the Region. The remaining area is covered by very small components of the Montane and Northern Fescue Subregions.

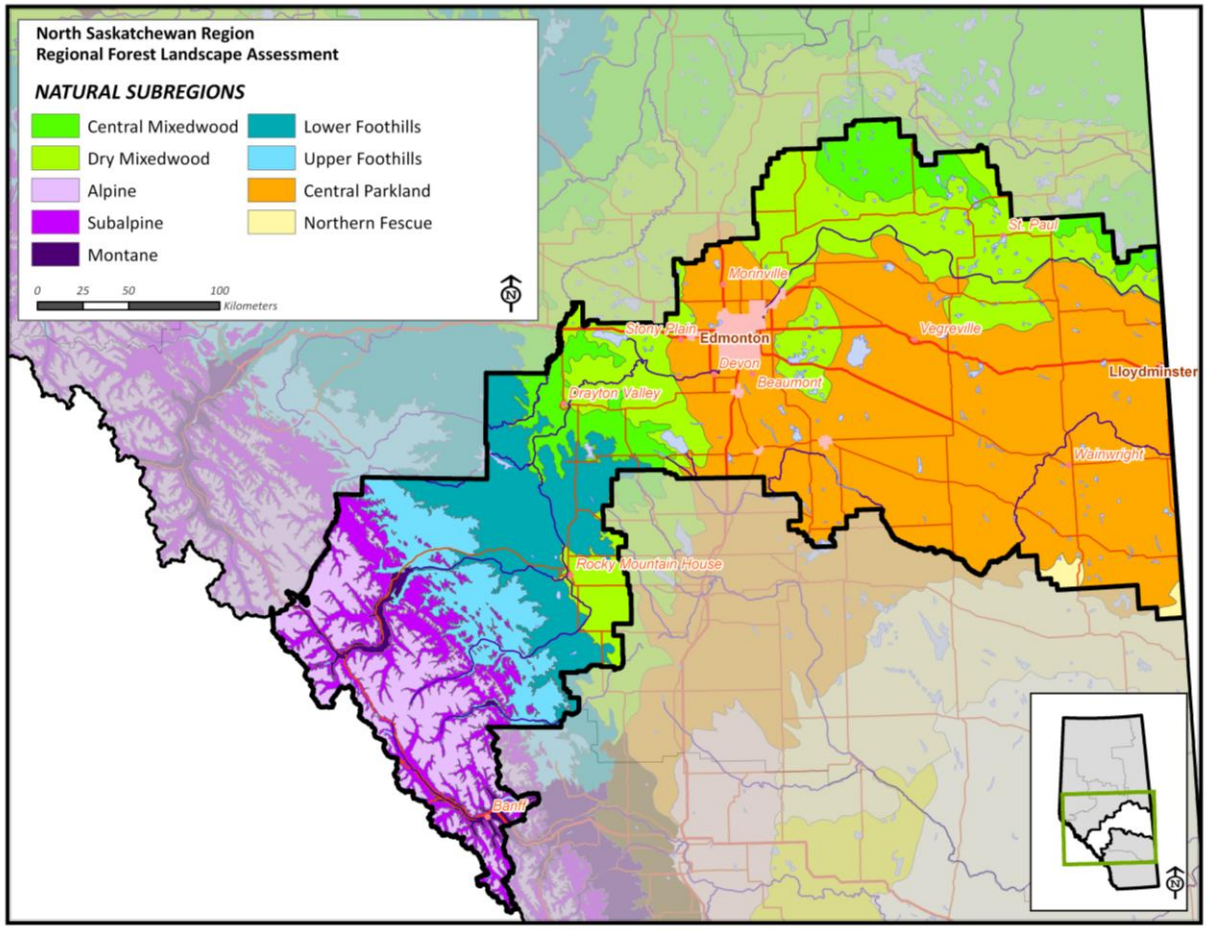


Figure 1-5 Alberta Natural Subregions

The following subsection summaries are presented in order of the prevalence of the subregion by area (see Table 1-4).

1.5.1 Central Parkland Natural Subregion

The Central Parkland Subregion is the largest subregion, making up 43% of the North Saskatchewan Region. The Central Parkland covers a large portion of the central part of Alberta and is mostly under cultivation. In addition, the Central Parkland accounts for the bulk of Alberta's population as it contains the province's three largest cities.

Undulating till plains and hummocky uplands are the dominant landforms. Lacustrine and fluvial deposits are common the north part of the Subregion. Much of the native vegetation occurring on the till plains was replaced by croplands before it could ever be surveyed. Soil types in the Subregion indicate mostly closed aspen forest and plains rough fescue grasslands. A mosaic of aspen and prairie vegetation occupies remnant native parkland areas.

The climate in this part of the Subregion (within the North Saskatchewan Region) is intermediate between the Dry Mixedwood to the north and west, and the Northern Fescue to the south. Monthly precipitation patterns are most similar to the Dry Mixedwood with a marked peak in July and significant rainfalls in June and August. The western third of the Central Parkland receives more annual precipitation on average than the remainder of the area, possibly due to higher elevations and more intense summer rainfalls.

1.5.2 Dry Mixedwood Natural Subregion

The Dry Mixedwood Natural Subregion is characterized by undulating plains, aspen dominated forests and fens. In the north and eastern part of the North Saskatchewan region where the Dry Mixedwood is located, the terrain is primarily undulating plains and somewhat hummocky uplands. Gray Luvisols are the dominant soils on uplands and Gleysols and Organics are dominant in wetlands.

The subregion has the warmest summers and highest number of growing degree day accumulations of any of the boreal subregions. About 70% of the annual precipitation falls during the April to August period with peak precipitation in June and July; often associated with intense convective storm events.

Aspen forests with mixed understories of rose, low-bush cranberry, beaked hazelnut and buffaloberry are typical on uplands. Treed, shrubby or sedge-dominated fens occupy low-lying areas. In the extreme eastern range, one may find jack pine stands on dry, well to rapidly drained glaciofluvial and eolian parent materials.

1.5.3 Lower Foothills Natural Subregion

The Lower Foothills Natural Subregion occurs at lower elevations along the foothills of the Rocky Mountains, extending east to Drayton Valley and Rocky Mountain House. The typical elevation range is approximately 700-800 m in the north to approximately 1500 m in the south and western areas of the Subregion where it borders the Upper Foothills. The rolling, till-covered plateaus consist of closed canopy mixed stands of aspen, lodgepole pine, white spruce and balsam poplar.

The topography of the Lower Foothills consists of undulating to strongly rolling plateaus. Sandstone and siltstone of Tertiary origin underlie the southern part of the Subregion with similar rock of Upper Cretaceous origin occurring in the northern parts of the subregion. Orthic Gray Luvisolic soils dominate, accompanied by Brunisolic subgroups at higher elevations. Most upland soils are well to imperfectly drained but there may be imperfectly to poorly drained Gleysolic soils (accompanied by seepage) in lower slope positions.

This Subregion is typical of Cordilleran climates, and continental influences are pronounced in the Lower Foothills Subregion, resulting in a decrease in both annual and winter precipitation and an increase in growing degree days when compared to conditions in the Upper Foothills Subregion. Precipitation is higher than in neighbouring subregions to the north and east.

The Lower Foothills Subregion has the most diverse forests in the province in terms of stand types and occurrence of individual tree species. Aspen, balsam poplar, white birch, lodgepole pine, balsam fir and larch (tamarack) grow as pure stands or as mixtures on a wide variety of slopes and aspects. Pure deciduous stands are more common at lower elevations, and coniferous-dominated stands occur at higher elevations within the subregion.

1.5.4 Alpine Natural Subregion

The Alpine Natural Subregion consists of lands typically above tree line along the Rocky Mountains and other main ranges. The area typically does not support tree growth with the exception of dwarf conifer species situated either individually or in scatter clumps. These alpine areas are characterized by harsh climates (cold summers, short growing season, persistent snow cover and strong winds), poor soil development, and in some cases permanent snowfields and glaciers.

1.5.5 Central Mixedwood Natural Subregion

The Central Mixedwood Natural Subregion makes up 7% of the North Saskatchewan region. It is represented by undulating plains with some hummocky uplands. Its climate is continental, with warm summers and cold winters. The northern part of this Subregion has lower mean annual temperature and precipitation compared to the southern part of the Subregion. This is most likely due to the increasingly strong influence of dry and cold continental arctic weather systems in these northern areas.

Parent materials in the Subregion are a combination of glacial till, lacustrine and fluvial materials. Orthic Gray Luvisolic soils are predominant, with Brunisols occurring on sands. Wetlands are often extensive and are generally associated with Mesisols, although Fibrisols and Gleysols also occur.

On upland areas, a mix of aspen-dominated deciduous stands, aspen-white spruce stands and white-spruce dominated stands are typical of till and lacustrine areas. Jack pine forests occur on coarse materials. Black spruce is dominant in fens and bogs.

1.5.6 Subalpine Natural Subregion

The Subalpine Natural Subregion lies below the Alpine Subregion but above the Montane. Coniferous forests dominate this landscape, with lodgepole pine occurring in the lower elevation zones of the

Subregion, and Engelmann spruce typically occurring in the upper elevation zones. Growth rates are typically slow as the climate is cool year round.

The substrate of the Subalpine is characterized by shallow morainal and residual materials over bedrock. Soil development has resulted in Eutric and Dystric Brunisols and Regosols. Where wetlands have developed, they are typically over Gleysols. The climate consists of short, cool, wet summers and long cold winters. However topography can play a large role in the creation of micro-climates for the purposes of vegetation growth. In valley bottoms and lower slopes, daytime temperatures in the summer are usually warmer than on upper slopes. However, cold air can pool in these bottom areas reducing the length of the growing season.

1.5.7 Upper Foothills Natural Subregion

The Upper Foothills Natural Subregion rests below the Subalpine Subregion. The climate soils and vegetation patterns indicate that this is a transition zone between the drier, somewhat warmer conditions of the Lower Foothills Subregion and the cooler, wetter conditions of the Subalpine Subregion. Strongly rolling to steep terrain with thin glacial deposits and exposed bedrock is typical.

The bedrock is composed mainly of sandstones and mudstones of Tertiary and Upper Cretaceous origin and coal seams are common in the latter. Surface materials are usually glacial till veneers and blankets over bedrock, with some colluviums and exposed bedrock on the steeper slopes. Well to imperfectly drained Brunisolic Gray Luvisolic soils are typical throughout most of the area. Orthic Gray Luvisols are associated with moderately well drained sites and are usually associated with deciduous vegetation. Wetlands are a complex of Terric and Typic Mesisols along with Peaty and Orthic Gleysols.

Typical climate patterns indicate short wet summers and snowy cold winters. On average, the Upper Foothills has a shorter growing season that the Lower Foothills and receives heavier summary and winter precipitation. It has the highest July precipitation of any of the subregions. These climatic conditions favour the occurrence of conifers over deciduous species because evergreen needles can begin photosynthesis early in the spring and continue late into the fall. The shorter growing season discourages maturation of twigs and buds of deciduous species.

Forests dominate this Subregion and are typically even-aged, fire-origin lodgepole pine stands often with an understory of black spruce. White spruce stands occur along river valleys and on lower slopes. Deciduous and mixedwood stands are restricted to southerly and westerly slopes where growing conditions are similar to lower elevations.

1.5.8 Montane Natural Subregion

The Montane Subregion sits below the Subalpine Subregion. Lodgepole pine, Douglas fir and aspen stands occur on east and northern aspects. Grasslands can occur on south and west aspects at lower elevations. At higher elevations, closed mixedwood and coniferous forests (dominated by lodgepole pine) can be found.

The climate consists of mild summers, high summer precipitation, and frequent Chinook winds. Due to the frequent Chinooks, winters in the Montane are warmer (on average) than almost anywhere else in Alberta. The variable terrain produces dramatic differences in microclimate. North- and east-facing

slopes tend to be cooler and moister as they receive less direct sunlight and less precipitation as a result of protection from the prevailing westerly winds.

1.5.9 Northern Fescue Natural Subregion

The presence of the Northern Fescue Natural Subregion is only incidental in the North Saskatchewan Region, occupying less than 1 percent of the Region's area. The Northern Fescue is represented by a mosaic of cultivated fields and moist native prairie. Typical landscapes consist of undulating to hummocky terrain.

The limited occurrence of aspen and poplar on moist lowland sites differentiates this Subregion from the southern Central Parkland where aspen groves are more frequent.

Dark Brown Chernozems on cultivated areas also help to distinguish this Subregion from the Central Parkland and Dry Mixedgrass. These Chernozems are typical on average sites and plains rough fescue is the dominant grass on lightly grazed native range.

1.6 Municipal Districts/Counties

The North Saskatchewan contains 6 types of municipal jurisdictions (6):

- 18 Municipal Districts (MD),
- 2 Improvement Districts (ID)
- 1 Special Municipality,
- 8 cities,
- 31 towns, and
- 376 smaller populated centers.

These registered municipal entities appear in Figure 1-6 and are listed in Table 1-5. Table 1-5 includes the population (7) of each of the registered areas according to the most recent census (Alberta 2010). Figure 1-6 shows the ID, MD and Special Municipality boundaries. Figure 1-7 shows the location of the 8 cities, 31 towns, and 376 smaller populated centers (e.g.: villages, summer villages) in the North Saskatchewan Region). The population of these smaller locations is rolled up into the MD to which they belong.

Note that all the MD and ID boundaries are coincident with the Region boundary, so no MD or ID is split by the Region.

The Improvement District of Banff includes all of Banff National Park with the exclusion of the town.

Towns in the west and southwest parts of the Region have a high dependence on forestry and energy sector operations (Rocky Mountain House and Drayton Valley). Towns in the east central portion are generally more dependent on agricultural operations, and more frequently servicing the oil and gas sector (Vegreville, Camrose, Elk Point, Provost, etc.)

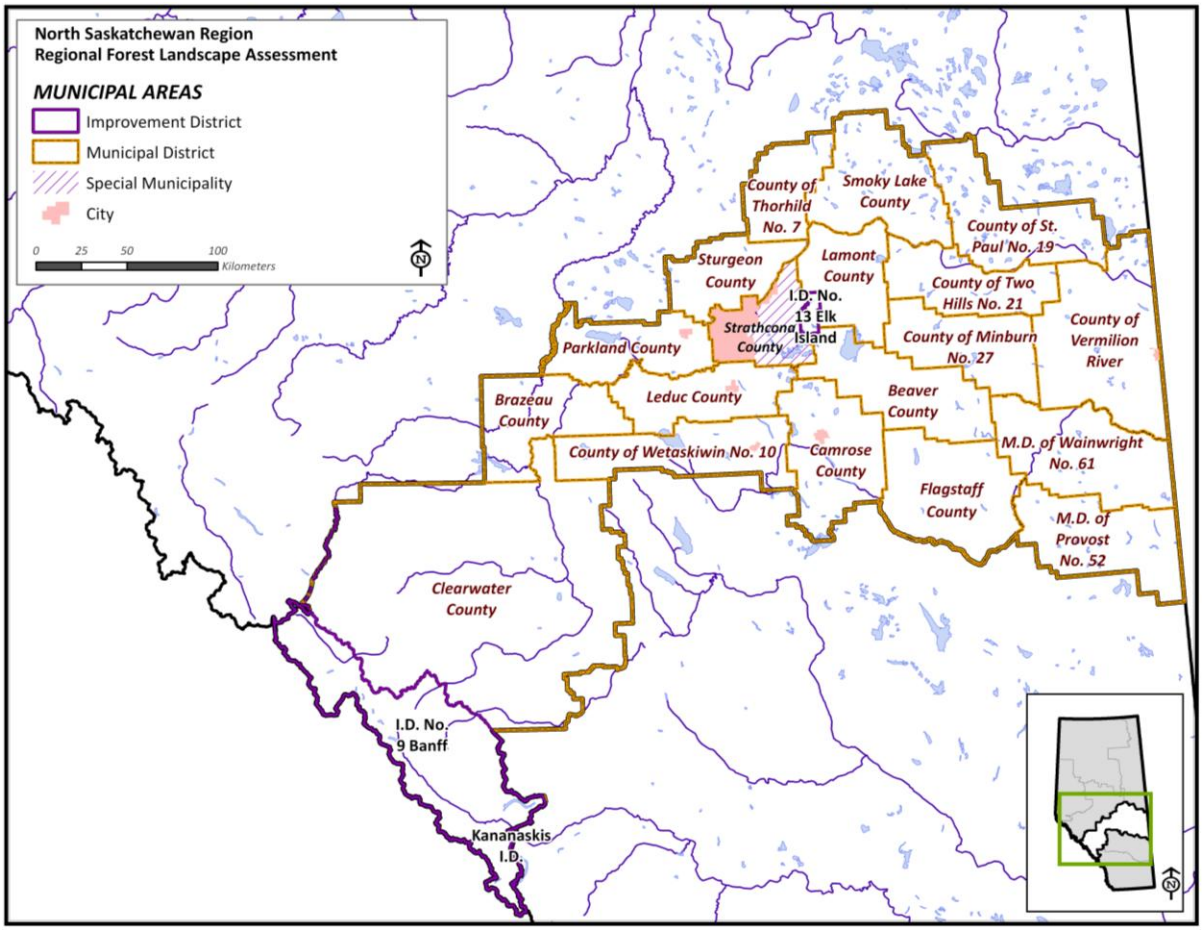


Figure 1-6 Municipal Jurisdictions

Table 1-5 Summary of Municipal Locations

Municipal Classification	Name	Population (2010)
Municipal District	Beaver County	5,676
	Brazeau County	7,040
	Camrose County	7,577
	Clearwater County	11,846
	Flagstaff County	3,506
	Lamont County	3,925
	Leduc County	13,260
	Minburn No. 27, County of	3,319
	Parkland County	30,089
	Provost No. 52, M.D. of	2,547
	Smoky Lake County	2,442
	St. Paul No. 19, County of	5,925
	Sturgeon County	19,165
	Thorhild No. 7, County of	3,547
	Two Hills No. 21, County of	2,926
	Vermilion River, County of	7,900
	Wainwright No. 61, M.D. of	4,113
	Wetaskiwin No. 10, County of	10,535
	Total	145,338
Improvement District	I.D. No. 9 Banff	938
	I.D. No. 13 Elk Island	21
	Total	959
Special Municipality	Strathcona County	87,988
City	Camrose	16,543
	Edmonton	782,439
	Fort Saskatchewan	18,653
	Leduc	23,292
	Lloydminster	17,402
	Spruce Grove	24,646
	St. Albert	60,138
	Wetaskiwin	12,285
	Total	938,855
Town	Total (31 Towns)	114,267
Village	Total (40 Villages)	15,306
Grand Total		1,302,713

A detailed list of individual towns and villages can be found in APPENDIX I.

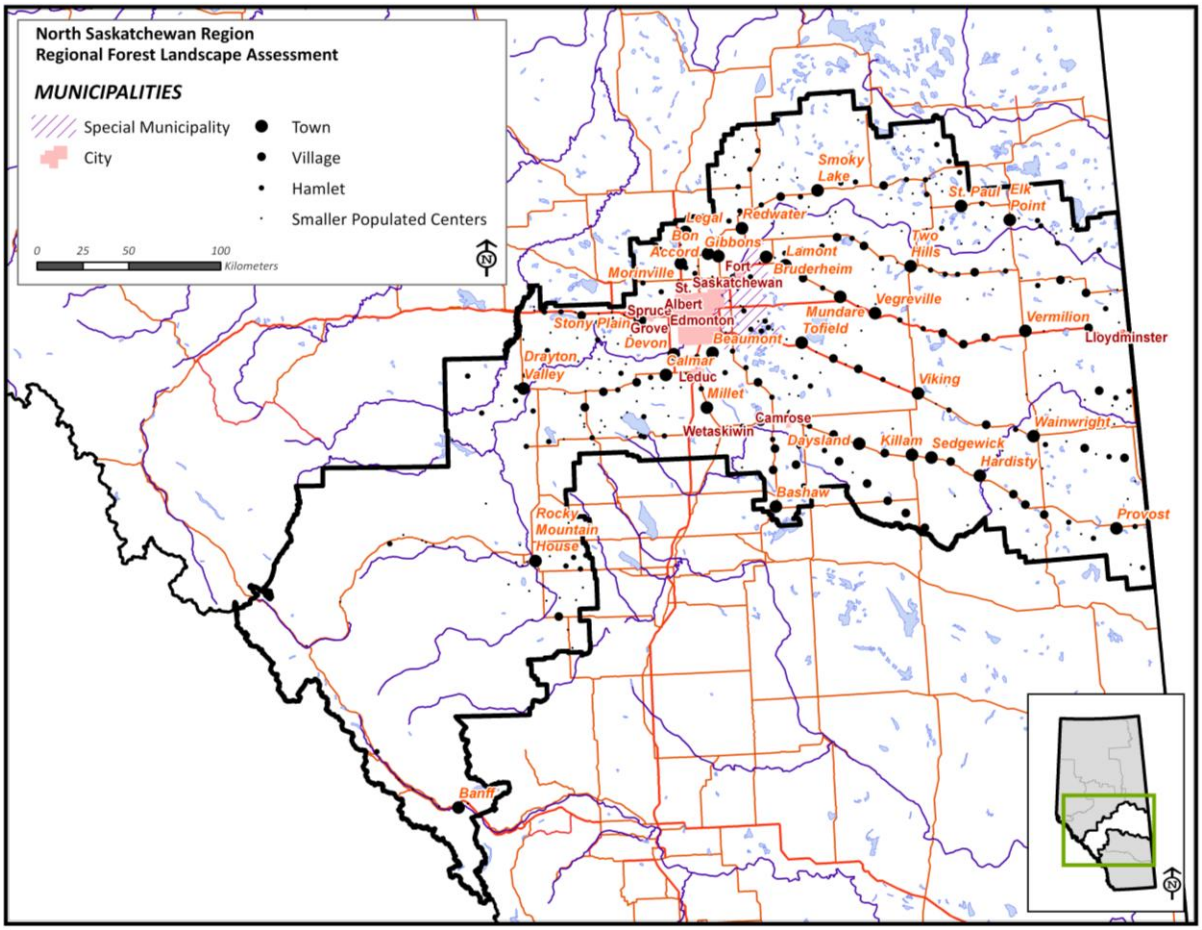


Figure 1-7 Cities, Towns and Other Populated Centers

1.7 Federal Government Lands

Federally managed lands in the North Saskatchewan Region include Banff and Elk Island National Parks (8) and Canadian Forces Base Wainwright (9). Encompassing 704,250 hectares, the Parks represent 8% of the Region (Table 1-6). CFB Wainwright (south of the town of Wainwright) is 59,811 hectares in size; making up less than 1% of the Region. CFB Namao, while still part of the North Saskatchewan Region is encompassed with the boundary of the City of Edmonton.

Table 1-6 Federal Lands

	Federal Land located in North Saskatchewan		Proportion of North Saskatchewan occupied by Federal land
Area Name	Area (ha)	% of Fed.Land	% of North Saskatchewan
First Nations	108,955	12	1
Military	59,811	7	1
National Parks	704,250	81	8
Total	873,017	100	10

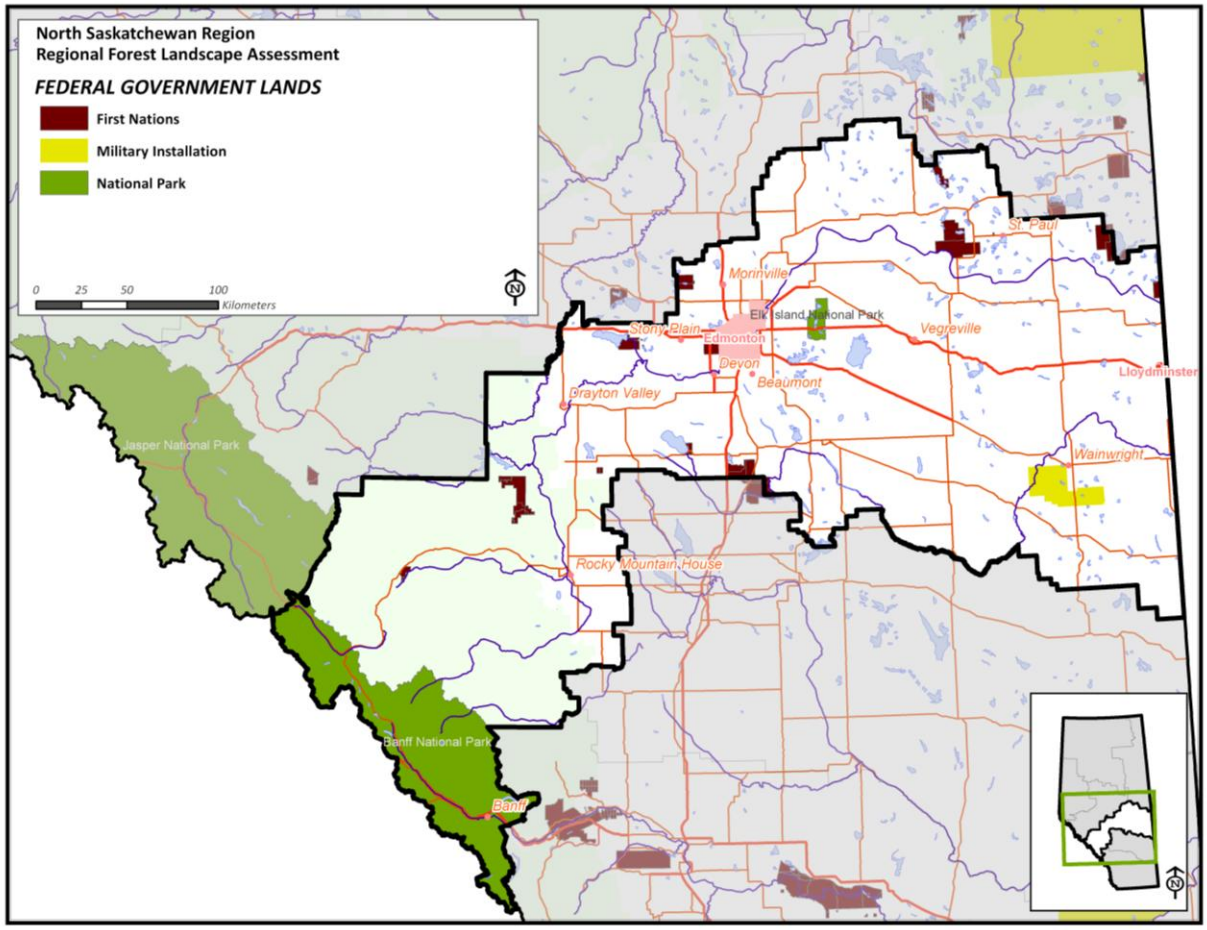


Figure 1-8 Federal Lands

1.8 First Nations

A summary of the First Nation communities (10) is shown in Table 1-7. The geographic distribution of First Nations is shown in Figure 1-9.

Each First Nation band is listed in Table 1-7, with its number of reservations. The population and source of the population details are provided for each First Nation. A population survey was completed in 2011 by the Federal government (Canada n.d.), but some bands were not represented.

First Nation lands total 108,955 hectares which represents approximately 1% of the North Saskatchewan Region. Saddle Lake is the largest single First Nation in both size (28,462 ha) and population (5,987). The First Nation reservation lands are spread across the Region and are not concentrated in any one area.

The O'Chiese, Sunchild and Big Horn First Nations are located in the Green Area, with the balance occurring in the White Area.

Table 1-7 First Nation Communities

First Nation Name	Treaty Number	Area (ha)	Percentage of all First Nations (%)	Number of Reserves	Population	Population Source
Alexander	6 (1876)	7,042	6	1	1,027	Canada (n.d.)
Big Horn	6 (1876)	2,206	2	1	134	Canada (n.d.)
Blue Quills[1]	6 (1876)	96	0	1		n/a
Buck Lake[2]	6 (1876)	1,034	1	1	1,293	Canada (n.d.)
Ermineskin	6 (1876)	8,529	8	1	1,874	Canada (n.d.)
Kehiwin	6 (1876)	390	0	1	1,065	Canada (n.d.)
Louis Bull	6 (1876)	3,198	3	1	1,309	Canada (n.d.)
Makaoo	6 (1876)	3,805	3	1	180	Canada (n.d.)
O'Chiese	6 (1876)	13,838	13	2	751	Canada (n.d.)
Pigeon Lake	6 (1876)	1,938	2	1	485	Canada (n.d.)
Puskiakiwenin	6 (1876)	8,589	8	1	484	Canada (n.d.)
Saddle Lake	6 (1876)	28,462	26	1	5,987	Canada (n.d.)
Samson	6 (1876)	3,265	3	1	3,746	Canada (n.d.)
Stony Plain	6 (1876)	5,188	5	1	987	Canada (n.d.)
Sunchild	6 (1876)	5,207	5	1	677	Canada (n.d.)
Unipouheos	6 (1876)	4,511	4	1	813	Canada (n.d.)
Wabamun	6 (1876)	6,597	6	2	1,086	Canada (n.d.)
White Fish Lake	6 (1876)	5,061	5	1	1,188	Canada (n.d.)
Total		108,955	100	20	23,086	

[1] Blue Quills First Nation land houses the Blue Quills First Nations College

[2] Buck Lake population from Paul First Nation

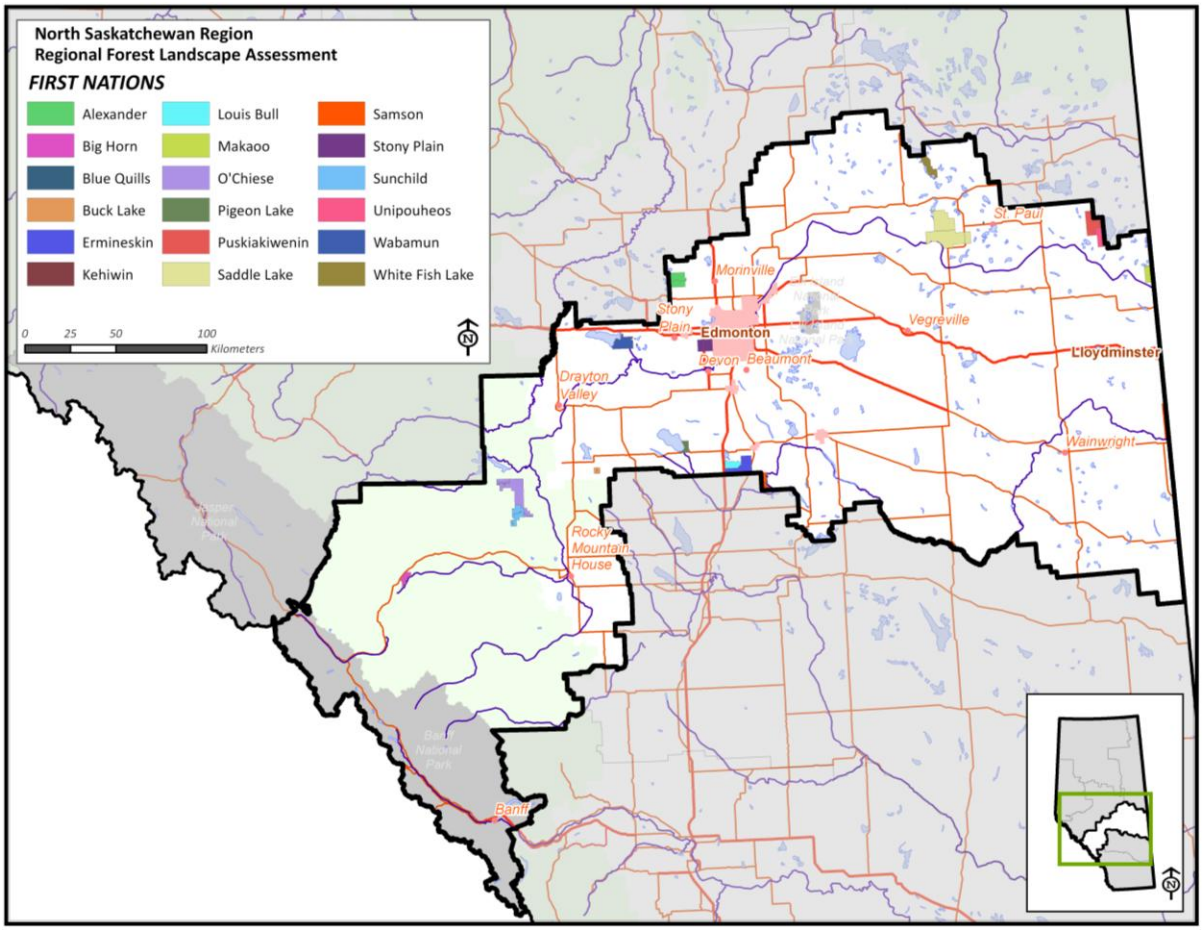


Figure 1-9 First Nations

1.9 Metis Settlements

There are 2 Metis settlements (11) contained in the North Saskatchewan Region (Table 1-8). Both are located in Smoky Lake County, in the northern portion of the Region (Figure 1-10). Individual Metis settlements are typically larger than individual First Nations reserves. In the North Saskatchewan Region, Metis settlements total 80,791 hectares, or almost 1% of the Region's area.

Table 1-8 Metis Settlements

Metis Settle	Area (ha)	Percentage of Metis (%)	Percentage of Region (%)	Population	Population Source
Buffalo Lake	35,342	44	0	1,206	Alberta (2010)
Kikino	45,449	56	1	1,113	Alberta (2010)
Total	80,791	100	1	2,319	

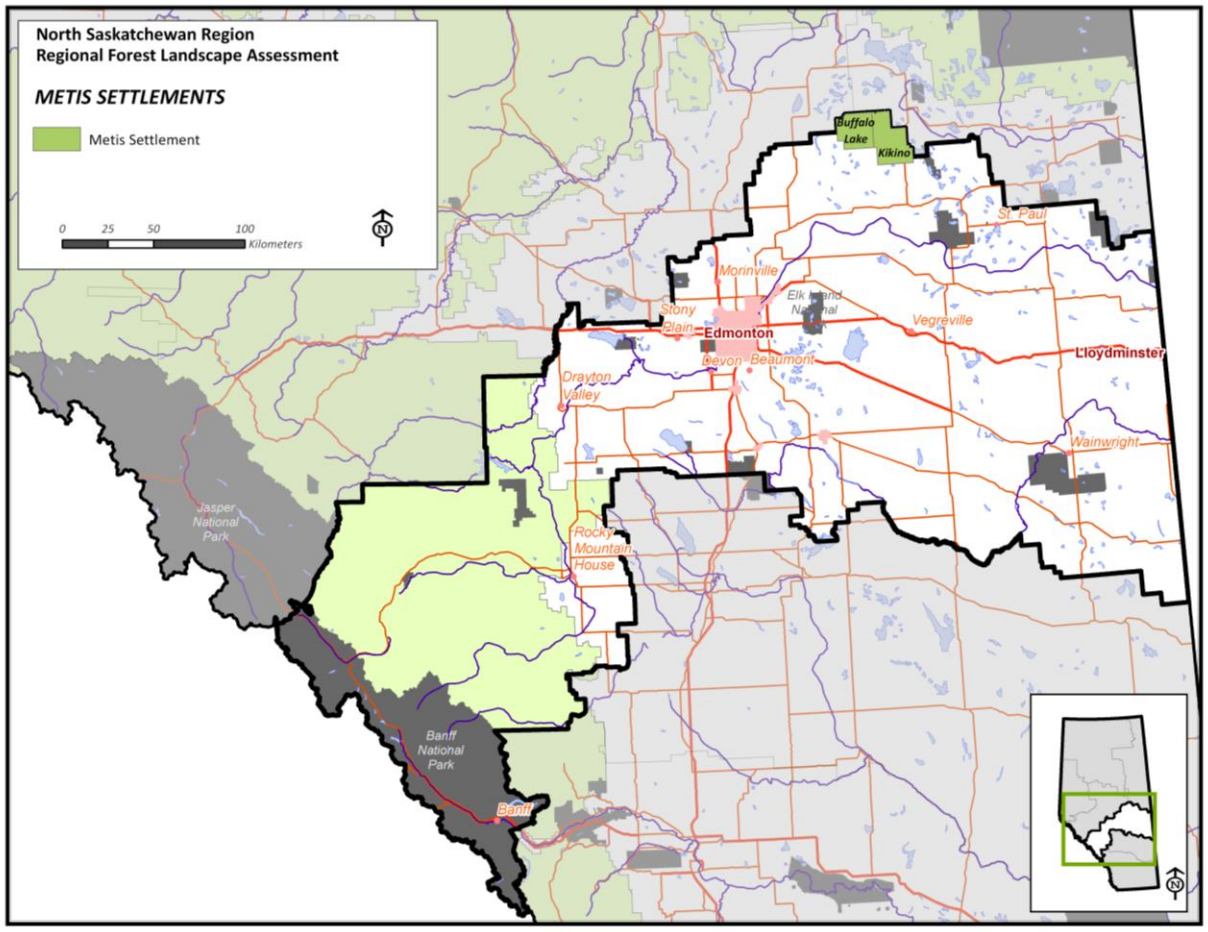


Figure 1-10 Metis Settlements

1.10 Parks and Protected Areas

There are many different designations of parks and protected areas in Alberta (13). These are defined in Table 1-9.

Table 1-9 Park and Protected Area Designations (14)

Type	Definition
Provincial Park	A Provincial Park represents areas which preserve natural heritage. They support outdoor recreation, heritage tourism, and natural heritage appreciation activities that depend upon, and are compatible with, environmental protection where natural, historical and cultural landscapes and features are protected under the Provincial Parks Act in Alberta.
Provincial Recreation Area	A Provincial Recreation Area represents the recreation areas in Alberta that support outdoor recreation and tourism and often provide access to lakes, reservoirs and adjacent Crown land. Recreation areas support a range of outdoor activities in natural, modified and man-made settings. They are managed with outdoor recreation as the primary objective.
Wilderness Area	Wilderness Areas are for preservation and protection of natural heritage providing opportunities for non-consumptive, nature-based outdoor recreation. No developments of any kind are permitted. Travel in wilderness areas is by foot only. Collection, destruction and

	removal of plant or animal material, fossils or other object of geological, ethnological, historical or scientific interest, are prohibited. Hunting, fishing and use of horses are not permitted.
Wildland Park	Wildland Parks exist to preserve and protect natural heritage and provide opportunities for backcountry recreation. Wildland parks are typically large, undeveloped natural landscapes that retain their primeval character. Trails and primitive backcountry campsites are provided in some wildland parks to minimize visitor impacts. Some wildland parks provide considerable opportunities for eco-tourism and adventure activities such as back packing, backcountry camping, wildlife viewing, mountain climbing and trail riding. Access and use of wilderness and wildland parks is not as restrictive as in wilderness areas.
Wilderness Park	Wilderness Parks and Wildland Parks have the same intent: to preserve and protect natural heritage and provide opportunities for backcountry recreation. The sole Wilderness Park in the Province has its own body of legislation ("Willmore Wilderness Park Act" of 1959)
Natural Area	A Natural Area represents natural and near-natural landscapes of regional and local importance for nature-based recreation and heritage appreciation. Natural areas are typically quite small; however, larger sites can be included. Most natural areas have no facilities and in those that do, facilities are minimal and consist mainly of parking areas and trails.
Ecological Reserve	An Ecological Reserve represents areas set aside for strict preservation of natural ecosystems, habitats and features, and associated biodiversity. These areas contain representative, rare and fragile landscapes, plants, animals and geologic features. Ecological reserves serve as outdoor laboratories and classrooms for scientific studies related to the natural environment. Public access is by foot only; public road and other facilities do not normally exist and will not be developed. Most ecological reserves are open to the public for low-impact activities such as photography and wildlife viewing.
Special Management Zone	A special management zone is a buffer around an existing feature that is used to protect the core feature of interest. These may or may not have access restrictions.
Crown Reservations	In some cases, areas of unique significance may not be named as a park, recreation area, wildland area or reserve. However the uniqueness of the site, or its proximity to a named park or protected area may result in the application of a protective (PNT) or consultative notation (CNT) within the Province's land-use disposition system. A PNT or CNT designation implies that the Province must be informed of any potential industrial development within the area. The Province may then apply specific conditions to the activity to protect the integrity of the land.

The North Saskatchewan Region contains several of the park and protected area designations noted above. The largest feature is Banff National Park which occupies approximately 8% (Table 1-10) of the Region. A total of 10% of the Region (876,971 ha) is allocated under some form of protection. In addition, another 0.74% of the Region (63,679 ha) contains protective or consultative notations to allow the Province to evaluate potential development near current parks or protected areas, or on other unique areas not yet designated under park or wilderness legislation. (see Table 1-11).

Figure 1-11 shows the locations of parks and other protected areas in the North Saskatchewan Region.

Table 1-10 Park and Protected Area Allocations

Classification	Type of Park/Protected Area	Number	Area in Region (ha)	Percentage of PPA[1] (%)	Percentage of Region (%)
Parks	National Park	2	704,250	80	8
	Provincial Park	14	13,782	2	0
	Provincial Recreation Area	48	20,354	2	0
	Wildland Area	2	87,091	10	1
	Wildland Park	1	190	0	0
	Total	67	825,667	94	10
Protected Areas	Natural Area	65	44,606	5	1
	Ecological Reserve	2	6,699	1	0
	Total	67	51,305	6	1
Total		134	876,971	100	10

[1] PPA - Parks and Protected Areas

Table 1-11 Areas under Protective or Consultative Notation

Classification	Type of Park/Protected Area	Number	Area in Region (ha)	Percentage of Reservations (%)	Percentage of Region (%)
Parks	Provincial Park	2	51,842	82	1
	Provincial Recreation Area	2	433	1	0
	Total	4	51,842	82	1
Protected Areas	Natural Area	37	11,604	18	0
	Total	37	11,604	18	0
Total		41	63,446	100	1

A detailed list of individual parks, recreation areas, wildland parks and areas, natural areas and ecological reserves can be found in APPENDIX II .

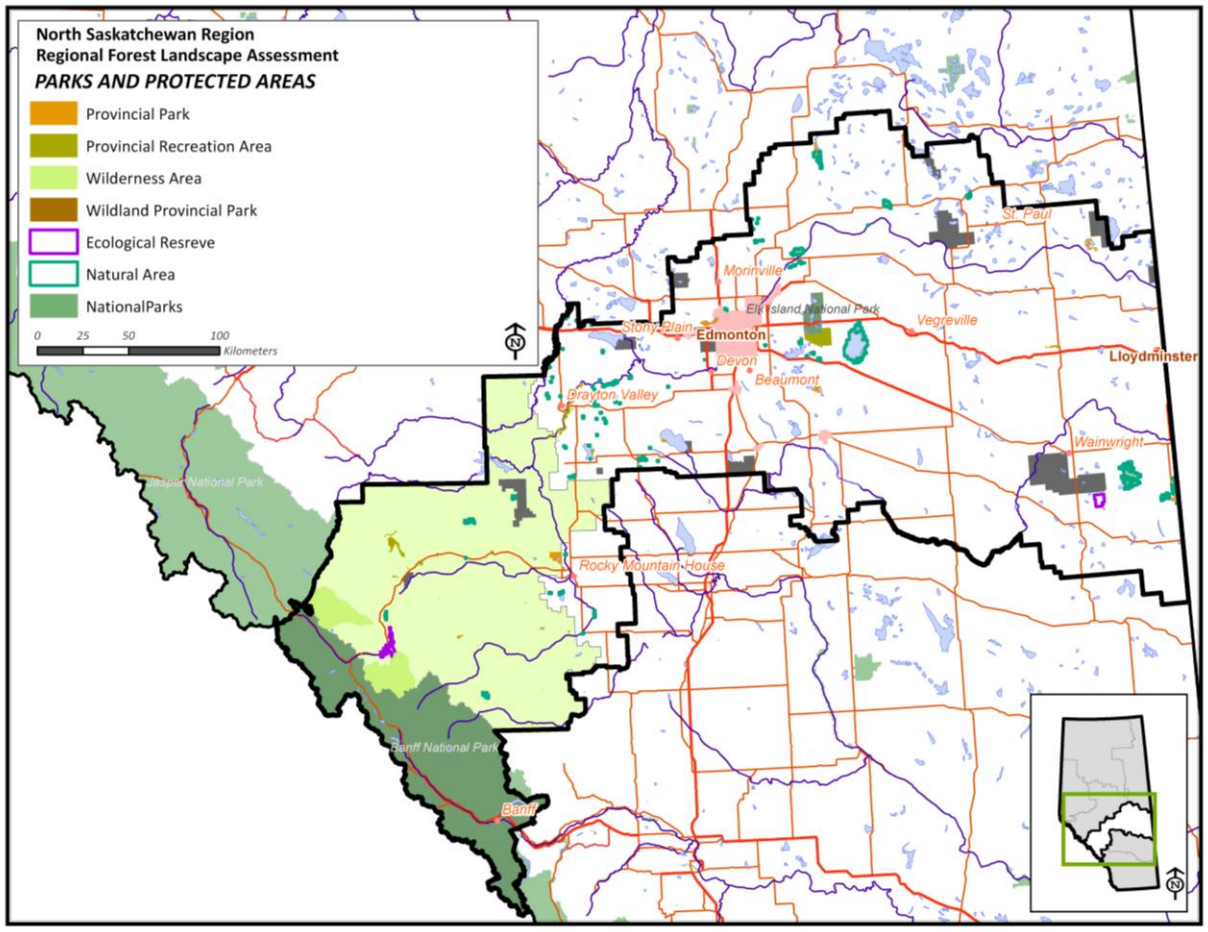


Figure 1-11 Parks and Protected Areas

1.11 Wildfire Management Areas

Wildfire management areas (15) are those areas which define wildfire management responsibilities (Figure 1-12). The predominant wildfire management area is Prairies occupying 44% of the Region. Clearwater, occupying approximately 25% is the second largest ESRD management area. Only very small portions of the Woodlands, Foothills and Southern Rockies regions fall inside the North Saskatchewan Region.

Table 1-12 Alberta Wildfire Management Areas

ESRD Region Name	Entire Region Area (ha)	Portion of ESRD Region located in North Saskatchewan Area (ha)	(%)	Proportion of North Saskatchewan occupied by ESRD Region (%)
Prairies[1]	14,652,182	3,757,021	26	44
Clearwater	2,474,741	2,186,781	88	25
Lac La Biche	6,396,339	1,312,229	21	15
Woodlands	2,612,133	267,570	10	3
Foothills	3,059,432	157,271	5	2
Southern Rockies	2,527,255	24,817	1	0
Sub-total	31,722,082	7,705,689		90
Area not managed by Alberta		873,016		10
Total		8,578,706		100

[1] Includes Highway 16 which runs through Elk Island Park but is not typically included in either National Parks or wildfire management area features

In terms of the influence of North Saskatchewan planning activities on the ESRD Regions, the majority of the Clearwater Region is located in the North Saskatchewan; whereas all other management areas in the North Saskatchewan are shared with other Land-use Framework Regions.

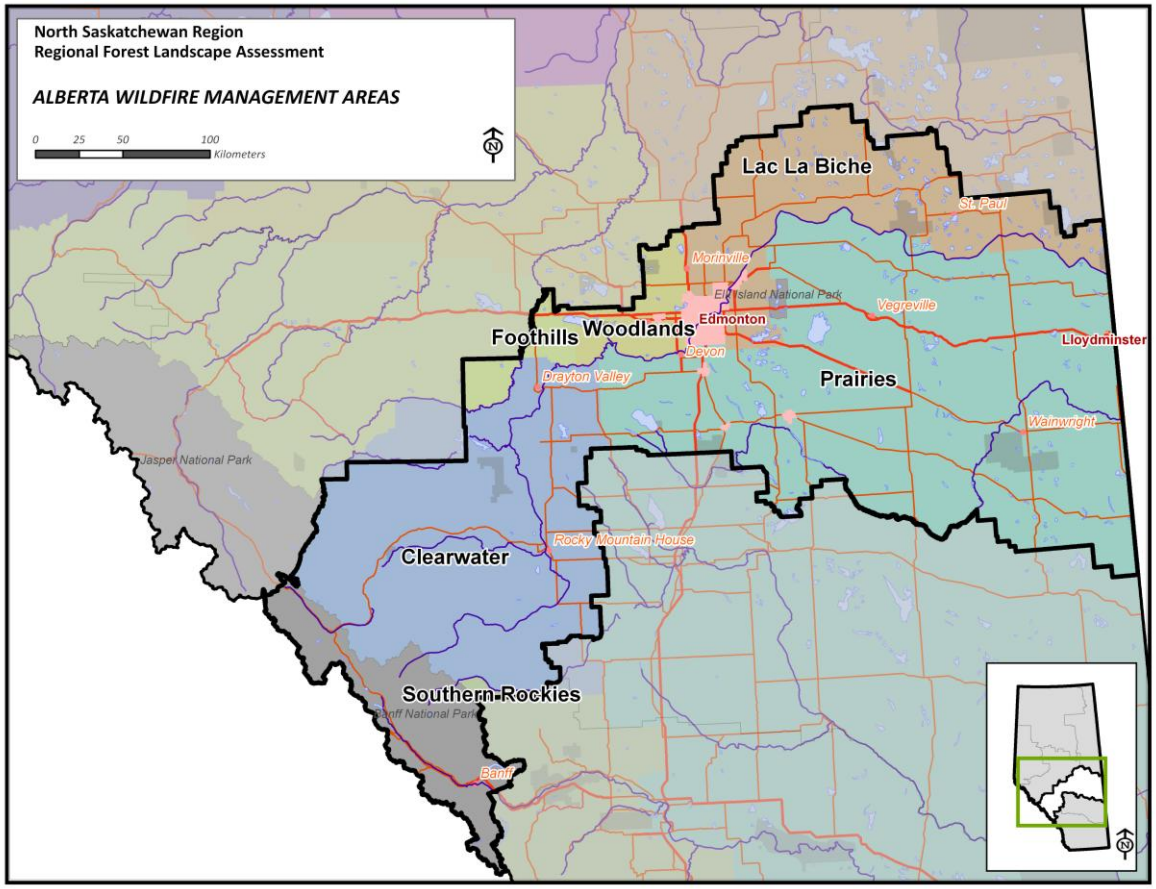


Figure 1-12 Alberta Wildfire Management Areas

2. Physical Conditions

2.1 Topography

The North Saskatchewan Region has a wide range of landscapes (16) as it extends from the Rocky Mountains easterly down to the central parkland. Several major river channels (e.g.: North Saskatchewan, Clearwater, Red Deer, and Bow) have created deeper valleys where they occur in the foothills, broadening out to more shallow valleys as they flow onto the plains.

The highest elevation in the Region is 3,586 m, which is represented by the Mount Assiniboine group, located on the continental divide, southwest of the town of Banff. The lowest elevation is approximately 497 m where the North Saskatchewan River enters Saskatchewan, north of the city of Lloydminster. Figure 2-1 illustrates the general topography of the Region.

An important element of topography for natural resource management is slope and aspect and their relationship with forest development. Those aspects are reviewed in the section regarding Natural Subregions (see section 1.5). However, slope is also an important factor in terms of defining operability for machinery as well as potential for erosion.

Four classes of slope percent were calculated based on generally accepted thresholds for operability:

0 – 30 percent	Operable
31 – 45 percent	Generally operable but may require special equipment or systems.
46 – 60 percent	Generally inoperable without special systems
60 + percent	Inoperable

About 11% of the Green Area portion of this Region has a slope defined as inoperable or 'inoperable without special systems' (Table 2-1). As expected, the majority of steep slopes are found in Banff National Park.

Table 2-1 Slope Class Distribution

	Slope Class (percent)								Total	
	0 - 30%		31 - 45%		46 - 60%		60% +			
General Location	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)
Green Area	1,439,542	81	147,379	8	87,080	5	101,937	6	1,775,938	100
White Area	5,929,324	100	424	0	2	0	0	0	5,929,751	100
Federal Lands	484,747	56	123,394	14	98,396	11	166,480	19	873,017	100
Total	7,853,613	92	271,198	3	185,478	2	268,417	3	8,578,706	100

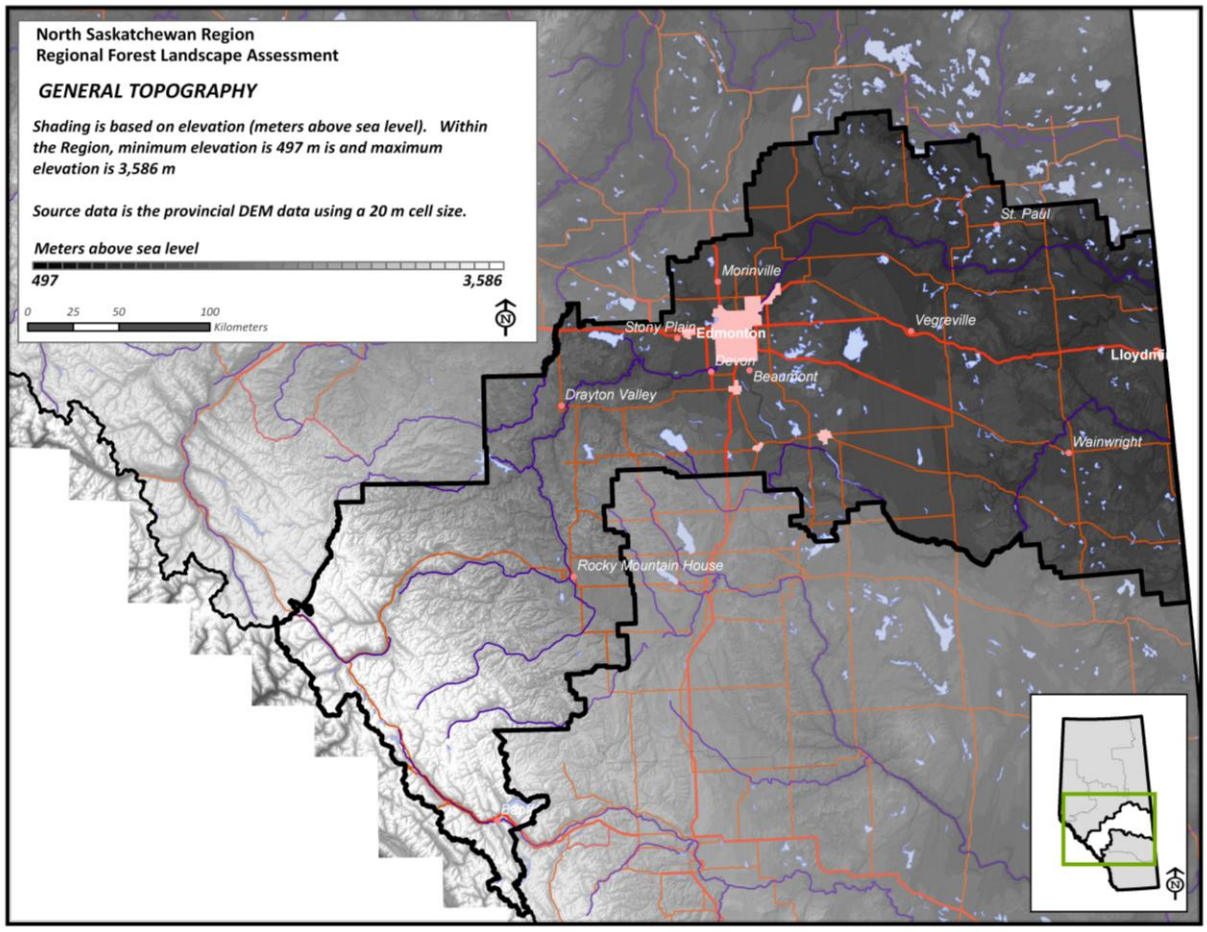


Figure 2-1 Topography

2.2 Soils and Landforms

A general description of soil orders present in the Province are described in the glossary (18). The dominant soil order is Chernozemic (17), which covers approximately 40% of the Region, primarily the eastern portion (Central Parkland) (Table 2-2). Luvisols (38%, and the second most common soil order in the Region), along with Brunisols and Podzolic soils are the three soil orders for forest soils in Canada. Brunisolic soils are typically interpreted as a "transitional" soil between generally unweathered parent material (common to Regosols) and mature forest soils represented by the Podzolic or Luvisolic orders.

The class "No Significant Soil Development" represents the large expanse of rock terrain in the foothills and Rocky Mountains.

Table 2-2 Soil Types

Soil Type			Area (ha)	Percentage (%)
Soil Order	Soil Group	Soil Subgroup		
Brunisolic	Eutric Brunisol	Eluviated Eutric Brunisol	66,736	1
Brunisolic	Eutric Brunisol	Orthic Eutric Brunisol	197,358	2
Sub-total			264,094	3
Chernozemic	Black Chernozem	Eluviated Black Chernozem	1,225,522	14
Chernozemic	Black Chernozem	Orthic Black Chernozem	1,101,459	13
Chernozemic	Black Chernozem	Solonetzic Black Chernozem	245,985	3
Chernozemic	Dark Brown Chernozem	Orthic Dark Brown Chernozem	503,459	6
Chernozemic	Dark Gray Chernozem	Gleyed Dark Gray Chernozem	22,953	0
Chernozemic	Dark Gray Chernozem	Orthic Dark Gray Chernozem	292,761	3
Sub-total			3,392,138	40
Gleysolic	Humic Gleysol	Orthic Humic Gleysol	5,165	0
Luvisolic	Gray Luvisol	Brunisolic Gray Luvisol	722,986	8
Luvisolic	Gray Luvisol	Dark Gray Luvisol	577,917	7
Luvisolic	Gray Luvisol	Gleyed Dark Gray Luvisol	45,266	1
Luvisolic	Gray Luvisol	Gleyed Gray Luvisol	63,250	1
Luvisolic	Gray Luvisol	Orthic Gray Luvisol	1,208,290	14
Luvisolic	Gray Luvisol	Podzolic Gray Luvisol	674,415	8
Sub-total			3,292,124	38
Organic	Mesisol	Typic Mesisol	4,142	0
Regosolic	Humic Regosol	Cumulic Humic Regosol	10,834	0
Regosolic	Humic Regosol	Orthic Humic Regosol	24,349	0
Regosolic	Regosol	Orthic Regosol	156,975	2
Sub-total			192,158	2
Solonetzic	Solodized Solonetz	Black Solodized Solonetz	623,520	7
No Significant Soil Development			805,364	9
Total			8,578,706	100

Chernozemic soils are normally associated with grassland landscapes, agriculture dominates the eastern portion of the Region. Luvisolic soils are dominant in forested landscapes and are generally underlain by loamy tills. Brunisolic soils are primarily found on sand-dominated parent materials throughout the Boreal forest.

Figure 2-2 illustrates the distribution of soil orders in the Region. Notable is the distribution of Regosolic and Brunisolic orders along areas of drainage in addition to the wide distribution and delineation of Luvisols and Chernozemics as evidenced by their dominance in total area.

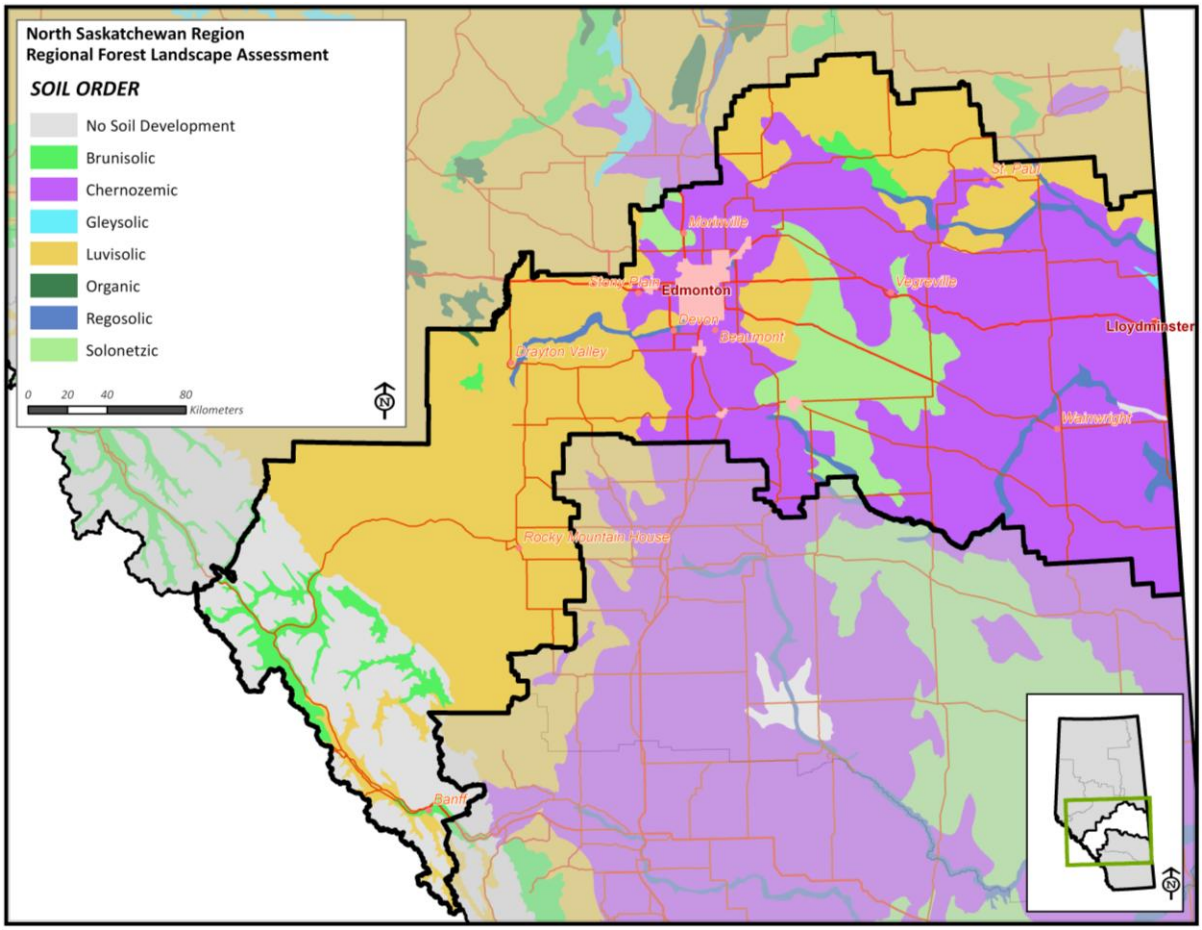


Figure 2-2 Soil Order

2.3 Hydrography

2.3.1 Water Basins

There are seven major drainage basins in the province (Figure 2-3).

The Land Use Framework regions are loosely based on these drainage boundaries. The North Saskatchewan Region (displayed in ***red*** on Figure 2-3) represents the majority of the North Saskatchewan River basin, stretching the entire width of the Province from west to east.

Figure 2-3 Major Water Basins

2.3.2 Rivers, Streams and Waterbodies

Hydrologic features (19) are mapped by the province and are classified according to their water status (permanent, recurring, intermittent). Many man-made features are identified by type (canal, reservoir, quarry, etc.), but for the purposes of this summary are grouped together as one category labelled "Man-made features".

Table 2-3 summarizes the area of waterbodies in the North Saskatchewan Region within each of the Green and White Areas as well as Federal lands. Similarly, Table 2-4 details the length of rivers and streams by their class, for each of the Green and White Area and Federal lands. The summary of water

features excludes wetlands as these are described separately in subsequent sections.

Table 2-3 Waterbody Classification

Waterbody Class	Area of Waterbody Features (ha)			
	Green Area	White Area	Federal Lands	Total
Major River	11,214	15,980	1,814	29,008
Lake (Permanent)	9,433	179,984	16,081	205,498
Lake (Recurring)	2,533	82,345	4,047	88,925
Oxbow (Permanent)	100	264	22	386
Oxbow (Recurring)	73	354	29	456
Man-made Features	2,601	6,026	13	8,639
Icefield	3,586		36,919	40,505
Total	29,540	284,952	58,924	373,416

Table 2-4 River/Stream Network Classification

River/Stream Class	Length of River/Streams (km)			
	Green Area	White Area	Federal Lands	Total
Stream (Permanent)	2,444	4,234	3,448	10,127
Stream (Recurring)	10,857	10,500	1,185	22,541
Stream (Indefinite)	9,596	19,620	520	29,736
Oxbow (Permanent)	13	138	6	157
Oxbow (Recurring)	44	219	3	266
Man-made Features	9	1,349	6	1,363
Total	22,962	36,059	5,168	64,190

Figure 2-4 shows the distribution of *permanent* water features in the North Saskatchewan Region. In addition, the significant rivers draining the Region are labeled. In total, there are 680 named lakes in the Region, of which the largest is Beaverhill Lake (13,814 ha). The 10 most significant rivers and lakes are listed in Table 2-5.

Table 2-5 List of Significant Water Features[1]

Significant Water Features			
Lake Name	Area (ha)	River Name	Length (km)
Beaverhill Lake	13,814	North Saskatchewan River	885
Pigeon Lake	9,731	Battle River	696
Wabamun Lake	8,031	Vermilion River	436
Abraham Lake	5,204	Ribstone Creek	231
Buffalo Lake	3,766	Clearwater River	199
Cooking Lake	3,642	Iron Creek	172
Bittern Lake	3,498	Sturgeon River	151
Buck Lake	2,527	Nordegg River	149
Birch Lake	2,345	Baptiste River	143
Lake Minnewanka	2,218	Red Deer River	136

[1] Area of the significant lakes, and length of the significant rivers, refer only to the portion within the North Saskatchewan Region

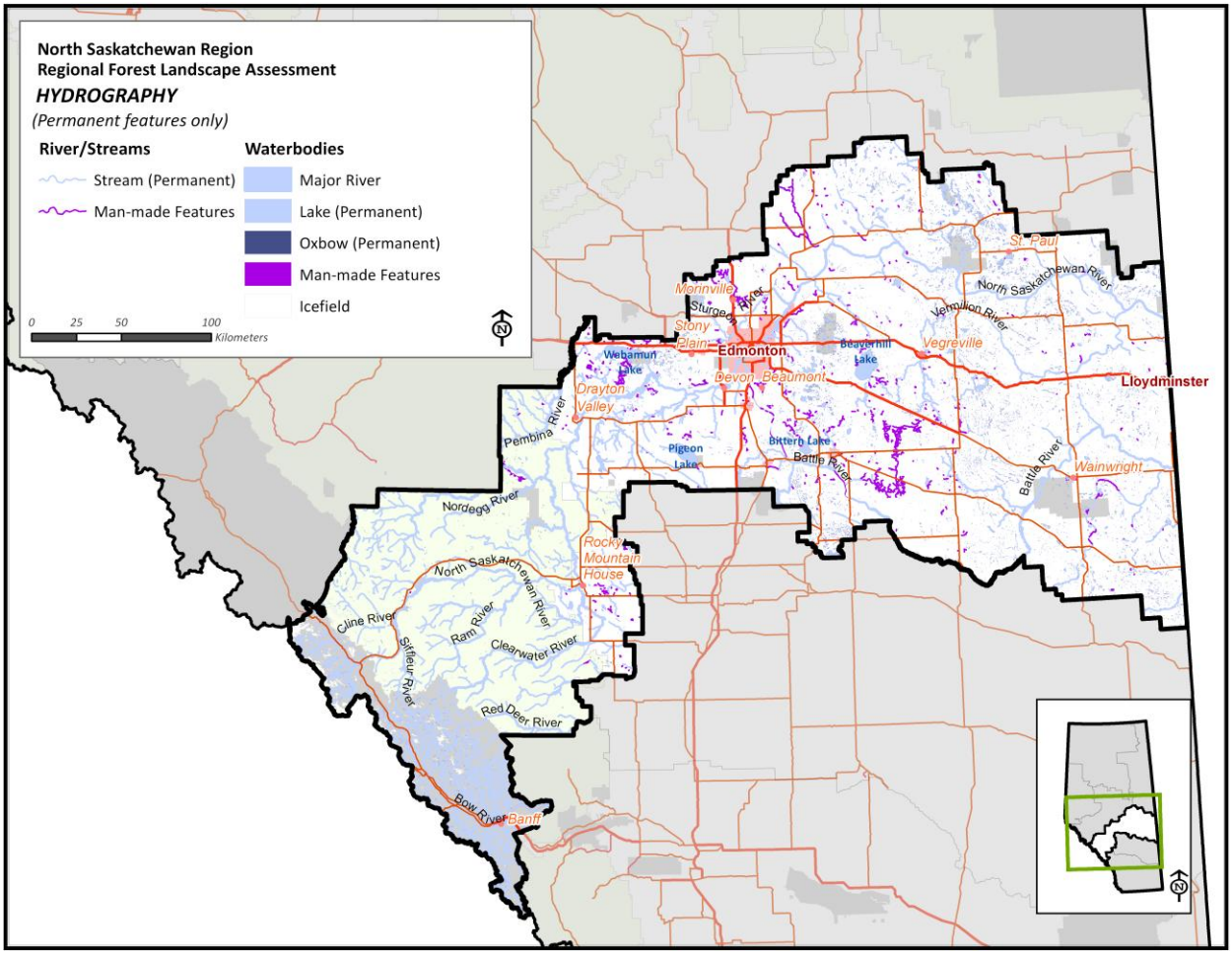


Figure 2-4 Permanent Waterbodies and Rivers

2.3.3 Wetlands

Wetlands are areas typically identified as bogs, fens or marshes and having little or no tree cover. Two sources of identification have identified wetlands in the Region:

- The AVI program (20) identifies wetlands by assigning a moisture regime of 'aquatic' and identifying the type of vegetation cover, which is typically herbaceous grass or forbs (Alberta 2005).
- The base mapping hydrography program (19) identifies wetlands as those areas of low lying terrain which have shallow water most of the year and varying heights of vegetation cover (Alberta 2006b).

The North Saskatchewan region contains approximately 1,651 hectares of wetland (Table 2-6). The majority of identified wetland is located in the White Area. No single significant area of wetlands occur in the Region, although a 230 hectare wetland complex is identified by the AVI data in the extreme

northeast corner of the Region (near the Saskatchewan border) and a second complex occurs just northwest of the town of Banff in Banff National Park.

A map of wetlands for the Region is not presented as they would not be visible at the map scale appropriate for this report.

Table 2-6 Wetland Summary

Wetland Classification	Area of Defined Wetland (ha)			
	Green Area	White Area	National Parks	Total
AVI				
Herbaceous Forbs/Grasses	275	578		853
Shrubs		7		7
Scattered Larch				0
Hydrography				
Wetlands		10	781	791
Total	275	595	781	1,651

2.4 Climate

Alberta has a continental climate which is characterized by a large variation in temperature between summer and winter. A wide range of climatic conditions are present in the North Saskatchewan due to the variety of topography from the Rocky Mountains in the west, to central parkland in the east. Climatic data from 1971 to 2000 summarized by Agriculture Alberta and Environment Canada (21) have resulted in the mapping of general climatic trends over the province.

Figures indicating the daily mean January temperature (°C); daily mean July temperature (°C); length of growing season (defined as the number of days where the daily temperature exceeds 5°C); and mean annual precipitation (mm) appear below as Figure 2-5, Figure 2-6, Figure 2-7 and Figure 2-8 (respectively).

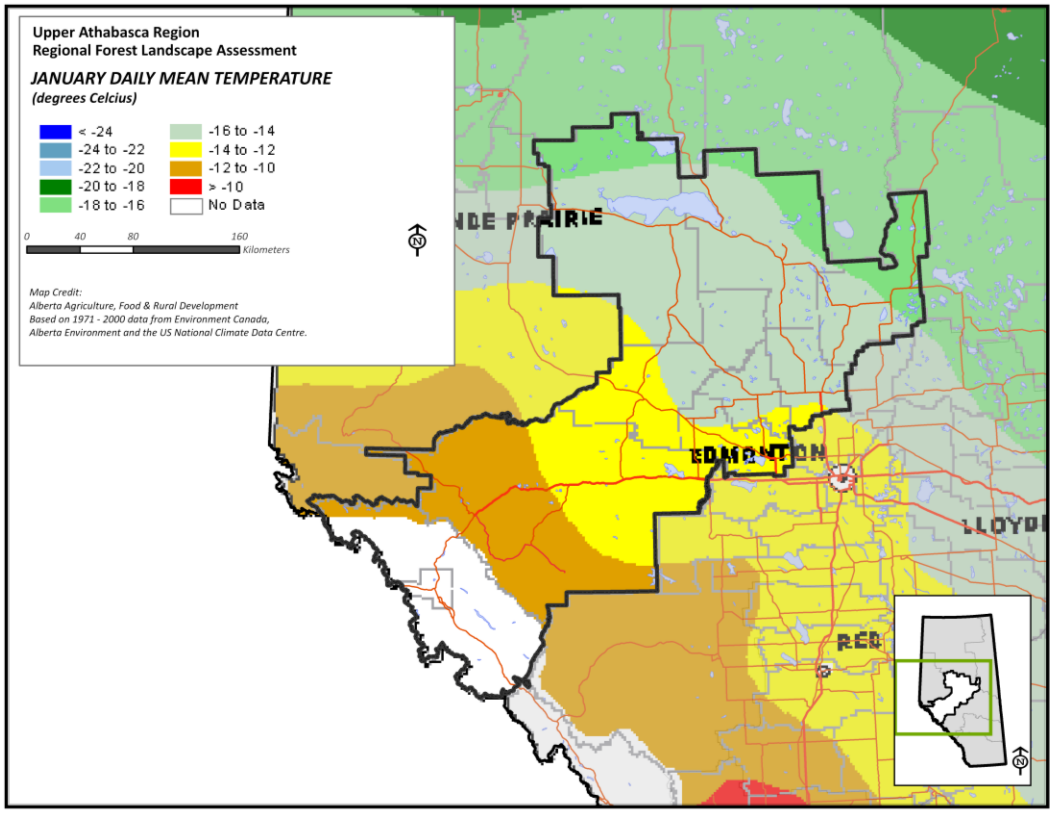


Figure 2-5 Daily Mean January Temperature

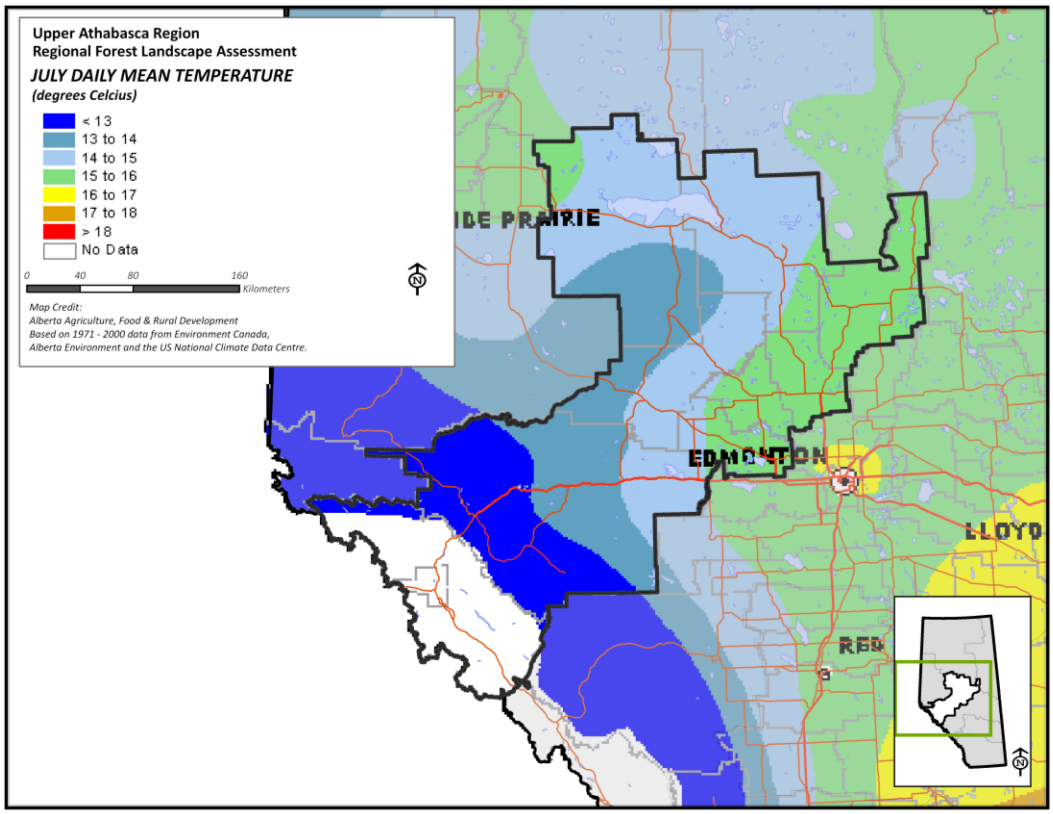


Figure 2-6 Daily Mean July Temperature

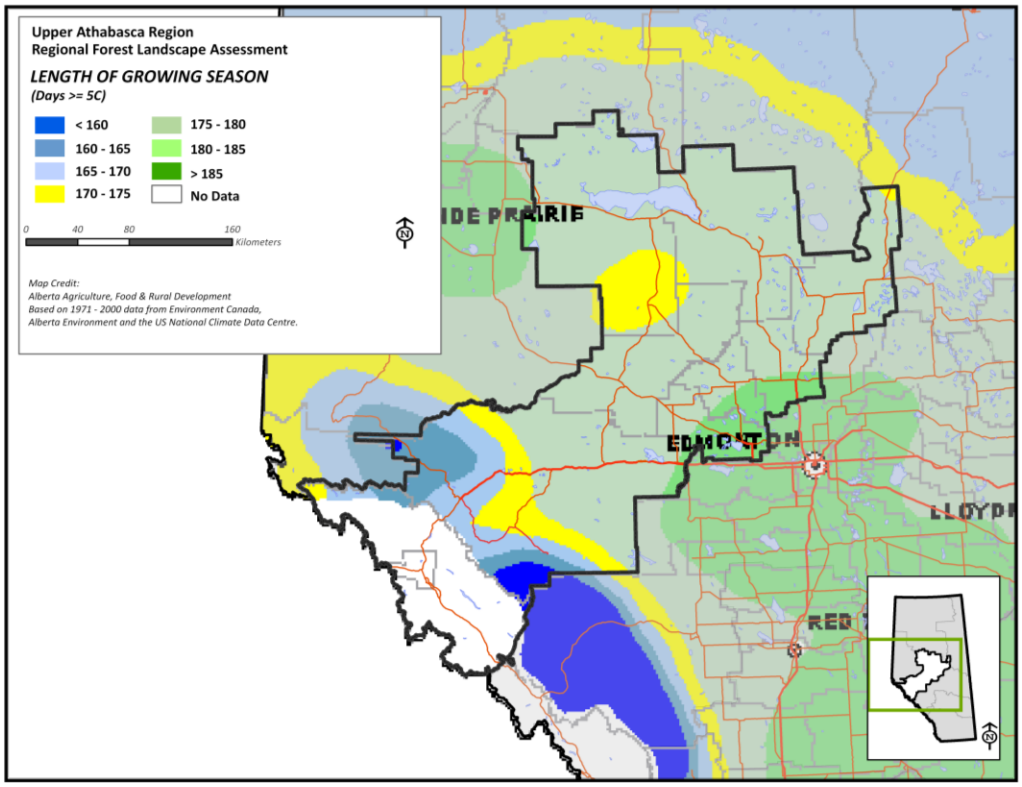


Figure 2-7 Length of Growing Season

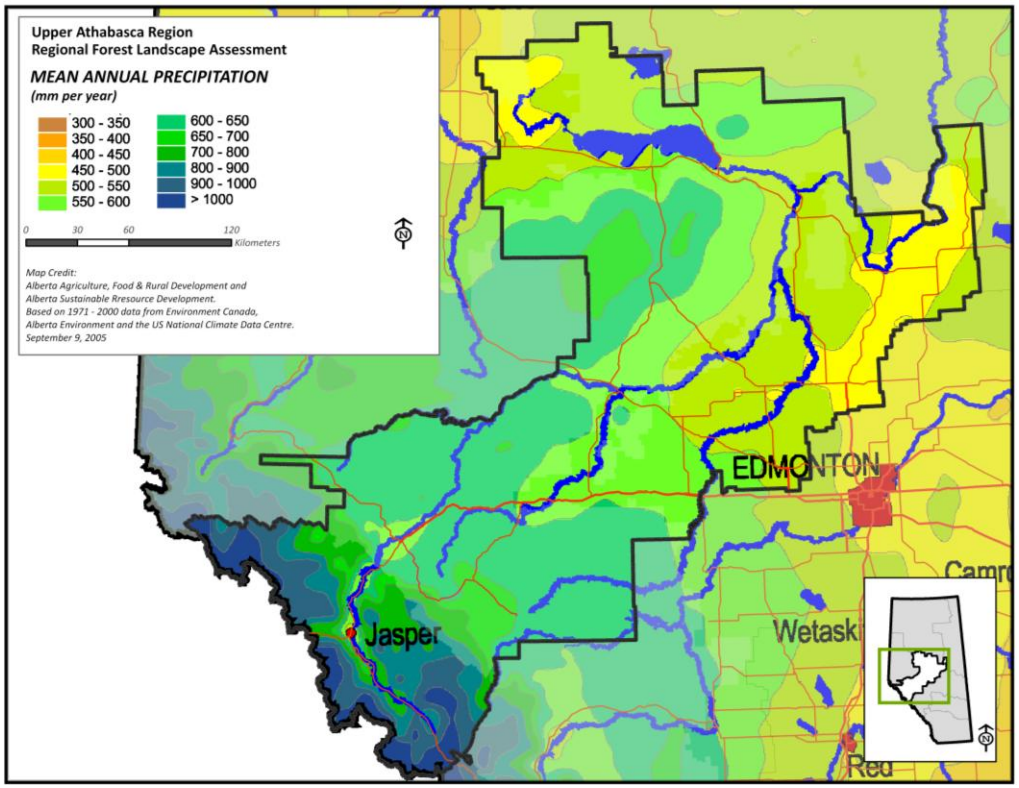


Figure 2-8 Mean Annual Precipitation

The provincial ecological classification identifies three ecoclimatic provinces present within the North Saskatchewan Region: Boreal, Cordilleran, and Grassland. The Cordilleran regime is typical in the Alpine, Subalpine and Montane Natural Subregions. The Boreal regime is largely in the north part of the North Saskatchewan Region as well as southwest of Edmonton, which is occupied by the Dry Mixedwood Subregion. The Upper Foothills and Lower Foothills, which occupy 15% of the North Saskatchewan Region (Table 1-4) are considered transitional zones between Boreal and Cordilleran ecoclimates. The Grassland regime occupies the eastern portion (44% of the Region), including Central Parkland and Northern Fescue natural subregions.

In addition to temperature, length of growing season and precipitation shown above, three important factors affecting reforestation success and tree growth have been summarized from the publication Natural Regions and Subregions of Alberta (Natural Regions Committee 2006).

Summer Moisture Index: The summer moisture index (SMI) is a measure of precipitation effectiveness during the growing season. It is calculated by dividing the number of growing degree days over 5°C by the amount of precipitation over the growing season (April through August). A high ratio indicates a greater likelihood that evaporation will exceed precipitation at some time during the growing season. For example, an SMI greater than 4 indicates dry to very dry climatic conditions, an SMI less than 3 indicates moist to wet climatic conditions with no moisture deficits during the growing season. An SMI between 3 and 4 indicates the likelihood of only moderate moisture deficits for short periods of the growing season.

Frost Free Days: The frost-free period is another indicator of temperature regimes that are favourable or unfavourable to plant growth. Factors contributing to short, erratic, frost-free periods are terrain variability and elevation. Rough terrain and higher elevations tend to reflect shorter and more unpredictable frost-free periods, likely due to variations in aspect and cold air drainage from high to low terrain. While general trends and averages are shown in the accompanying figure, the calculations of average frost-free periods are highly unreliable because of year-to-year variations in weather patterns and topographic variability.

Growing Season Precipitation: Growing season precipitation (GSP) is the portion of mean annual precipitation which falls from April to August. Higher proportions of precipitation during the growing season indicate continental climatic influences (where the bulk of the precipitation falls during the summer).

General patterns of summer moisture index, frost-free days and growing season precipitation are displayed in Figure 2-9.

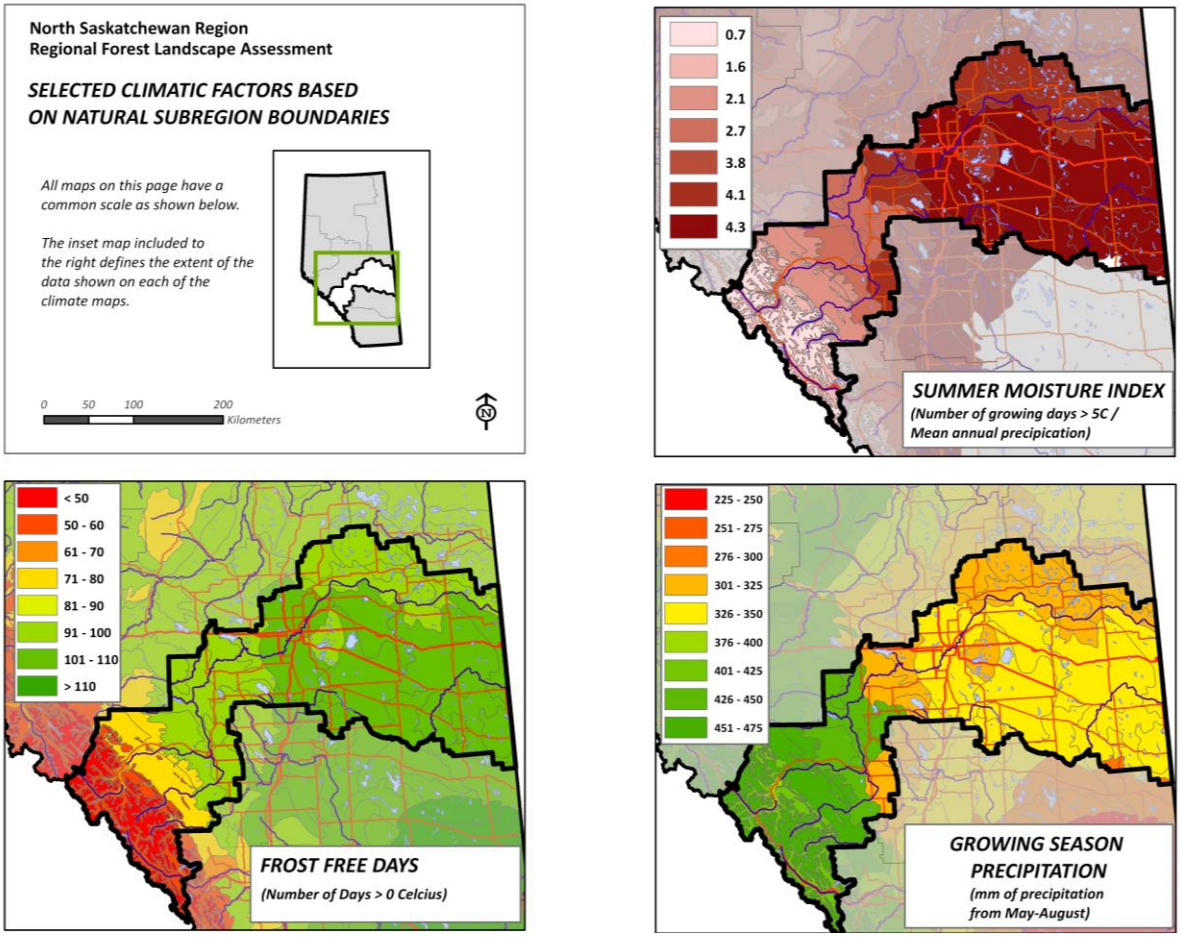


Figure 2-9 Climatic Factors Associated with Natural Subregions

3. Landscape Pattern and Structure

3.1 Source of Data

A review of landscape patterns based on vegetation is only possible where a detailed forest inventory exists. Digital Alberta Vegetation Inventory (AVI) data was compiled by ESRD using industry and Crown sources (23). This compiled data was used for the following assessments of species, stand type, age class, seral stage, patch distribution and interior forest. Approximately 28% of North Saskatchewan Region has detailed AVI data available. Figure 3-1 indicates the relative coverage of AVI detail across the North Saskatchewan Region and the source of that information. All AVI specifications data meet the minimum standard for vegetation classification as described in Alberta (2005).

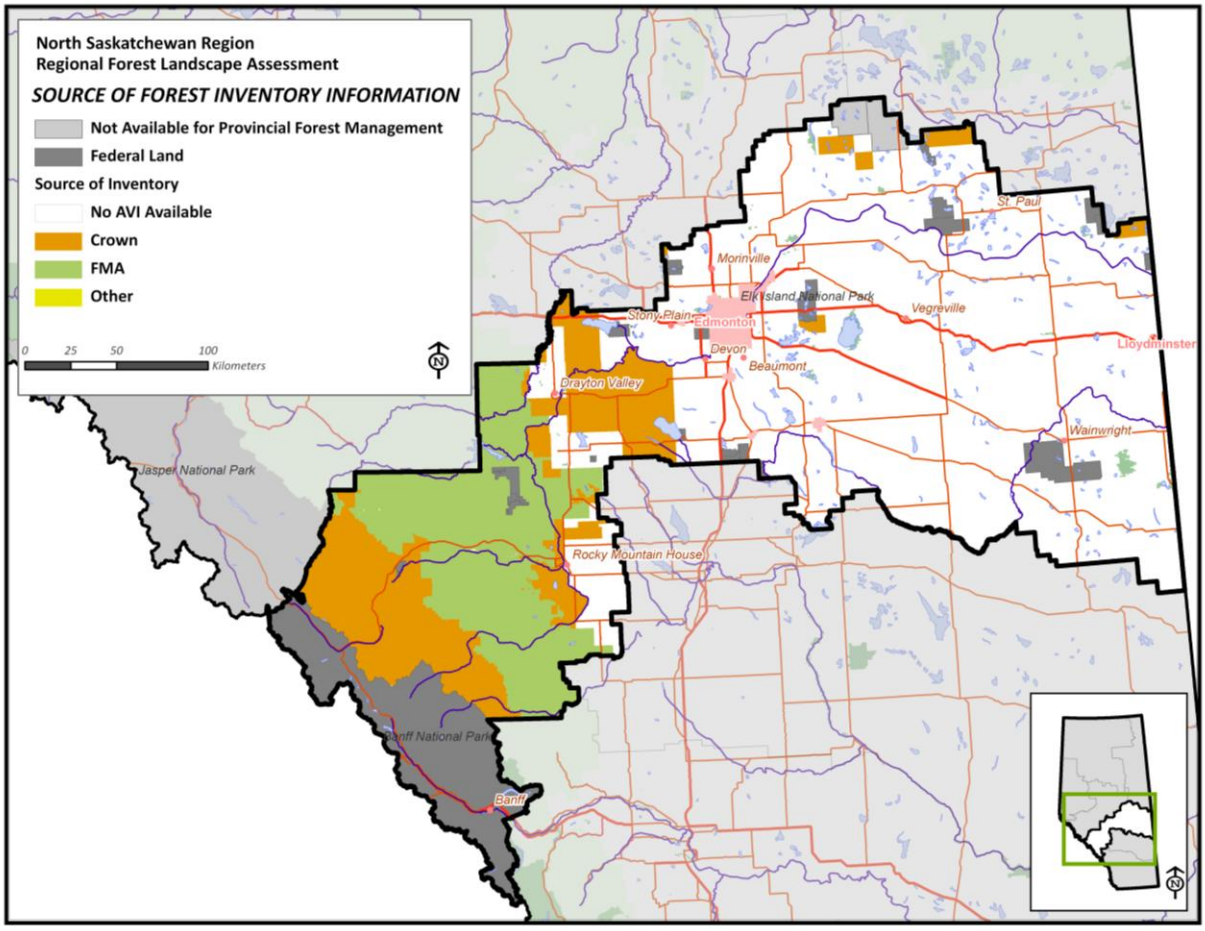


Figure 3-1 Source of AVI Information

The available inventory has been compiled over a number of years; hence the age of the inventory information varies across the Region (22). As indicated by Table 3-1, the prevalent age of the AVI in this

Region is either: between 11 and 15 years old, or greater than 20 years old. None of the inventory is newer than 10 years old; indicating that the inventory is approaching the need for a significant update. For the purposes of this report, the inventory data has been updated with known depletions related to harvesting, wildfire and land use disturbances (up to and including 2011), but stand characteristics have not been modified to reflect changes in stand growth (density, height, species composition).

Note that the area identified as "No AVI Available" is comprised largely of cultivated land in the White Area in addition to Banff and Elk Island National Parks. The balance of the non-inventoried area is in the White Area or selected portions of the Green Area where ESRD has no management responsibility (e.g.: Federal lands, Metis communities , First Nations).

Table 3-1 Age of AVI Information

Age of AVI (years)	Area (ha)	Percentage (%)
5 to 10 years	0	0
11 - 15 years	952,254	11
16 - 20 years	632,118	7
Greater than 20 years	818,079	10
Sub-total	2,402,451	28
No AVI Available	6,176,254	72
Total	8,578,706	100

For the purposes of this landscape assessment, only the overstory detail was used for the classifications of species, forest types, age class and seral stage; the understory information was not considered. It is certainly understood that individual FMA holders may use other business rules for classifying such attributes for their planning and yield estimation, but these overall landscape assessments are based only on the overstory characteristics.

3.2 Forest Species

Forest species (23) refers to the general commercial tree species in Alberta and does not include species such as willow or alder as they are typically more shrub-form in Alberta. In this assessment, the selected species was the leading tree species as identified in the forest inventory. Note there are two classes of "undifferentiated" species. The class "Hardwood - undiff" refers to stands that could be aspen or poplar – the differentiation was not possible at the time of the forest inventory interpretation. The class "Pine-undiff" represents areas where lodgepole pine and jack pine are indistinguishable either because of hybridization between the two species, or the quality of the photos available for species interpretation.

Pine-leading stand types are the most common over the area of inventoried lands, forming mostly pure stands as well as occurring in mixed conifer stands in the eastern edge of the inventory area. Aspen occurs in mixedwood stands in the central areas of the Region, but form virtually pure stands in the north eastern parts of the Region.

White and black spruces occur commonly throughout the Region. White spruce occurs in mixed conifer, mixedwoods and in pure stands. Black spruce occurs primarily on lowland areas. Note that there may be significant areas of sparse black spruce and larch occurring in wetlands. These areas would typically be classified as "Not Treed" due to the wetland being the dominant feature. The Region also contains a significant amount of Engelmann spruce, which tends to occur in higher elevations along the foothills.

The category "Undeclared species" refers to regenerating wildfires or harvest areas for which a leading tree species has not yet been established or declared.

Table 3-2 Leading Species Distribution

Leading Tree Species Common Name	Latin Name	Area (ha)
Coniferous		
White spruce	*Picea glauca*	217,494
Engelmann spruce	*Picea engelmannii*	140,093
Black spruce	*Picea mariana*	136,817
Pine - undiff	*Pinus sp.*	21,635
Lodgepole pine	*Pinus contorta*	571,219
Jack pine	*Pinus banksiana*	66
Balsam fir	*Abies balsamea*	1,083
Alpine fir	*Abies lasiocarpa*	3,606
Tamarack	*Larix laricina*	45,706
Sub-total: Coniferous		1,137,719
Deciduous		
Hardwood - undiff	*Populus sp.*	29,614
Trembling aspen	*Populus tremuloides*	314,468
Balsam poplar	*Populus balsamifera*	45,519
Paper birch	*Betula papyrifera*	4,716
Sub-total: Deciduous		394,316
Regeneration		
Undeclared species		54,822
Sub-total: Regeneration		54,822
Sub-Total Forested Land		1,586,857
Not Forested		741,013
No Inventory Data		6,250,835
Total		8,578,706

The geographic distribution of species is evident in Figure 3-2. Coniferous species are most prevalent in the west with a trend to hardwoods easterly across the Region. The large area of "Not Treed" in the south central part of the Region is primarily agricultural land in an inventoried area of the White Area.

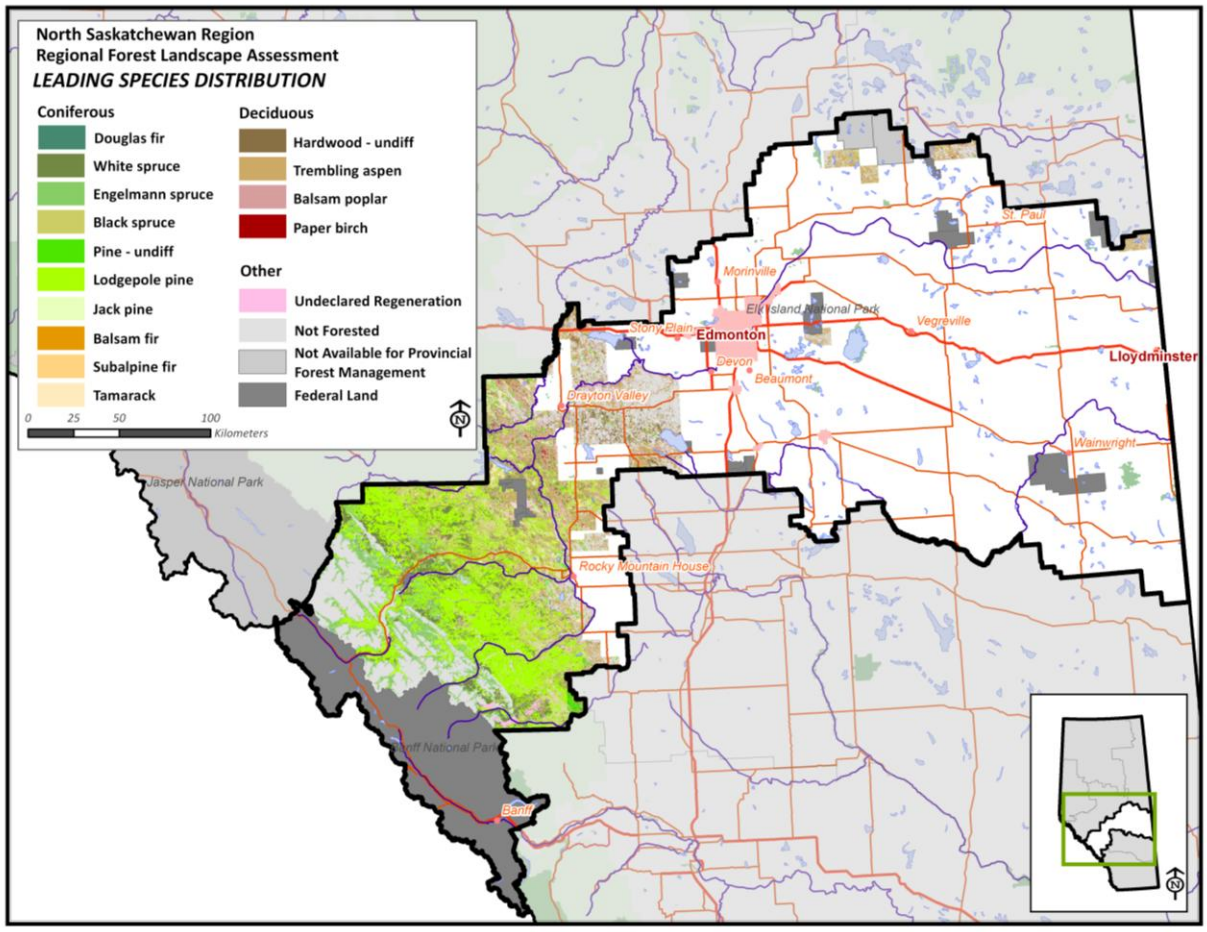


Figure 3-2 Leading Tree Species

3.3 Forest Cover Types

Cover type groupings (23) are based on the provincial strata defined in the yield projection guidelines of the Forest Planning Standard (Alberta 2006). Strata are hierarchical, based first on broad cover group (Deciduous, Deciduous-Coniferous, Coniferous-Deciduous, Coniferous) and then by leading coniferous species (except in the case of pure deciduous). There are 10 primary forest cover types defined in the Planning Standard. The stratum 'Coniferous – Douglas fir leading' is not represented in the forest inventory information available for the North Saskatchewan region.

The Region is dominated by primarily conifer stand types (Table 3-3), with 1,088,888 hectares of the Region covered by spruce and pine coniferous forest strata. These types are most common in the western part of the Region where the foothills lead into more steep slopes and cooler environments. Deciduous stands are significant in the Region (331,134 hectares) and are generally found in the central and northeastern part of the Region. The "Regeneration" category are those harvest areas or wildfires for which an AVI strata has not been assigned.

Figure 3-3 shows the spatial distribution of cover types across the North Saskatchewan Region.

Table 3-3 Forest Cover Type Summary

Description	Code	Area (ha)
Forested Land		
Pine pure or leading	C-P	571,074
Black spruce pure or leading	C-Sb	180,790
White spruce pure or leading	C-Sw	337,004
Pine/Hardwood	CD-P	22,696
Black spruce/Hardwood	CD-Sb	1,847
White spruce/Hardwood	CD-Sw	25,213
Hardwood/Pine	DC-P	25,797
Hardwood/Spruce	DC-S	36,479
Deciduous	D	331,134
Regeneration (undeclared strata)		54,822
Sub-total		1,586,857
Not Forested		741,013
No Inventory Data		6,250,835
Total		8,578,706

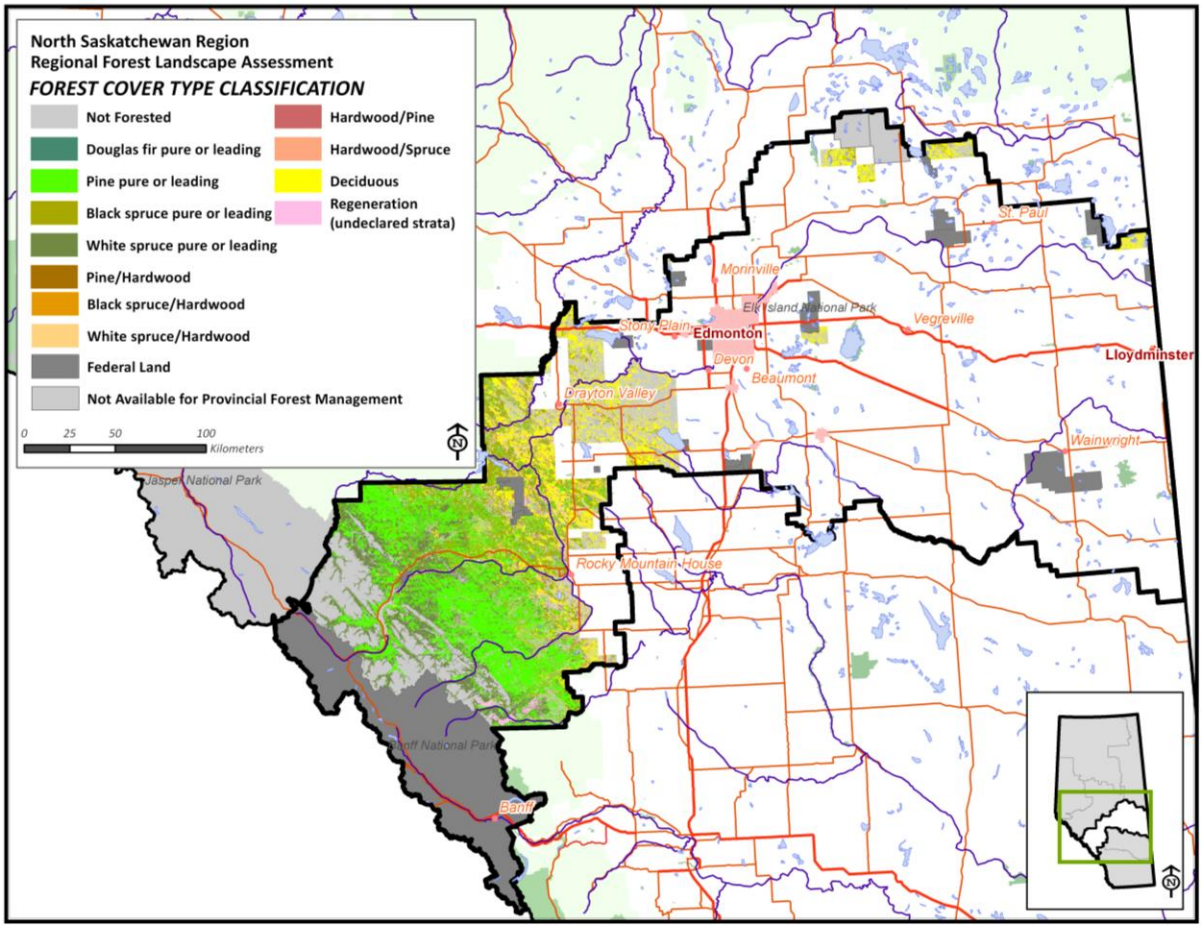


Figure 3-3 Forest Cover Type Distribution

3.4 Forest Age Classes

The age class distribution (23) over the forested landscape of the Region is shown in Table 3-4. The majority of the forest would be considered mature, with a full 40% of the inventoried area (925,424 hectares) falling in age classes 100 years or older. The second largest grouping of ages is the neighbouring class of 90-99 years old, which represents 9% of the forested landbase for which detailed information is available. The pattern of the age class distribution is shown in Figure 3-4.

An overview map of the distribution of age classes appears as Figure 3-5.

Table 3-4 Age Class Distribution

Age Class (years)	Area (ha)
Forested Land	
0 - 9	53,189
10 - 19	57,871
20 - 29	22,855
30 - 39	11,673
40 - 49	18,752
50 - 59	20,091
60 - 69	48,225
70 - 79	100,145
80 - 89	113,777
90 - 99	214,854
100 - 109	102,920
110 - 119	178,912
120 - 129	239,303
130 - 139	88,446
140 - 149	107,898
150 - 159	57,863
160 - 169	34,250
170 - 179	18,085
180 - 189	9,460
190 - 199	18,594
200 +	69,692
Sub-total	1,586,857
Not Forested	741,013
No Inventory Data	6,250,836
Total	8,578,706

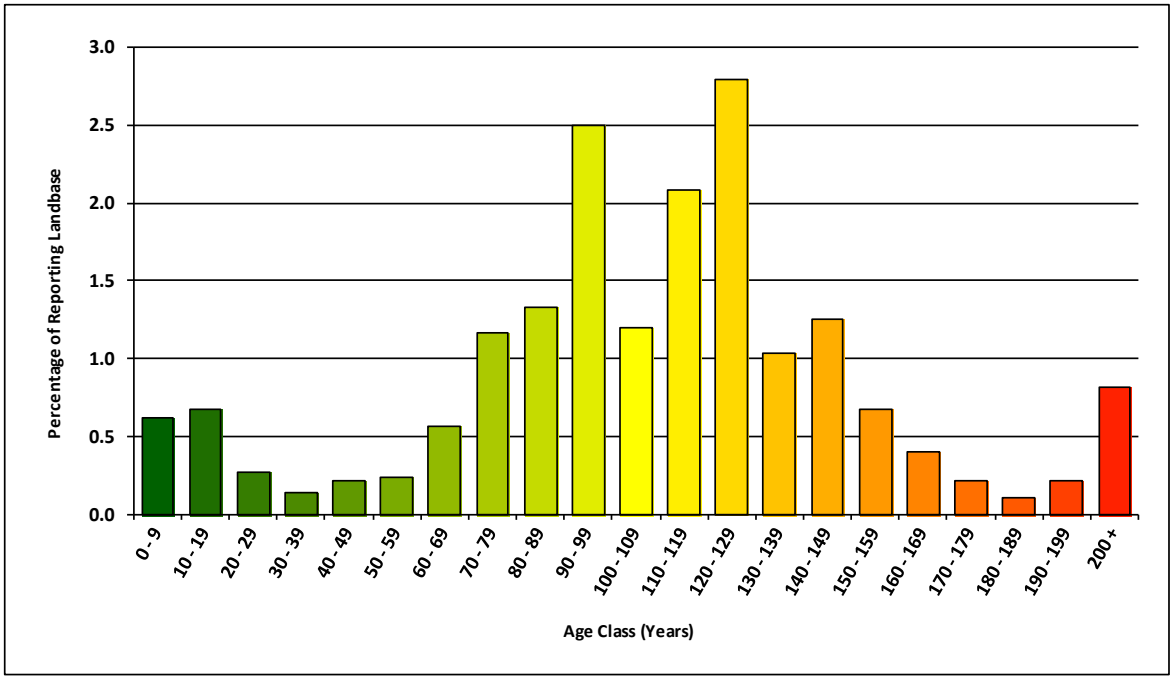


Figure 3-4 Distribution of Age Classes

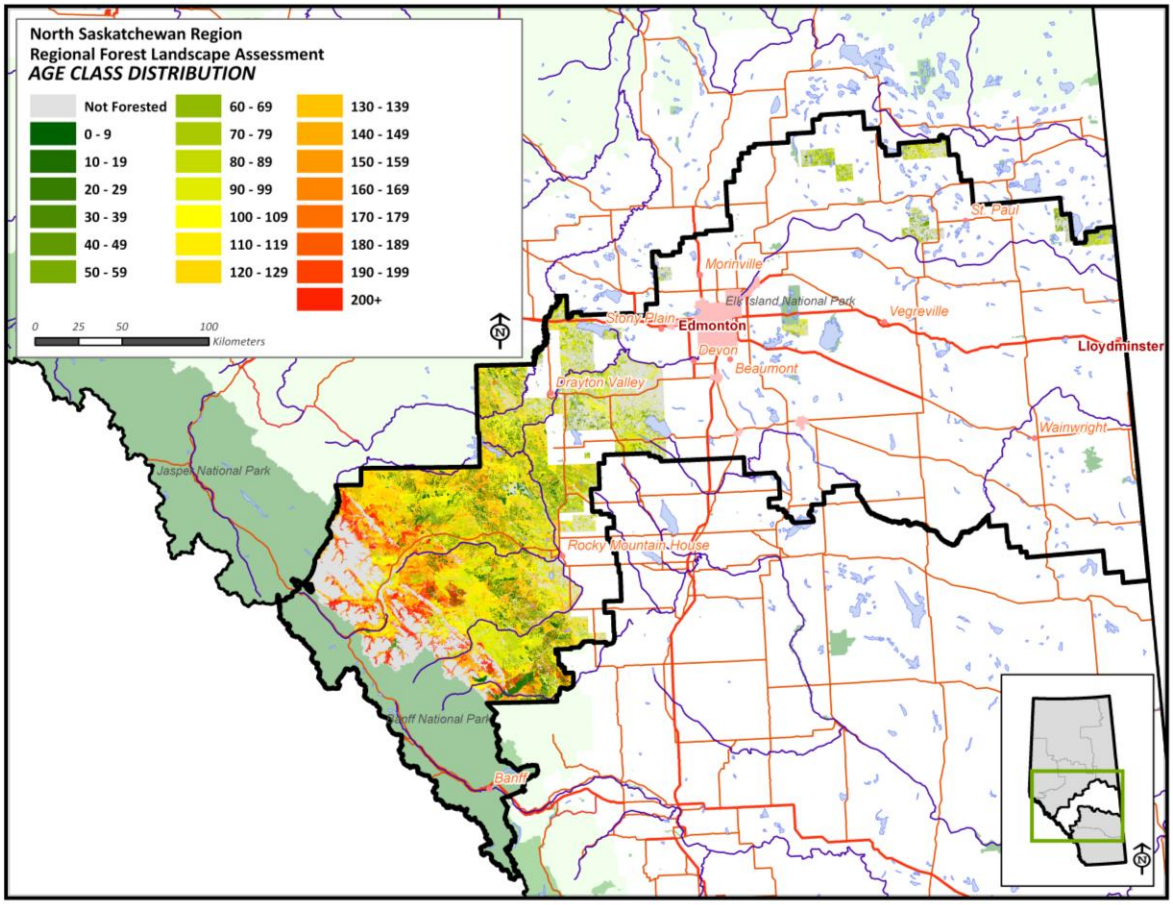


Figure 3-5 Age Class Distribution

3.5 Seral Stages

Seral stages (23) refer to stages in forest succession that are characterized by plant community conditions. For the purposes of this report, seral stages are defined by stand age.

Seral stage classes across the inventoried area of the North Saskatchewan Region are represented mostly by Mature and Old forest (Table 3-5). The Young class is made up primarily of regenerating harvest areas and wildfires and occupies approximately 5% of the inventoried land base (111,060 hectares). Old and Very Old growth forest totals 643,591 hectares, representing approximately 4% of the inventoried land base and 1% of the Region.

Table 3-5 Seral Stage

Seral Stage	Definition	Area (ha)
Forested Land		
Young	Stand age < 20 years	111,060
Immature	Stand age 20 to 79 years	221,742
Mature	Stand age 80 to 119 years	610,464
Old	Stand age 120 to 179 years	545,845
Very Old	Stand age >= 180 years	97,746
Sub-total		1,586,857
Not Forested		741,013
No Inventory Data		6,250,835
Total		8,578,706

The spatial distribution of seral stage is shown in Figure 3-6, which clearly shows the dominance of mature forest development in the western part of the Region, and immature forest in the central and northeastern areas.

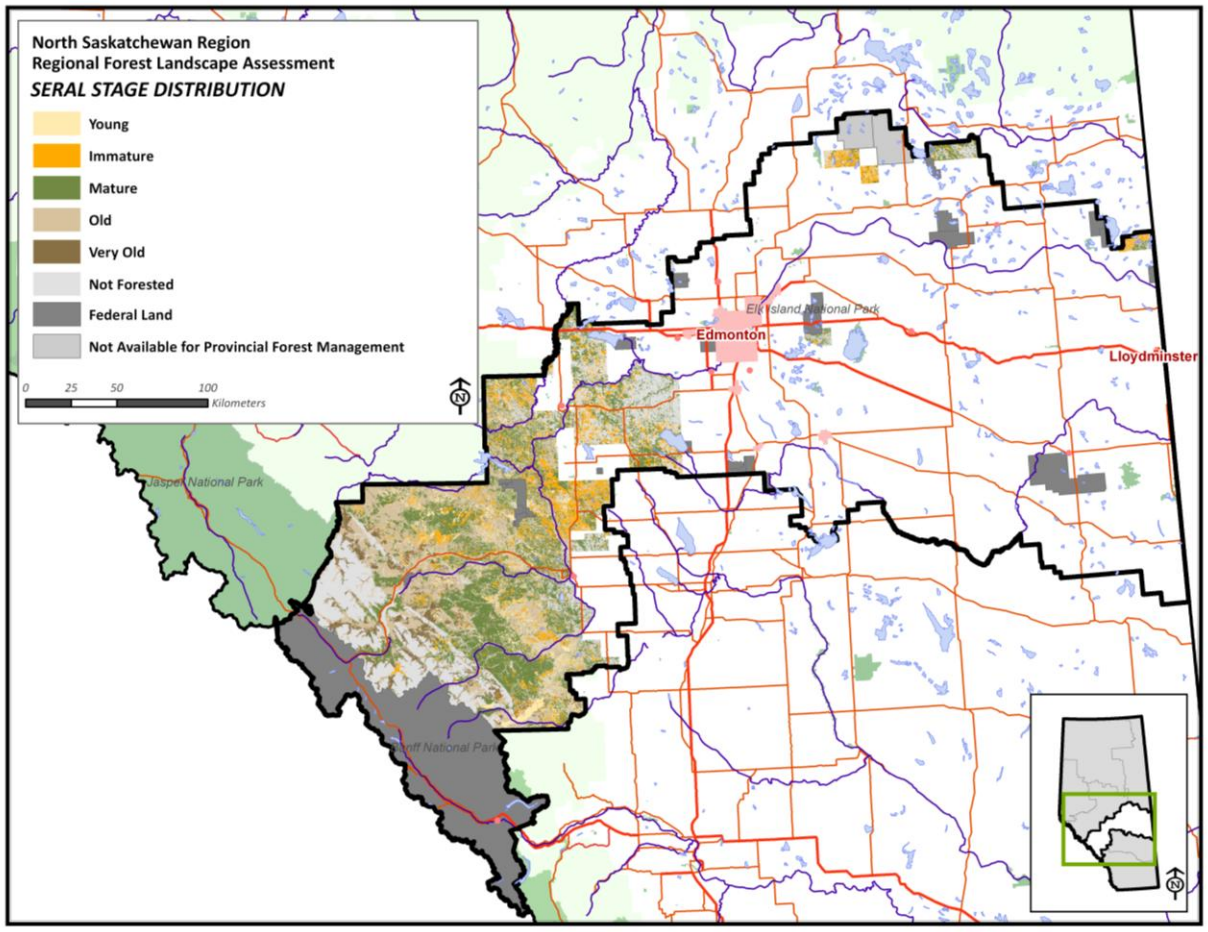


Figure 3-6 Seral Stage

3.6 Forest Patches

3.6.1 Patch Distribution of Young Stands

Patches are forest stands of the same seral stage (23) not split by any linear feature greater than 8 meters wide. Contiguous patches where the seral stage was classified as "Young" (less than 20 years of age) were classified into 4 patch-size categories. Those results appear as Table 3-6 and Figure 3-7.

Table 3-6 Patch Distribution of Young Seral Stage

Patch Size Class (ha)	Number of Patches	Area (ha)
0 - 20	24,284	45,731
20 - 100	1,189	42,942
100 - 250	62	8,937
250 +	16	14,166

The large area represented by the patch size class of greater than 250 hectares, is primarily due to large fires in the south west corner of the North Saskatchewan Region (near the Banff National Park boundary) which occurred in 2001 and 2009 (see section 4.5).

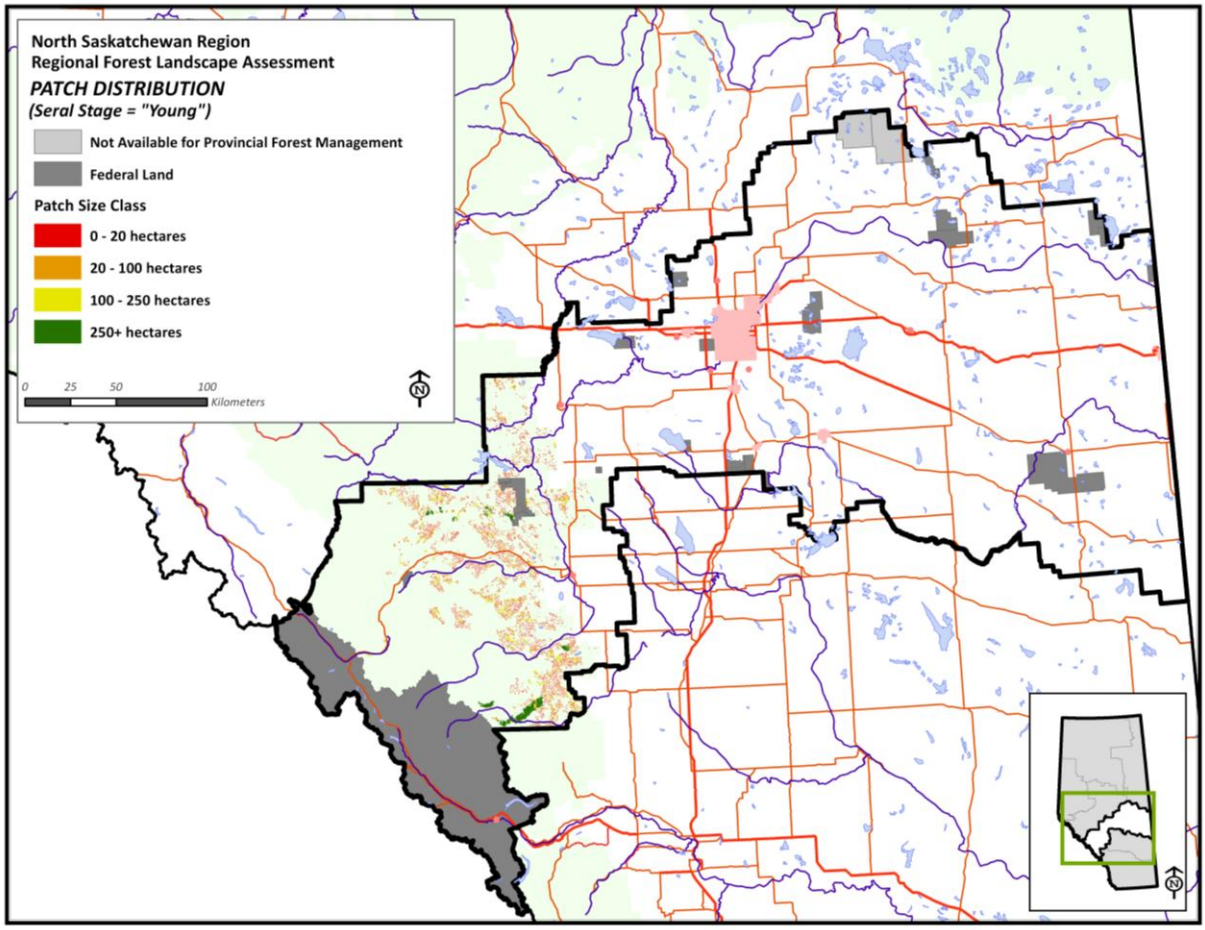


Figure 3-7 Patch Distribution of Young Stands

3.6.2 Interior Forest

Interior forest is one of two Forest Management Planning (FMP) reporting requirements that monitors the effect of forest fragmentation and resulting impacts on forest biodiversity. Interior forest is defined as forested areas greater than 100 hectares in size that are located beyond a defined edge-effect buffer zone. The edge-effect buffer zone is applied in two cases:

- along any stand edge which shares a common boundary with a linear disturbance greater than 8 meters in width; or
- stand edge along which the seral stage changes (note that the seral stage definitions used in the interior forest assessment are identical to the definitions presented in Table 3-5)..

The edge-effect buffer zone is calculated as:

- 60 meters where the adjacent area is non-forested, or forested but less than 40 years old; and

- 30 meters where the adjacent forest stand is less than or equal to 40 years old but not mature forest.

There is no edge effect applied where adjacent stands are at least mature, old or very old forest. Using these rules, the resulting interior forest was determined for the North Saskatchewan Region. The area summary is displayed in Table 3-7, and a map of the interior forest locations appears as Figure 3-8.

Table 3-7 Interior Forest by Seral Stage

Seral Stage	Number of Patches greater than 100 ha	Area of Patches > 100 ha (ha)
Young	0	0
Mature	377	200,123
Old	426	206,740
Very Old	116	40,691

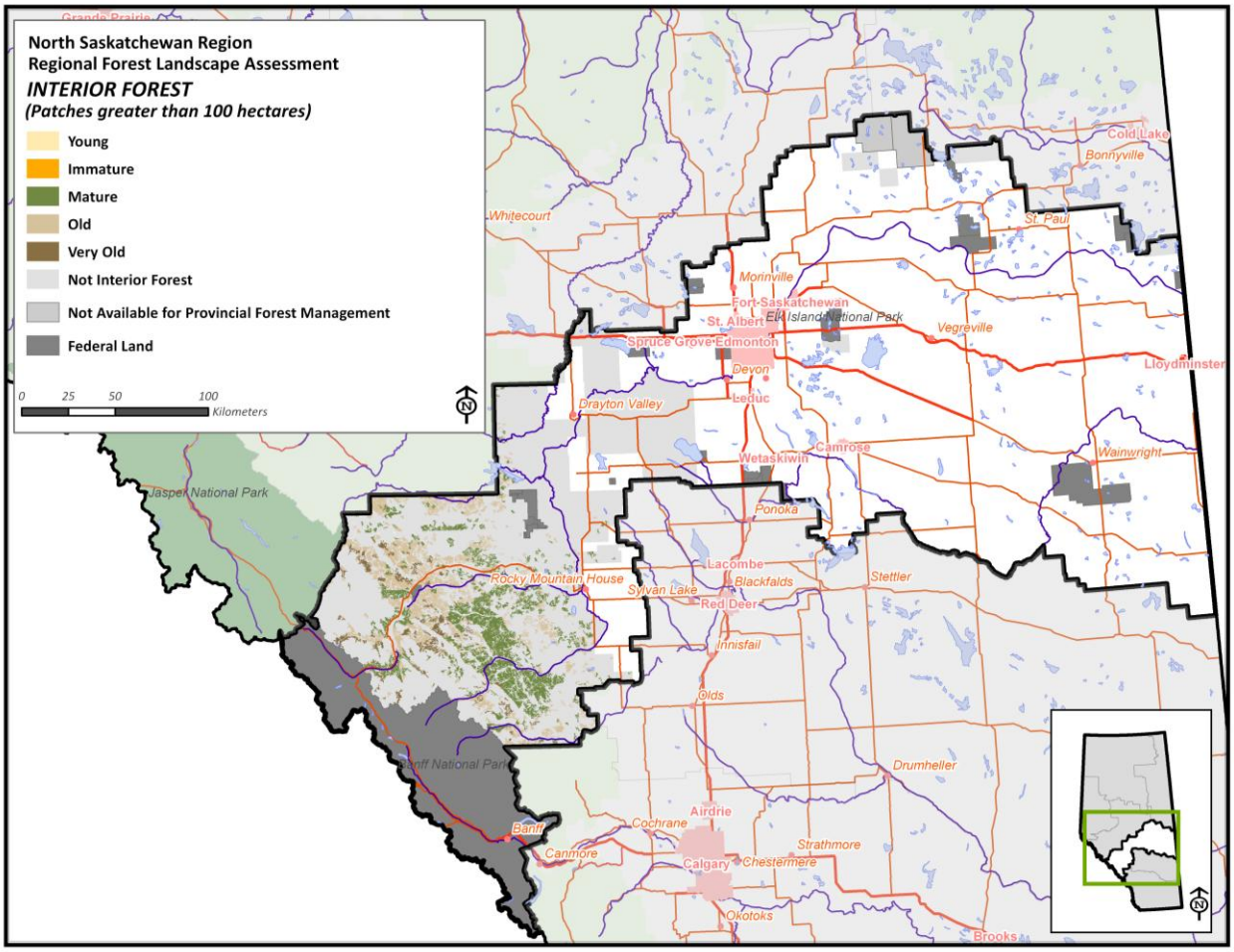


Figure 3-8 Interior Forest by Seral Stage

4. Landscape Disturbance and Succession

4.1 Inherent Disturbance Regime

The natural disturbance regime in the North Saskatchewan consists of wildfire and natural pests, with wildfire being the dominant natural factor shaping the composition and distribution of species (Rowe et al. 1973). Wildfire disturbance is the primary process introducing variability in the forest mosaic (Andison 1999).

The dominant landscape disturbances are now through anthropogenic, or man-caused, events such as increased area taken up by access and settlements as well as development of the forest and energy industries. In addition, regulation and policy to limit the impact of natural disturbances (for example: wildfire control, wildfire prevention and insect suppression programs) have contributed to a landscape shaped primarily by man's activities.

4.2 Insects and Diseases

Insect surveys conducted by ESRD, Forest Management Branch, Forest Health Section indicate that the most prevalent insect pests in this Region are:

- Hardwood defoliators:
    - Large aspen tortrix (*Choristoneura conflicta*)
    - Bruce spanworm (*Operophtera bruceata*)
    - Tent caterpillar (*Malacosoma disstria*)
- Mountain pine beetle (*Dendroctonus ponderosae*)

4.2.1 Hardwood Defoliators

Table 4-1 summarizes the total area of hardwood defoliation as surveyed by ESRD between 1998 and 2011 (inclusive) (25).

The hardwood defoliator agent causing the most damage in this Region is large aspen tortrix which accounts for 83% of the total area impacted by hardwood defoliators. The majority of the historical infestations are of moderate severity. Of the three main defoliator agents, typically only one of the species is the dominant defoliator at a given time.

Other hardwood defoliators (gypsy moth, satin moth, spearmarked black moth, aspen leafroller) are present in the province and potentially in the North Saskatchewan Region, but no surveys have detected any significant populations worth noting.

Table 4-1 Summary of Hardwood Defoliator Agents

Insect Pest - Hardwood Defoliators		Severity of Impact						Total	
		Light		Moderate		Severe			
Common Name	Latin Name	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)
Large aspen tortrix	*Choristoneura conflictana*	122,687	21	216,677	37	143,441	25	482,805	83
Bruce spanworm	*Operophtera bruceata*	272	0	1,222	0		-	1,493	0
Forest tent caterpillar	*Malacosoma disstria*		-		-	68,701	12	68,701	12
Aspen defoliators			-	7,433	1	18,039	3	25,472	4
Total[1]		122,958	21	225,331	39	230,182	40	578,472	100

[1] Sum of infestation survey records 1999 to 2011 inclusive

Figure 4-1 is an overview of the history of the presence of hardwood defoliator outbreaks impacting forests in the North Saskatchewan Region. As these defoliators tend to occur in cycles, only the last 8 years of infestation are mapped. The level of damage associated with hardwood defoliators is quite low due to the dominance of coniferous stand types in the Region. A detail summary of the most important of these insect species (large aspen tortrix, Bruce spanworm and tent caterpillar) is presented in following sections.

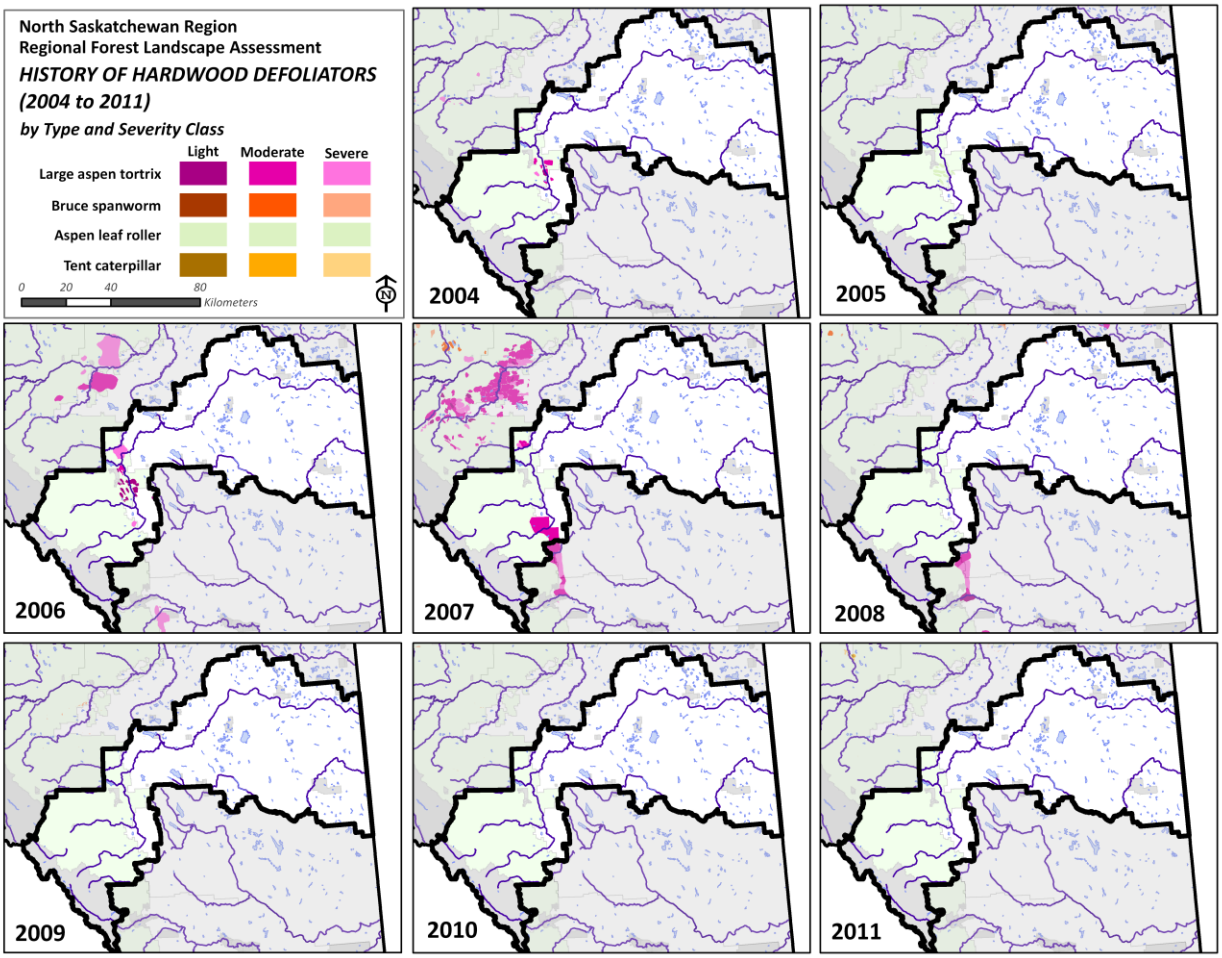


Figure 4-1 History of Hardwood Defoliation Outbreaks (2004-2011)

Large Aspen Tortrix

The large aspen tortrix occurs across Canada and is one of the most serious pests of trembling aspen. Aspen is the preferred host, but the tortrix will also feed on willow, balsam poplar and white birch. Outbreaks may last 3-4 years. Damage is predominantly caused by the later larval stages which may also feed on buds. Massive defoliation can reduce growth increment but rarely results in tree mortality.

Frequently, infestations of large aspen tortrix in the North Saskatchewan can account for over half of the overall provincial infestation however these infestations are very sporadic.. Tortrix has not been an issue either in the province or Region since 2008.

Bruce Spanworm

Bruce spanworm also occurs widely across Canada. Aspen is the principle host, but the spanworm will also feed on willow, balsam poplar, white birch and shrubs such as Saskatoon, currants and wild rose. Historically, outbreaks have not lasted more than 2 years and typically decline very quickly. Hence there seems to be little value in adopting control measures for this pest.

Infestations of Bruce spanworm are sporadic in nature. The most recent infestation occurred over 2007 and 2008 but quickly collapsed. Bruce spanworm's prevalence in the North Saskatchewan Region is very low, infesting a very small portion of the Regions forests.

Tent Caterpillar

The tent caterpillar occurs across Canada and is considered the most serious defoliator of hardwoods. While aspen is the preferred host, the tent caterpillar will attack almost any hardwood species during outbreaks. Outbreaks generally last 2 to 4 years and may reoccur every 8-10 years. Infestation cause branch dieback and reduce growth increment. Several years of severe defoliation may cause mortality, particularly where trees may have additional stress factors.

There has been no significant tent caterpillar outbreak since the last major infestation which ran from 2005 to 2008. Incidence of tent caterpillar outbreaks in the North Saskatchewan Region are very low; the only infestation recorded was noted in the 2002 survey.

Given the potential greater damage to forest growth caused by tent caterpillar, there have been trials to assess bacterial control mechanisms. No such mechanism has been implemented in an operational setting.

4.2.2 Mountain Pine Beetle

The mountain pine beetle is the most destructive pest of mature pine forests in North America. Mature and over-mature pine under some sort of stress is the preferred host, but as populations increase, smaller-sized pines and healthy trees can all be attacked. Outbreaks continue as long as a food source is available. The beetle kills trees by clogging and destroying the conductive tissue of the tree. Its larvae feed in the phloem of the tree, disrupting the flow of water and nutrients. In addition, the larvae introduce a blue-stain fungus which prevents the tree from using it's pitch to repel the attacking beetles.

Figure 4-2 shows the historical spread of mountain pine beetle into the North Saskatchewan Region since annual surveys were undertaken in 2006 (24). The North Saskatchewan Region forests were not significantly impacted over the study period.

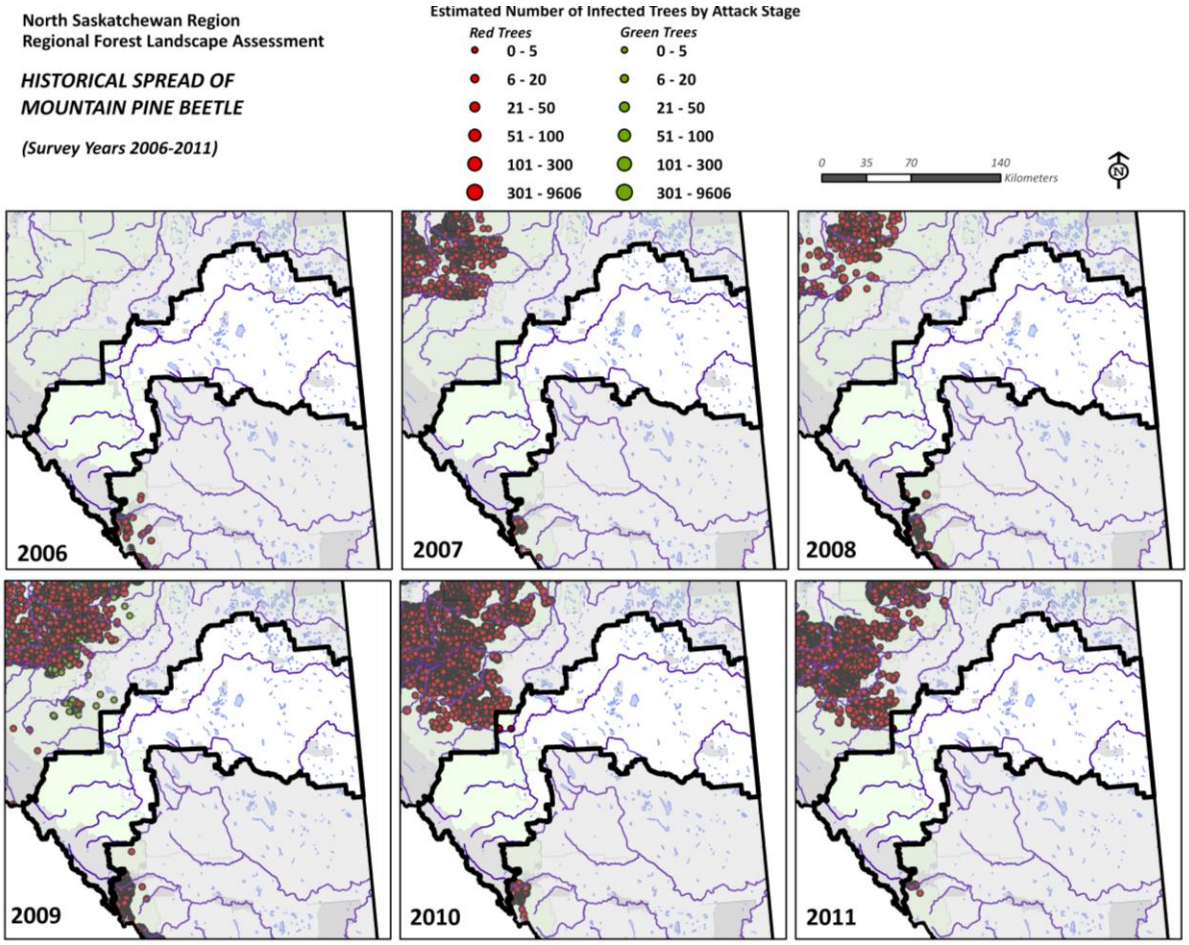


Figure 4-2 Historical Spread of Mountain Pine Beetle

4.2.3 Other Forest Health Agents

The health of the forest can be impacted by other agents (e.g.: moisture deficits, weather, other pathogens) (48). ESRD has reported localized hail damage, with one area totalling 26,145 hectares. Figure 4-3 shows the areas of hail damage surveyed in 2010. Survey results indicate the hail damage as moderate severity. Red belt, which is a general term describing tree kill by adverse weather, was observed in 2 general areas in the Region (outlined in pink in Figure 4-3), totalling 975 hectares. Along the south border of the Region-a small area of blow down (256 hectares) was recorded in 2010

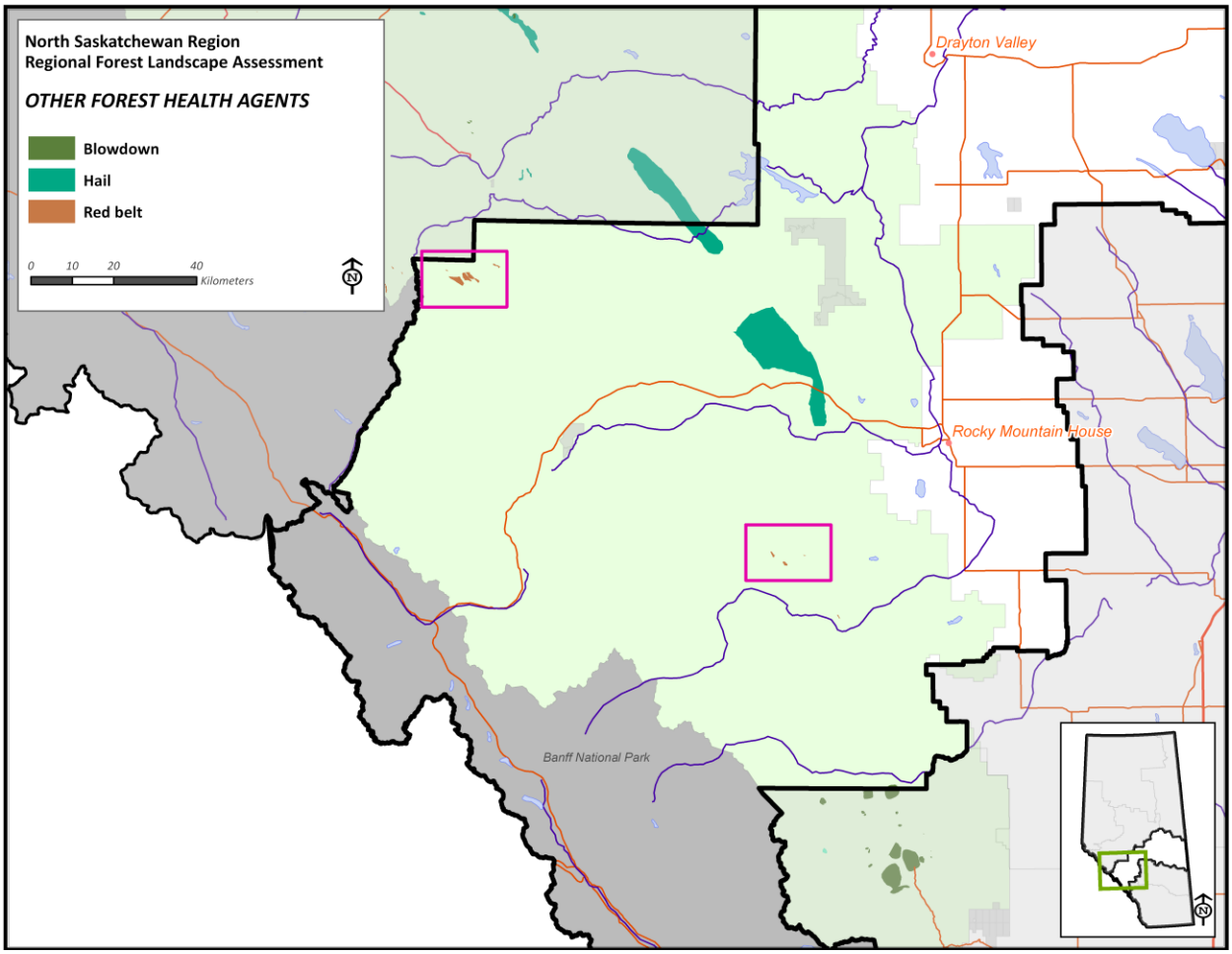


Figure 4-3 Other Forest Health Agents

4.3 Invasive Plant Species

An invasive species has been defined as "a species, subspecies or lower taxon, introduced outside its natural past or present distribution ... whose introduction and/or spread threaten biological diversity" (United Nations Environment Program 1992). Invasive plant species are monitored by Agriculture Alberta as well as Public Lands and Forestry Divisions of Environment and Sustainable Development (27). Alberta classifies invasive plants into two categories (Alberta 2008a):

Prohibited Noxious	A noxious plant (including seeds) that must be destroyed by the landowner or person who occupies the land. Destroy means to kill all growing parts or to render reproductive mechanisms non-viable.
Noxious	A noxious plant (including seeds) that must be controlled by the landowner or person who occupies the land. Control means that the action may destroy the plant, but at best, must inhibit its growth or spread.

Additionally, plants can be identified as “Nuisance”. These have no legislative controls but are identified as potential problem species. The Weed Control Regulations of 2010 also allow municipalities to declare additional plant species as prohibited or noxious and impose the current regulations on those species.

Any areas that receive reclamation activities are potential problem sites for invasive species as commercial seed mixes can contain seeds from noxious plants. There are 1,227 sites of observed invasive species in the North Saskatchewan region. At each site, it is possible that multiple invasive species are present. Sample sites are visited by municipal and provincial inspectors on a regular basis. Table 4-2 shows the invasive plants status for the Region by class (prohibited, noxious, nuisance).

Only 1% of the sites visited had no problem weeds surveyed. Fortunately, the occurrences of prohibited noxious plants is very low, the 3 occurrences account for less than one quarter of one percent of all observations. Incidences of noxious plants is the highest category at 79% of all observed invasive plants, with the most common problem species being Tall Buttercup and Canada Thistle.

Figure 4-4 shows the distribution of invasive plants in the Region. The majority of occurrences are in the Green Area, likely as a result of tighter controls on seed spread in the agricultural areas of the White Area.

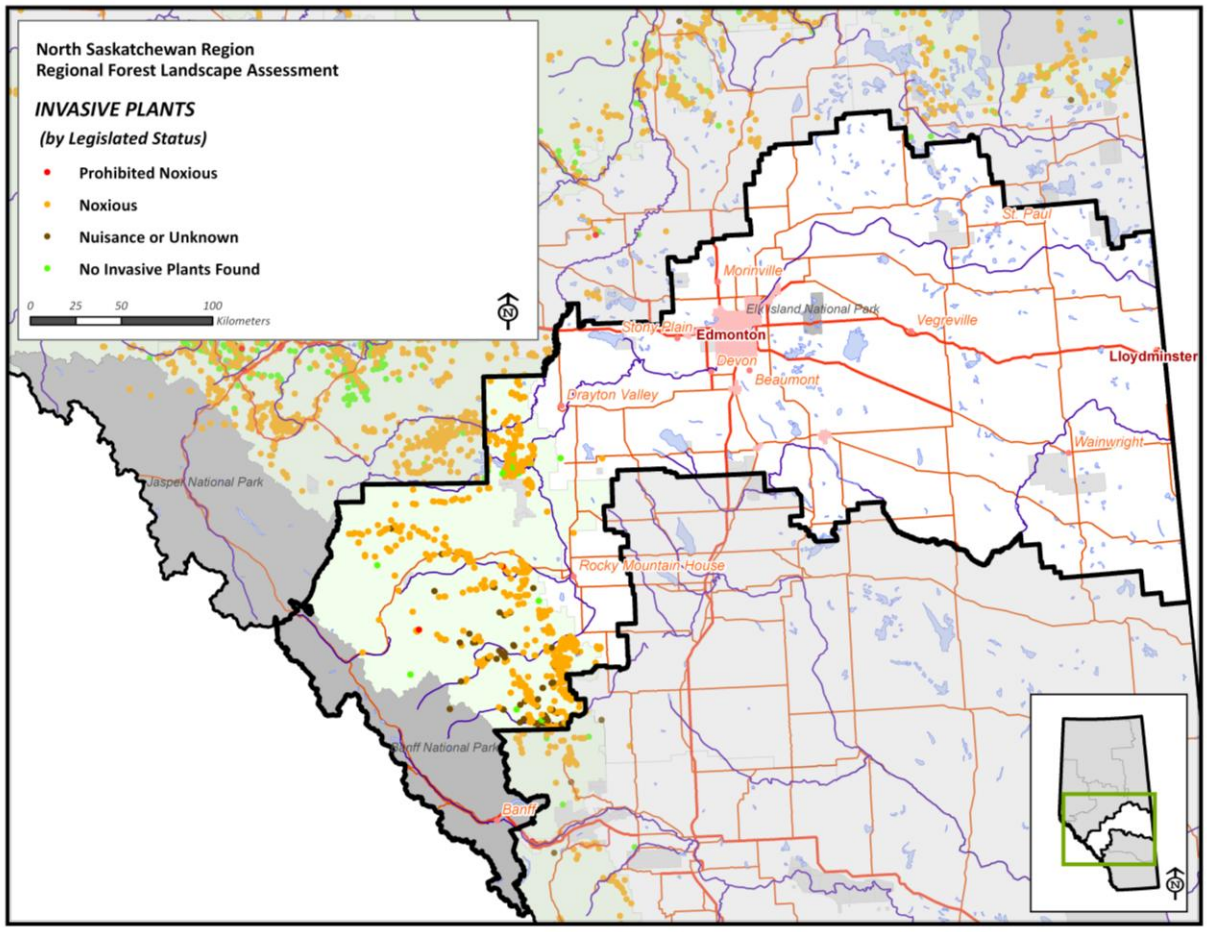


Figure 4-4 Invasive Plant Distribution

Table 4-2 Ranking of Invasive Plant Species

Classification and Weed Name	Incidence of Observed Weeds	Percentage of All Obs. (%)
No Weeds Found		
None	20	1
Sub-total No Weeds Found	20	1
Prohibited Noxious		
Purple Loosestrife	3	0
Sub-total Prohibited	3	0
Noxious		
Canada Thistle	241	14
Common Tansy	37	2
Common Toadflax	1	0
Oxeye Daisy	110	7
Perennial Sow Thistle	126	7
Scentless Chamomile	111	7
Tall Buttercup	691	41
Toadflax	1	0
White Cockle	11	1
Sub-total Noxious	1329	79
Nuisance/Unknown Status		
Bladder Campion	1	0
Cleavers	14	1
Narrow-Leaved Hawk's Beard	84	5
Stork's Bill	14	1
Wild Caraway	217	13
Sub-total Nuisance	330	20
Total	1682	100

4.4 Forest Succession

Forest succession is the composition of vegetation communities, on a site, over time. The process of succession results in different structural components (e.g.: density by species, understory composition, snags or other dead materials) at various time periods. Many of these structural components can undergo a somewhat predictable pattern of change as stands age. The discussion of successional factors and patterns presented here are a compilation of information from Boreal Centre (2002), Song (2002), Daishowa-Marubeni (2008). The report compiled by the Boreal Centre includes a considerable list of papers devoted to the subject of succession in the boreal mixedwood.

Moisture regime has the greatest influence on forest succession (Boreal Centre 2002). In the boreal mixedwood of Alberta, moist sites are characterized by stands of black spruce and larch, medium sites by aspen and white spruce and dry sites by pine (Boreal Centre 2002, Daishowa-Marubeni 2008). Succession on moist and dry sites indicate that the original black spruce (moist sites) and pine (dry sites) tend to be generally replaced with the same stand type after fire, though often with some component of

aspen. In cases where black spruce occurs as an understory to pine, the trajectory may result in a continued mixed-coniferous stand and not a pure pine stand, particularly in the absence of a fire event.

Following fire, aspen regenerates aggressively on medium sites through root suckering and is virtually always present in regenerating stands (Boreal Centre 2002). The introduction of white spruce on medium sites is more variable for a number of reasons (e.g.: variable seed production on neighbouring seed trees, distance from seed sources). Because of this variability in white spruce regeneration, several stand development pathways are possible on medium sites. Where ever white spruce seed is available along with a suitable seed bed, an even-aged mixed stand of white spruce and aspen can be expected. Because aspen is shade intolerant, it will typically not regenerate under a closed canopy. This leads to the conversion of these mixed stands to pure white spruce in approximately 100 years.

When white spruce seed is available, but the seedbed may not be suitable for quick germination, the stand will initially generate to aspen and spruce will incrementally enter the site. This condition leads to an uneven-aged mixed wood stand which will also eventually become a pure white spruce stand, but over a considerably longer time than under the even-age scenario.

The transition of stands to the mature stage is triggered by closure of the canopy. Self-thinning of the trees begins at this stage, but stand gaps are not yet prominent features. Mature stands tend to have the lowest level of structural diversity (Boreal Centre 2002)

The transition from mature to old stands is gradual. Key changes include canopy breakup and release of understory vegetation, emergence of secondary canopy species and accumulation of snags and downed logs (Stelfox 1995). Overall, structural diversity is highest in old stands and is reflected in high species richness of both plants and animals (Stelfox 1995).

4.5 Wildfire History

Disturbances by wildfire have been tracked and recorded by ESRD since devolution of natural resource management to Alberta in the 1930s (29). The wildfire records summarized in the following tables and figures represent all wildfires, regardless of their origin (lightning or man-caused).

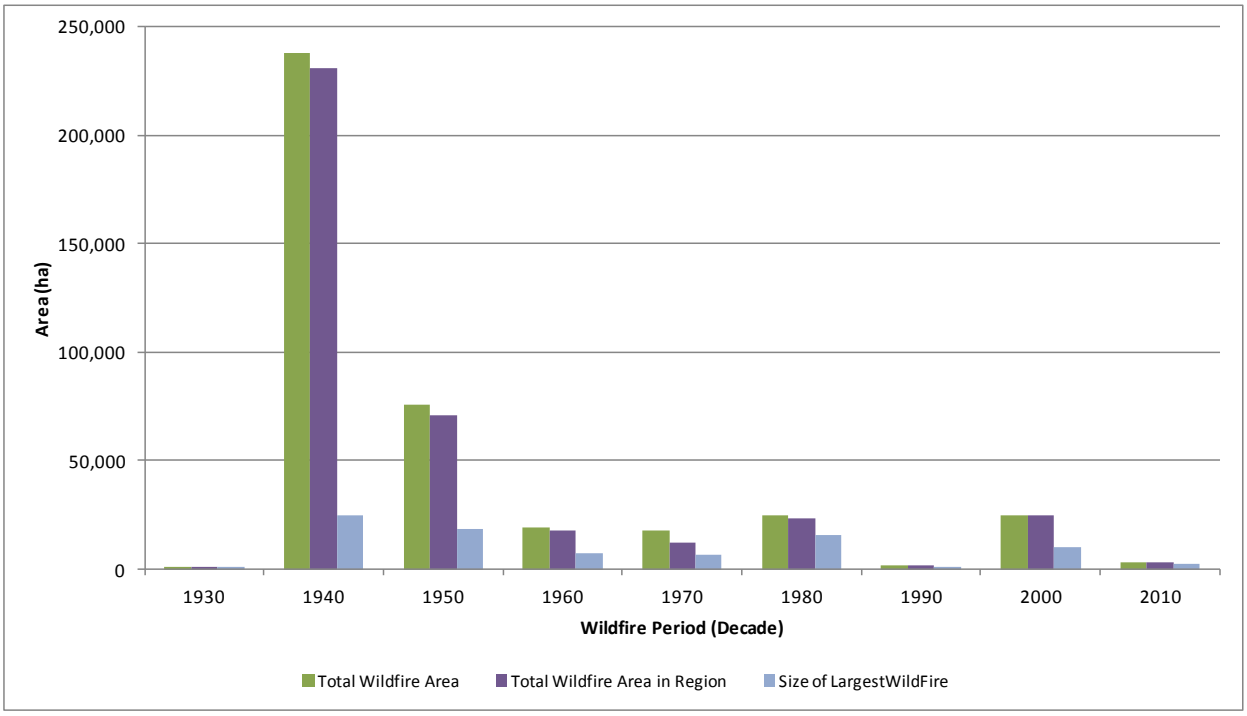
Summary statistics of the Region's wildfire history are reported in Table 4-3. The reporting period is by decade with the labelled wildfire date representing the start of the decadal period (i.e.: period '1930' represents 1930-1939 inclusive, etc.). The number of wildfires by decade is highly variable, as are the total area burned, average wildfire size and size of largest wildfire (Table 4-3, Figure 4-5). However, the median wildfire size is on a clear trend downwards (Figure 4-6). This is likely the result of substantial efforts in the areas of proactive wildfire prevention activities, faster wildfire response and improved wildfire control practices. These factors are also reflected in the drop in percent of the Region burned each decade (Table 4-3).

Table 4-3 Wildfire Statistics by Decade

Wildfire Period	Number of Wildfires	Total Wildfire Area (ha)	Wildfire Area in North Saskatchewan (ha)	Average Wildfiire Size (ha)	Median Wildfire Size (ha)	Size of Maximum Wildfire (ha)	Area Burned as percentage of Region[1] (%)
1930	2	21,633	1,054	527	527	732	0
1940	88	709,475	230,804	2,672	824	24,792	3
1950	38	287,461	70,660	1,770	439	18,256	1
1960	19	373,161	17,848	871	178	7,402	0
1970	24	61,932	11,930	745	258	6,664	0
1980	6	96,570	23,276	4,161	899	15,416	0
1990	5	293,722	1,764	353	315	701	0
2000	53	165,765	24,936	416	11	9,825	0
2010[2]	24	35,543	3,479	120	9	2,637	0

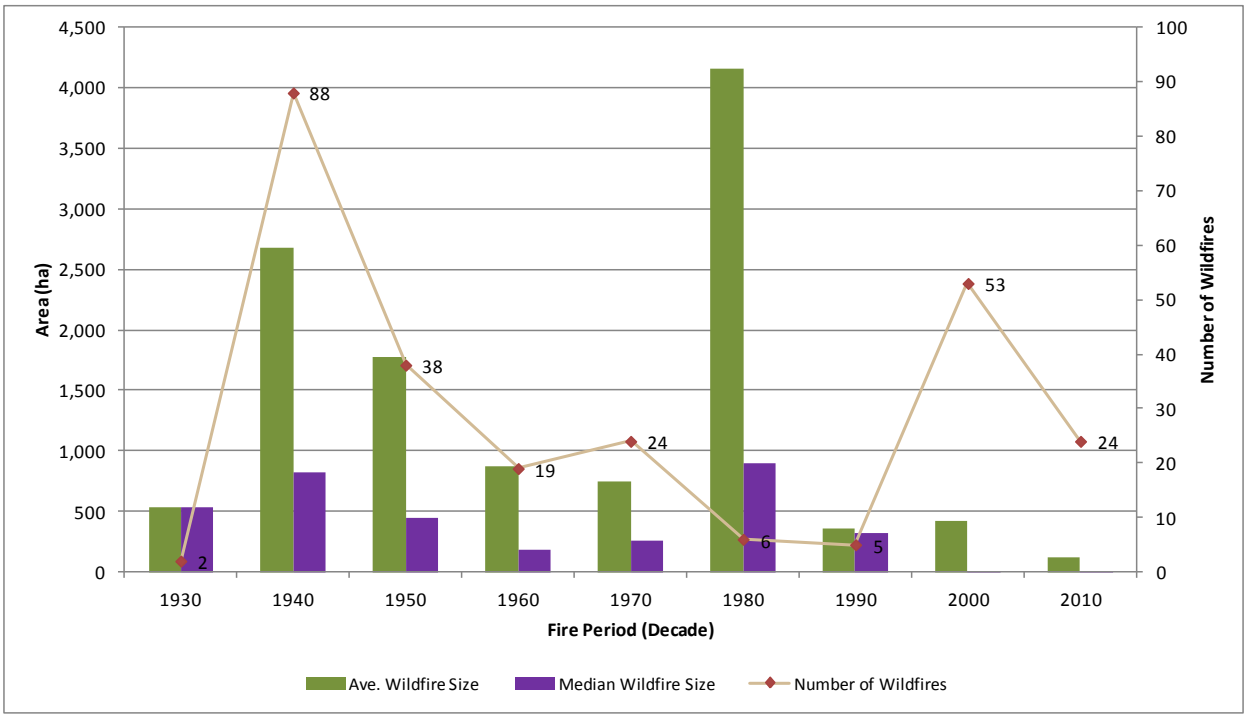
[1] Note that the area used for percent calculation is only the Region's Green and White Area.

[2] The 2010 'decade' includes only 2 years of data.



(NB: The 2010 'decade' includes only 2 years of data)

Figure 4-5 Wildfire Size Statistics by Decade



(NB: The 2010 'decade' includes only 2 years of data)

Figure 4-6 Average and Median Wildfire Size by Decade

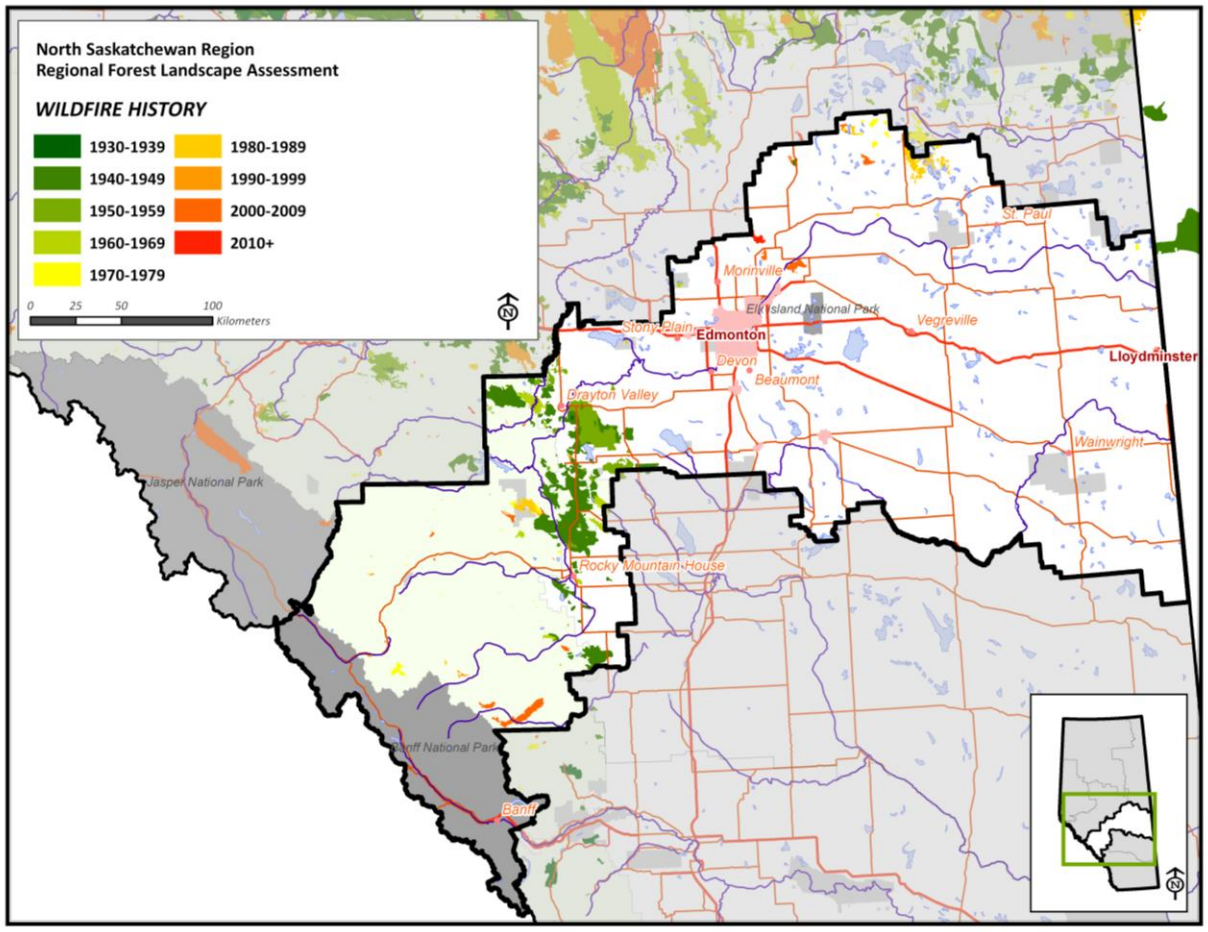


Figure 4-7 Wildfire Distribution by Decade

4.6 Timber Harvesting

From the time of the transfer of resource management from the Federal government to the provincial government in 1930 (Alberta 1930) to approximately the early-1960's, forest harvesting was generally for local or regional use. Large scale commercial harvesting began in 1985 with the establishment of an FMA with Weyerhaeuser (Drayton Valley) in 1985, who began harvesting in the northern part of the Region. The major increase in harvesting activity was coincident with the FMA established in 1992 with (the former) Sunpine Forest Products, now Sundre Forest Products Inc., a division of West Fraser Timber. A summary of the harvest area and number of harvest areas by decade is displayed in Table 4-4.

For the purposes of this report and for spatial mapping, the source data for this metric was spatial harvest area boundaries (31,30) and forest inventory information (23). Harvest area boundaries represent the boundary of a specific harvest activity and carry their associated year of harvest; inventory information (which is stand based, rather than block based) may or may represent a single harvest activity, and in many cases, may not have a year of harvest. In many cases, the harvest activity is evident on the inventory photography, but the actual date of the activity was not traceable.

The information presented in Table 4-4 represents all the known harvested area in the Region based on both harvest boundary and inventory datasets. The number of actual harvest events is difficult to assess as the inventory data (in many cases) does not distinguish individual harvest boundaries. The count provided in Table 4-4 is a best approximation based on the information available.

Table 4-4 Summary of Harvest Area by Decade

	Total Harvested Area		Number of Harvest Areas		Average Harvest /Year [1]
Year of Harvest	(ha)	(%)	Count	(%)	(ha)
1960-1969	3,019	1	429	3	503
1970-1979	5,586	2	759	6	559
1980-1989	10,758	6	923	7	1,076
1990-1999	46,625	32	4,692	35	4,663
2000-2009	56,808	43	2,845	22	5,681
2010 [2]	3,629	3	129	1	3,629
Unclassified	29,144	13	3,269	26	
Total	155,569	100	13,046	100	

[1] The Average harvest per year is based on the number of reported years in each decade.

[2] The 2010 decade contains only 1 year of data

The rapid expansion of harvested activity is evident in Table 4-4 and Figure 4-8.

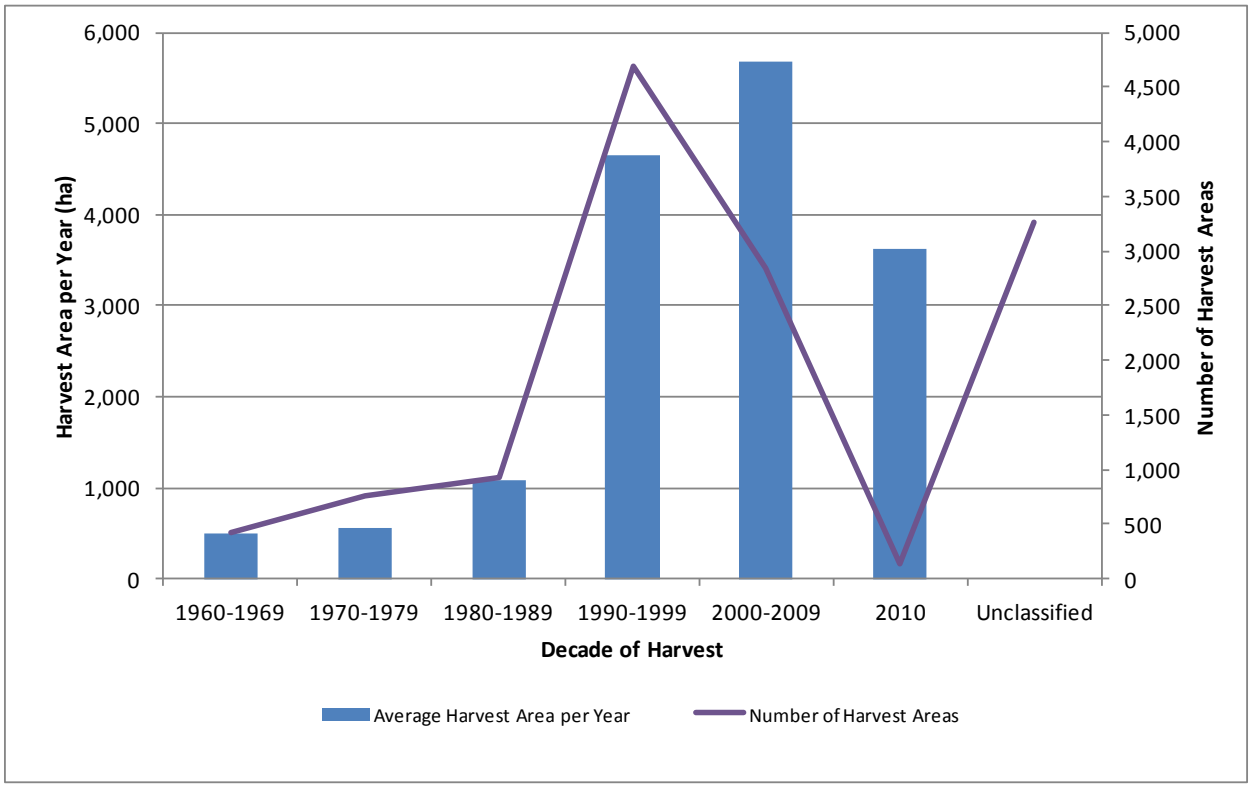


Figure 4-8 Average Annual Harvest Area and Count by Decade

A map showing the distribution of harvest area is in Figure 4-9.

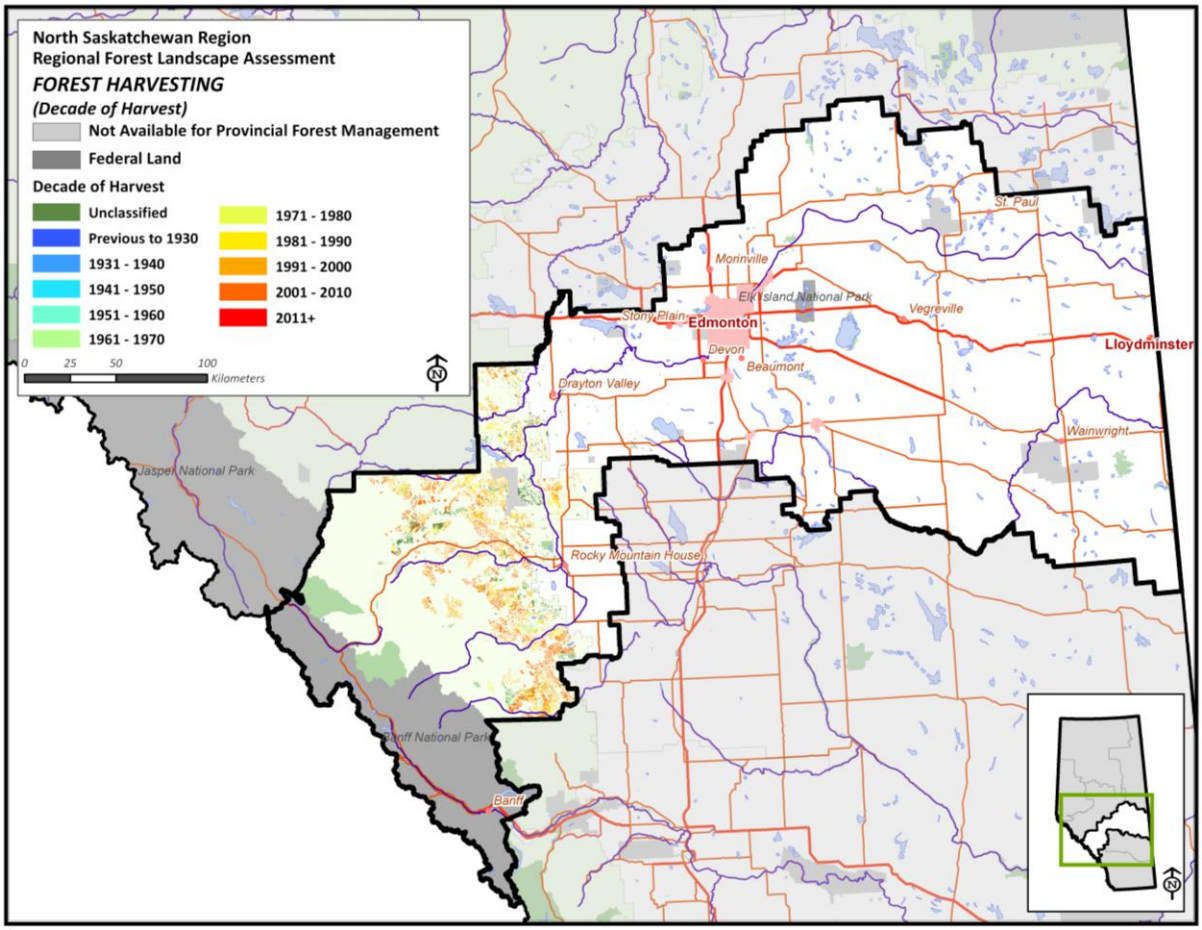


Figure 4-9 Harvest Area by Decade

4.7 Access

There is a well developed network of roads in the North Saskatchewan Region (32). The White Area road development is coincident with agricultural and cultural (towns, villages, etc) expansion. In the Green Area, resource exploration and extraction (forestry and oil and gas) have been the main drivers of road development.

Figure 4-12 shows the major transportation routes in the Green Area of the Region, including the railroad access. In this map, note that only major paved and all-season gravel roads are displayed. The white area holds a much larger density of roads due to the presence of larger population centers and the network of agriculture roads. The main transportation corridors in the Green Area are:

- Highway 22: running south from Highway 16 at Entwistle through Drayton Valley and Rocky Mountain House.
- Highway 11: running west from Rocky Mountain House, to the Jasper/Banff Parkway.

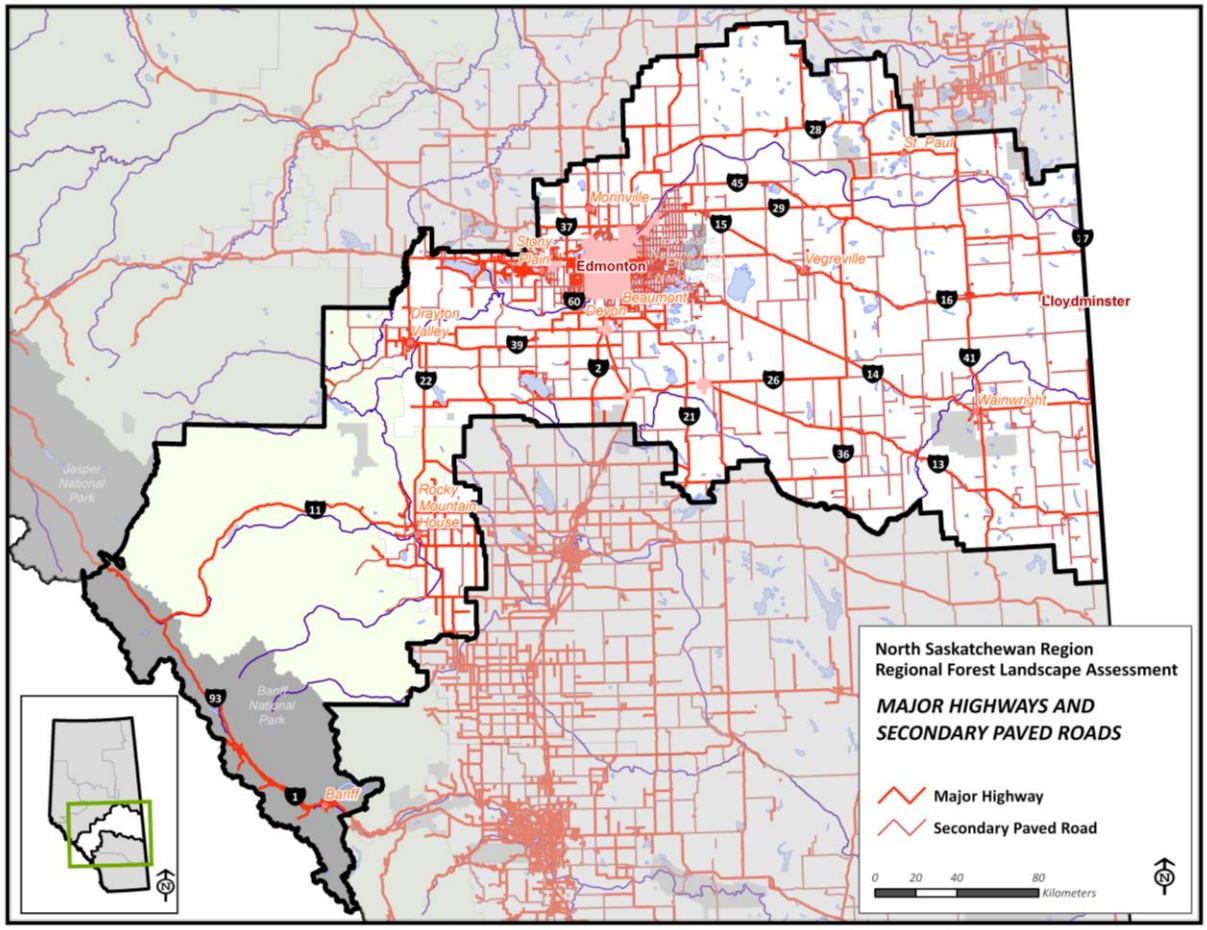


Figure 4-12 Major Transportation Access in the North Saskatchewan Region

Table 4-5 summarizes the length of road by road class and railway within each of the Green Area, White Area and on Federal land. There is substantially more road development in the White Area and this would be expected primarily due to urban development and agricultural activities. Access throughout the Green Area is generally the result of natural resource exploration and extraction.

Table 4-5 Length of Road by Class and Location

	Length of Roads (km)			
Road Classification	**Green Area**	**White Area**	**Federal Lands**	**Total**
Major Highway	276	8,948	575	9,798
Secondary Paved Road	121	5,618	61	5,800
Gravel Road	3,104	31,954	606	35,664
Winter Road / Unclassified		1,974	7	1,981
Trail suitable for Vehicle Access		42		42
Total Roads	3,501	48,536	1,249	53,285
Railway	37	2,128	96	2,261

A map of all road classes is shown in **Error! Reference source not found.**. This includes all road and rail access, but does not include seismic lines.

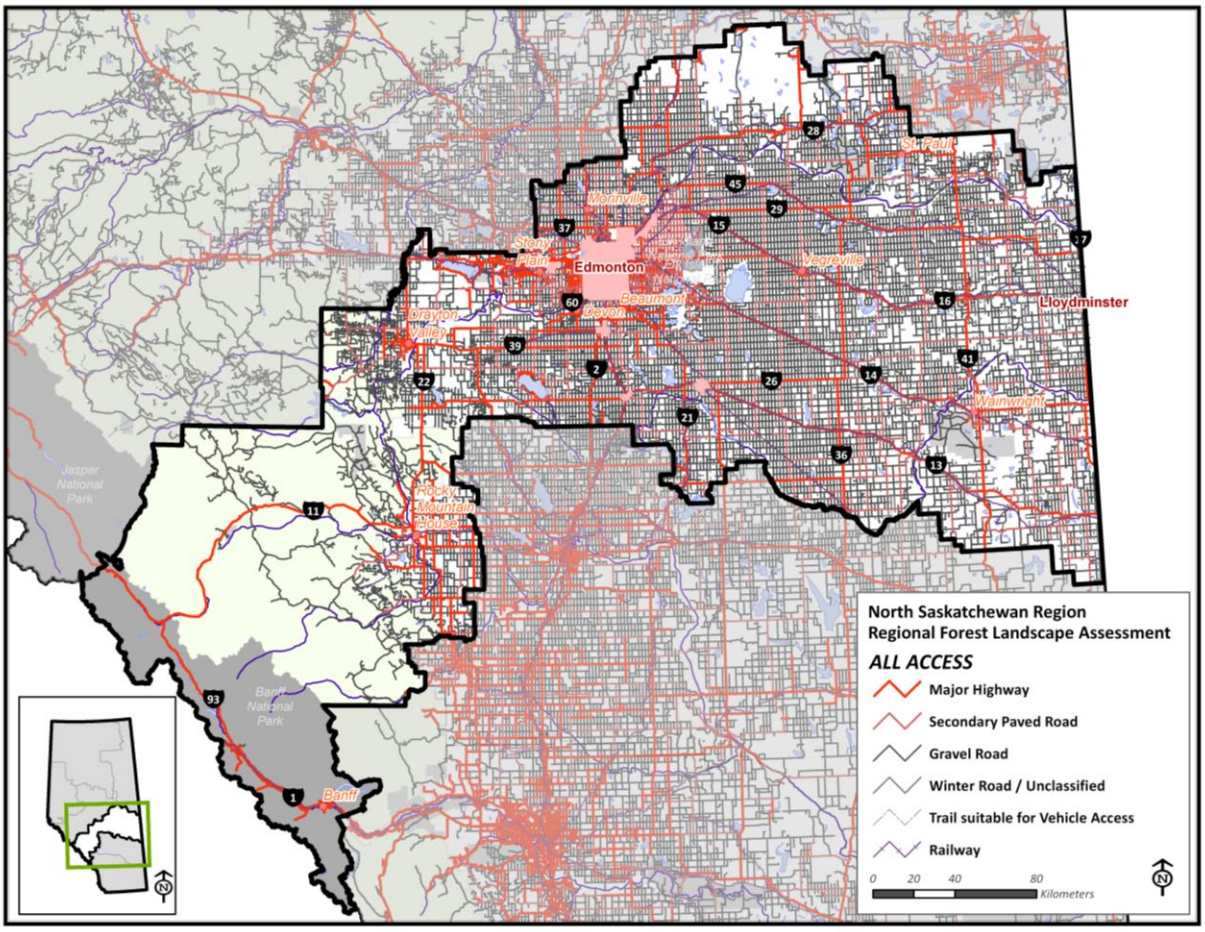


Figure 4-10 All Road Access by Road Class

4.8 Industrial Development

The energy sector accounts for the majority of disposed surface dispositions in this Region (33). As indicated in Table 4-6, the highest percentages of dispositions have been issued to these types: License of Occupation, Pipeline Agreement and Mineral Surface Lease. A License of Occupation typically is for all season road access to specific areas. Pipelines connect well sites, so naturally there are a high proportion of pipeline dispositions located in the Region. A Mineral Surface Lease can be issued for a number of energy industry facilities, the most common feature in this Region are oil or gas well sites.

Table 4-6 Land-use Dispositions

Description	Type	Number of Dispositions	Distribution		Area as Percentage of Region[1] (%)
			Area (ha)	Percentage of All Dispositions (%)	
Easement	EZE	1,706	5,122	5	0
Licence of Occupation	LOC	6,081	41,686	43	1
Mineral Surface Lease	MSL	9,831	18,454	19	0
Pipeline Installation Lease	PIL	1,134	299	0	0
Pipeline Agreement	PLA	10,177	24,574	25	0
Rural Electrification Agreement	REA	203	969	1	0
Right of Entry Agreement	ROE	2,440	5,674	6	0
Vegetation Control Easement	VCE	84	141	0	0
Total		31,656	96,918	100	1

[1] Note that the area used for percentage calculation is only the Region's Green and White Area.

Figure 4-11 shows the dense development of well sites and pipelines, most predominantly in the eastern edge of the Green Area. The total area occupied by industrial dispositions is 96,918 hectares or 1% of the Region's area for which dispositions are allocated. The percent area occupied by disposed land is based *only* on the Green and White Areas of the Region (see section 1.2), as Alberta cannot authorize dispositions on Federal lands.

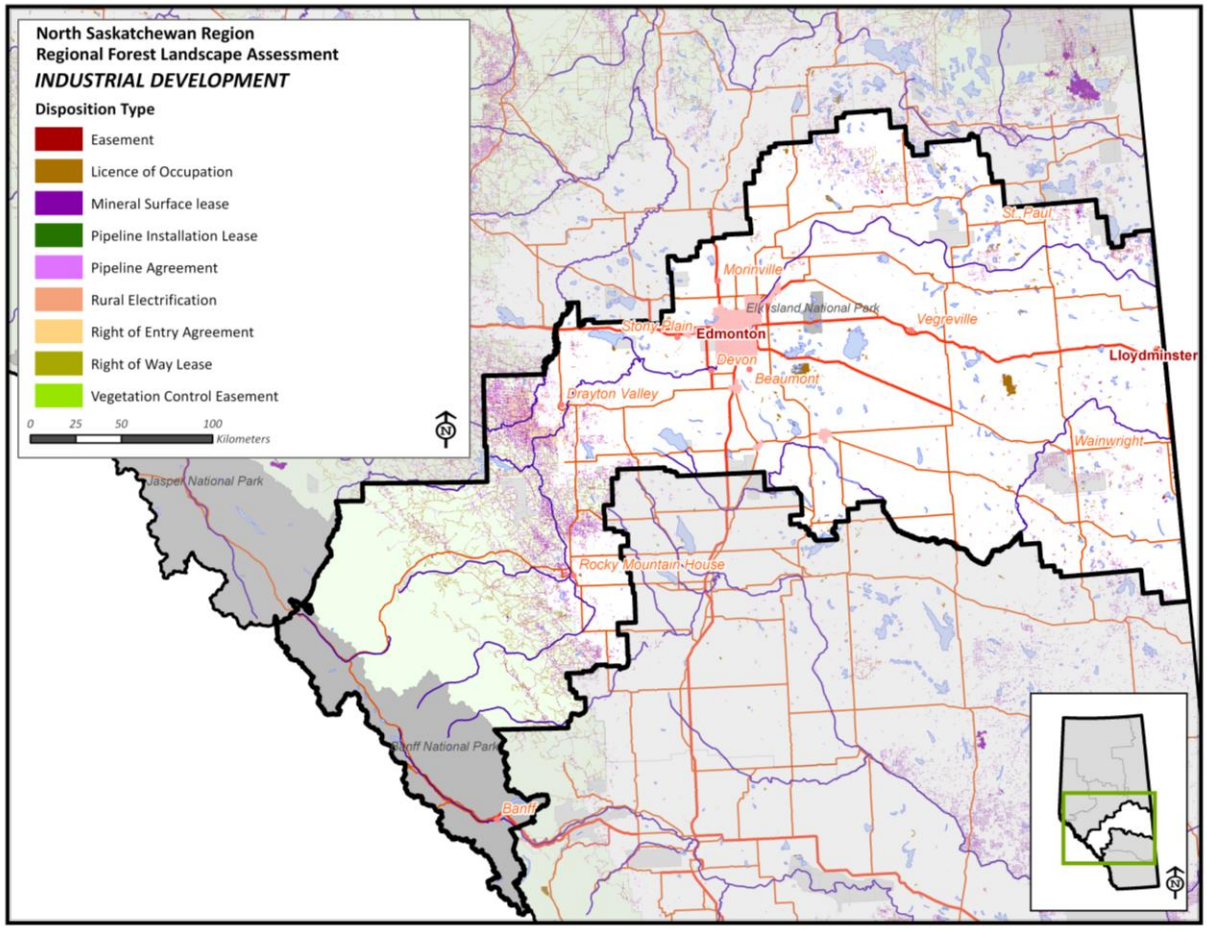


Figure 4-11 Industrial Development under Permit and License

4.9 Monitoring Sites

Permanent monitoring plots have been established throughout the North Saskatchewan Region under a variety of programs. For the purposes of this discussion, 'monitoring programs' are those for which a commitment has been made for ongoing, repeated measurements over time, on a series of established plots. A description of the main types of monitoring systems and programs follows the data summary presented in Table 4-7.

Note that Table 4-7 has values for both the number of installations and the number of plots. A single installation can be comprised of many plots, or it can be a single plot, depending on the type of program under which the plots were established.

In addition, Table 4-7 lists a variety of programs to which the ESRD installations belong. There is no program distinction for either the Alberta Biodiversity Monitoring Institute or Other Agency plots as this information is not available.

Table 4-7 Monitoring Installations

Monitor Plot Classification	Green Area		White Area		Federal Lands		Total	
	No. Installations	No. Plots	No. Installations	No. Plots	No. Installations	No. Plots	No. Installations	No. Plots
ESRD Permanent Sample Plots								
Permanent Sample Plots	113	389	1	4			114	393
Reforestation Monitor Plots	51	2,010					51	2,010
Stand Dynamics Plots	41	41					41	41
Other PSP (Special Projects)	6	30					6	30
Alberta Biodiversity Monitoring Institute								
ABMI Sample Grid	43	43	153	153	14	14	210	210
Other Agency Permanent Sample Plots								
ISP Registered	602	602	1	1			603	603
Total	856	3,115	155	158	14	14	1,025	3,287

The distribution of monitoring sites across the North Saskatchewan Region is displayed in Figure 4-12.

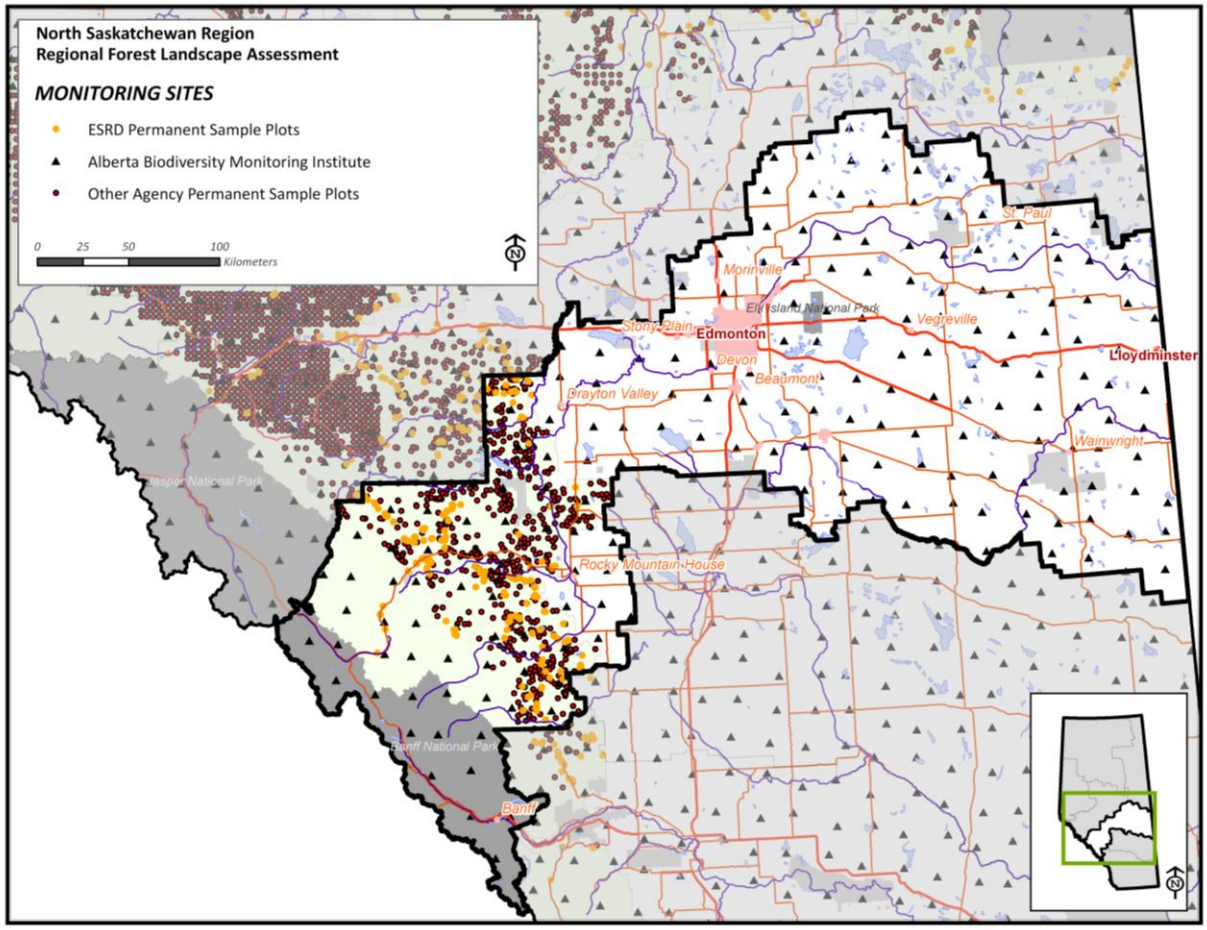


Figure 4-12 Permanent Monitoring Sites

4.9.1 ESRD Permanent Sample Plots

ESRD has been actively managing a variety of programs which involve the use of permanent sample plots (PSP) since the early 1960's (35).

Protection and Registration.

Locations of all installations are registered with the Public Lands, Land Status Automated System (LSAS). Most registrations are designated as Protective Notation (PNT), Consultative Notation (CNT) or Disposition Reservation (DRS). In these cases, any proponent of industrial activity near a PSP must consult with the Department prior to any development to assess potential impact to the sample plot. The Department may give permission for the activity to proceed, but in return it may request compensation to re-establish the plot post-disturbance.

Permanent Monitoring Programs

Permanent Sample Plots	Permanent sample plots have been established since 1960, primarily in mature stand types representative of the most common forests in Alberta. Initially, their purpose was to provide volume estimates for the purpose of yield curve construction. Two sample designs are in place. The initial design involves an installation comprised of four plots. A later design (approximately 1980) revised the PSP installation to be a single plot. The re-measurement cycle for an installation is either 5 or 10 years, depending on stand age.
Reforestation Monitor Plots	Reforestation monitor plots were first established in the early 1980s for the purpose of monitoring the initial stand development (from initial planting to approximately 8-10 years old). An installation is typically made up of 40 plots, distributed over a grid on newly reforested cutblocks. The measurement cycle is annual or bi-annual.
Stand Dynamics Plots	Stand Dynamics plots are similar in nature to the Reforestation Monitor Plots, however their target dynamic is the stand age after the successful establishment of a new forest to the juvenile stand development stage. Re-measurement schedule is approximately 2 years.
Other PSP (Special Projects)	There are a variety of special projects for which additional permanent sample plots have been installed. Some examples are to monitor stand development: (a) in response to mountain pine beetle infestation; (b) following specific wildfire events, or (c) in response to a local or regional forest growth issue (spruce budworm, blowdown event, etc.).

4.9.2 Alberta Biodiversity Monitoring Institute

The Alberta Biodiversity Monitoring Institute (ABMI) conducts monitoring of more than 2000 species and habitats to support decision making about biodiversity in the province. The network of plots (36) is based on a 20km by 20km grid, following the protocol for the Canadian National Forest Inventory (NFI) (Canada 2004).

Protection and Registration.

Locations of all installations are predetermined as per the protocol for the NFI. However, the exact plot locations on the ground are not publicly accessible to maintain an unbiased measure of biodiversity and the human footprint across the province (map locations are within 5.5 km of the actual survey location). Locations are not registered with the Public Lands LSAS system as these points do not require protection of any kind.

Monitoring Program

A total of 1656 plots are located across the province, of which 210 fall in the North Saskatchewan Region. Due to the systematic layout of the plots, they theoretically are distributed across the Region, in the same proportion as the allocation of Green Area, White Area and Federal lands. Each location is re-visited every 5 years; at which time a variety of terrestrial and aquatic surveys are completed.

4.9.3 Other Agency Permanent Sample Plots

Many other agencies establish and monitor sample plots on an ongoing basis. Many FMA holders maintain PSP programs in addition to other forest growth and yield cooperatives (37).

Protection and Registration.

Locations of most permanent sample plots established by other agencies are registered with the Public Lands, Land Status Automated System as Industrial Sample Plots (ISPs). This designation is similar to the Protective or Consultative Notation of the ESRD plots, but applies to non-government holdings. ISP registration alerts other land users that monitoring plots are in place and if disturbed without permission of the owner, compensation may be required.

Monitoring Program

The PSPs in this class are established for a wide variety of purposes. Some compliment the provincial PSP program and are used for the development of local yield curves; others are collaborative installations established by growth and yield cooperatives. Re-measurement schedules depend on the purpose of the installation.

5. Land Use

5.1 Timber Allocations

Annual allowable cut (AAC) levels are calculated by FMU (section 1.4) and are set or approved by Alberta (38). Table 5-1 lists the FMUs located in the North Saskatchewan Region, along with AAC levels prorated by the proportion of the FMU area located inside the North Saskatchewan Region. Prorating AAC levels was done only for the purpose of comparing relative timber allocations between the various Land-use Framework regions. The values presented here represent the proportion of AAC calculated as at the time of publication of this report. For currently approved AAC information, please contact the Government of Alberta.

Table 5-1 only lists FMUs for which AAC levels have been calculated and published. The map presented in Figure 5-1 shows all the FMUs located in the Region, highlighting those which have AAC levels calculated.

Table 5-1 Current AAC Levels Prorated by FMU Area

FMU			Portion of FMU located in North Saskatchewan		Proportion of North Saskatchewan occupied by FMU	Annual Allowable Cut (m^3/year) (Prorated to FMU Area)		
Name	Managed by	Entire FMU Area (ha)	Area (ha)	% of FMU	% of North Saskatchewan	Coniferous	Deciduous	Total
R10	FMA	587,327	571,242	97	7	1,372,186	153,191	1,525,378
R12	FMA	533,183	464,666	87	5	831,668	242,600	1,074,267
R13	FMA	268,089	48,541	18	1	152,396	10,871	163,267
W6	FMA	233,762	49,790	21	1	52,265	32,275	84,540
B9	FMA	173,659	24,111	14	0	24,028	7,453	31,480
W5	FMA	72,059	21,844	30	0	9,146	14,062	23,207
R14	Crown	21,093	21,093	100	0	9,122	8,170	17,292
Sub-total		1,889,173	1,201,288		14	2,450,810	468,621	2,919,431
No Allowable Harvest Calculated			7,377,418		86	0	0	0
Total			8,578,706		100	2,450,810	468,621	2,919,431

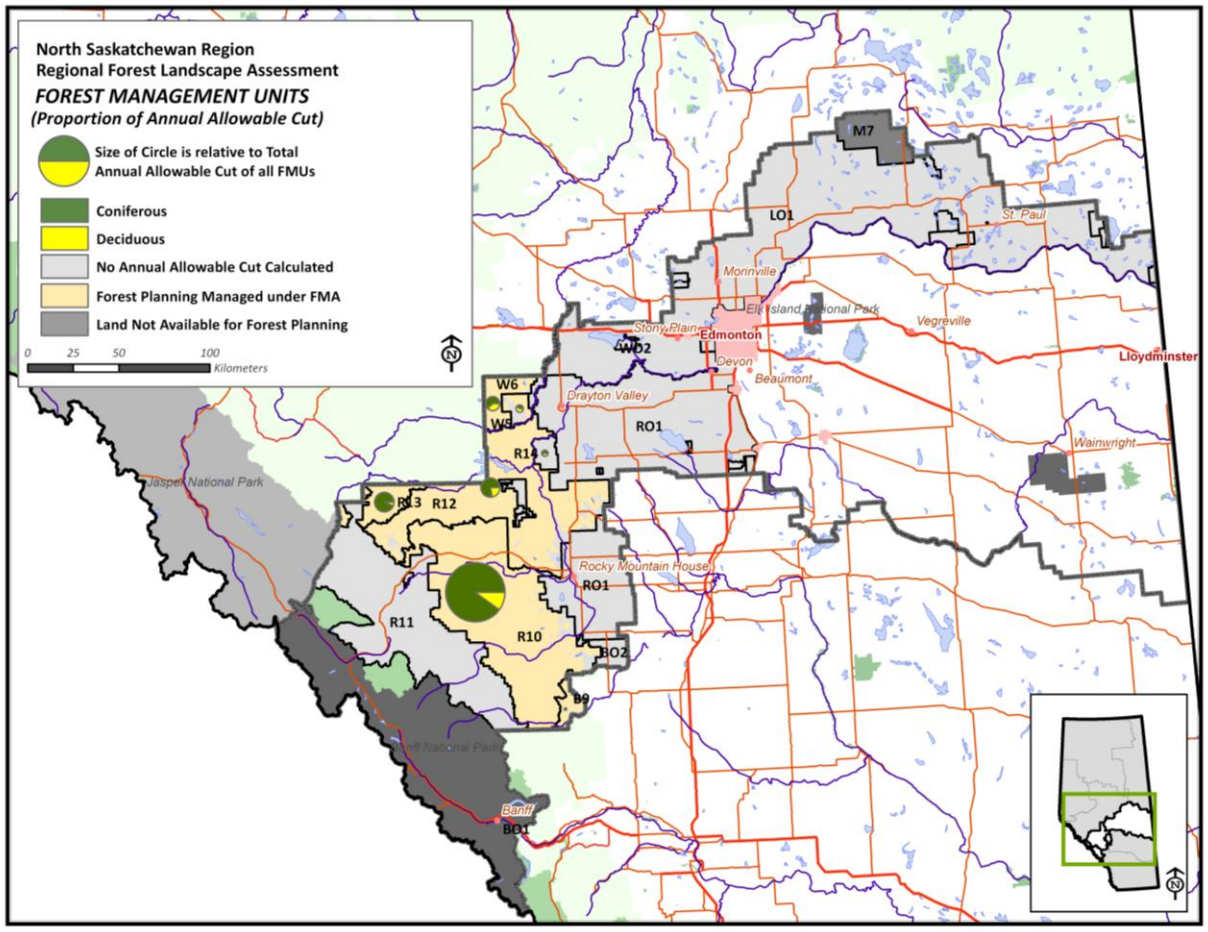


Figure 5-1 FMUs with Prorated AAC Levels

5.2 Trapping

The fur trade in Western Canada is often credited with driving the European occupation of modern day Canada (Foster 2007). Permitting and licensing of trappers was introduced by the Alberta Game Act in 1920 and the establishment of Registered Fur Management Areas (RFMA) for furbearer management came about in the early 1940s. The current Wildlife Act (Alberta 2000) regulates open seasons and areas, methods and reporting requirements. Eight Fur Management Zones are used to establish trapping seasons and quotas for some species (fisher, lynx, otter, and wolverine).

Approximately 2,064,085 hectares (24 %) of the North Saskatchewan Region are covered by registered fur management areas (39) or traplines (Figure 5-2), of which 87% are in the Green Area. The average size of an individual trapline is 12,359 hectares, with the largest at 68,024 hectares. The five largest traplines are in the foothills, adjacent to the protected areas. All Alberta furbearing species can be harvested in the North Saskatchewan Region.

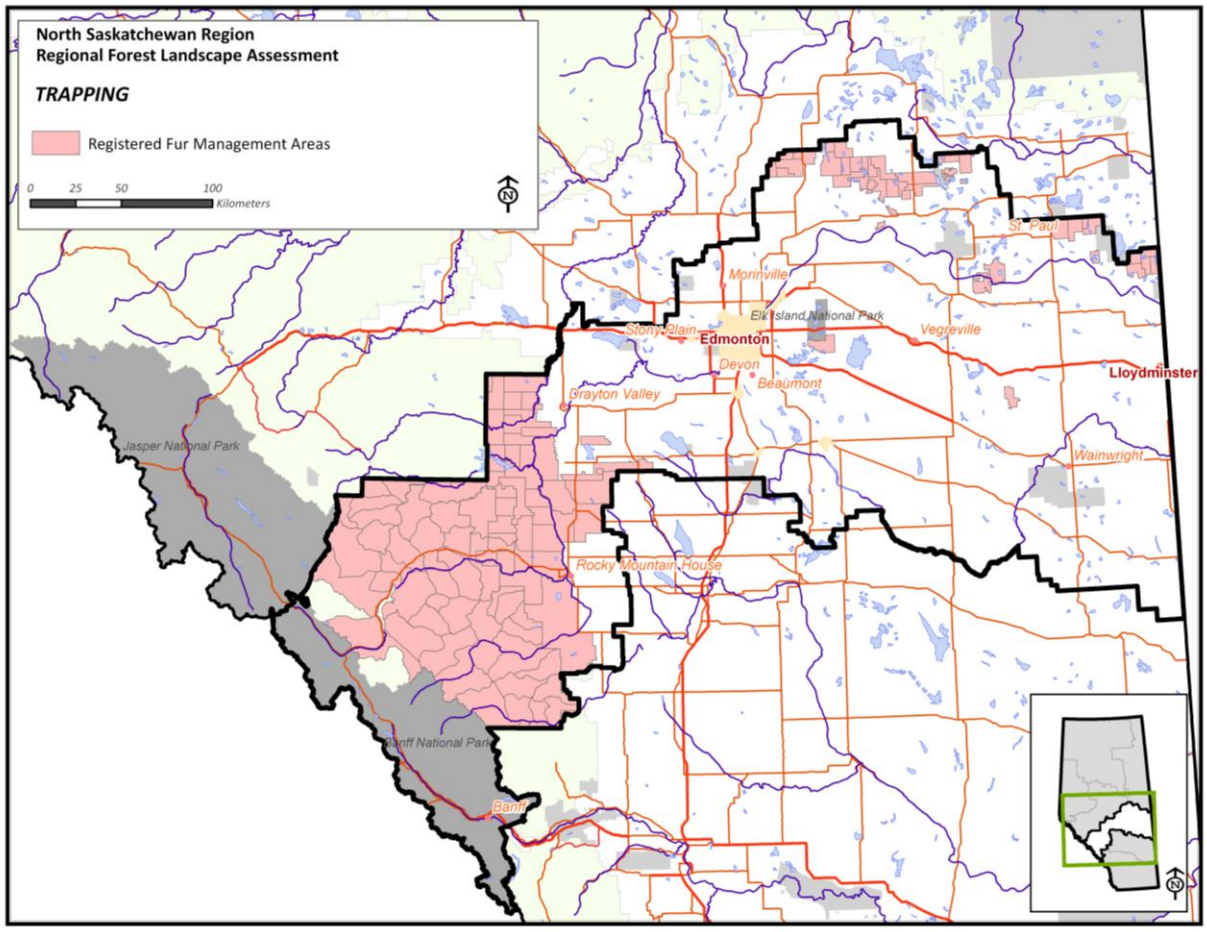


Figure 5-2 Registered Fur Management Areas

5.3 Grazing

Approximately 3.3 million hectares of grazing land is used by livestock producers in Alberta (40). Various levels of grazing permits are issued based on size, type of forage and landscape (41). Table 5-2 describes the types of grazing allocations in Alberta. Table 5-3 summarizes the 408,569 hectares of grazing allocations (by type) across the North Saskatchewan Region.

The majority of the grazing dispositions are located in the White Area (Figure 5-3) however, 14% of the allocations are found in the Green Area.

Table 5-2 Types of Grazing Allocations

Forest Grazing Licence	Long term license (up to 10 years). Renewable. Licensee cannot control public access. Predominantly issued in forested areas where access for other activities (recreation, forest harvesting, etc) need to be accommodated.
Grazing Lease	A long term (up to 20 years) authorization to individuals, corporations or

	associations. Renewable. Access can be controlled with the exception for timber harvesting.
Grazing Permit	Short term permits issues on an annual basis and often on land that is fragmented and perhaps periodically wet.
Provincial Grazing Reserve	Not disposed, these are public areas managed by Public Lands for the purpose of providing summer pasture for farmers and ranchers. Access is not restricted for recreational opportunities. Managed by local associations.

Table 5-3 Grazing Dispositions

Type of Disposition	Code	Number	Area in Region (ha)	Percentage of Grazing (%)	Percentage of Region (%)
Forestry Grazing Allotment	FGL	31	15,220	4	0
Grazing Lease	GRL	1,365	306,845	76	4
Grazing Permit	GRP	178	13,865	3	0
Provincial Grazing Reserve	GRR	10	70,155	17	1
Total		1,584	406,086	100	5

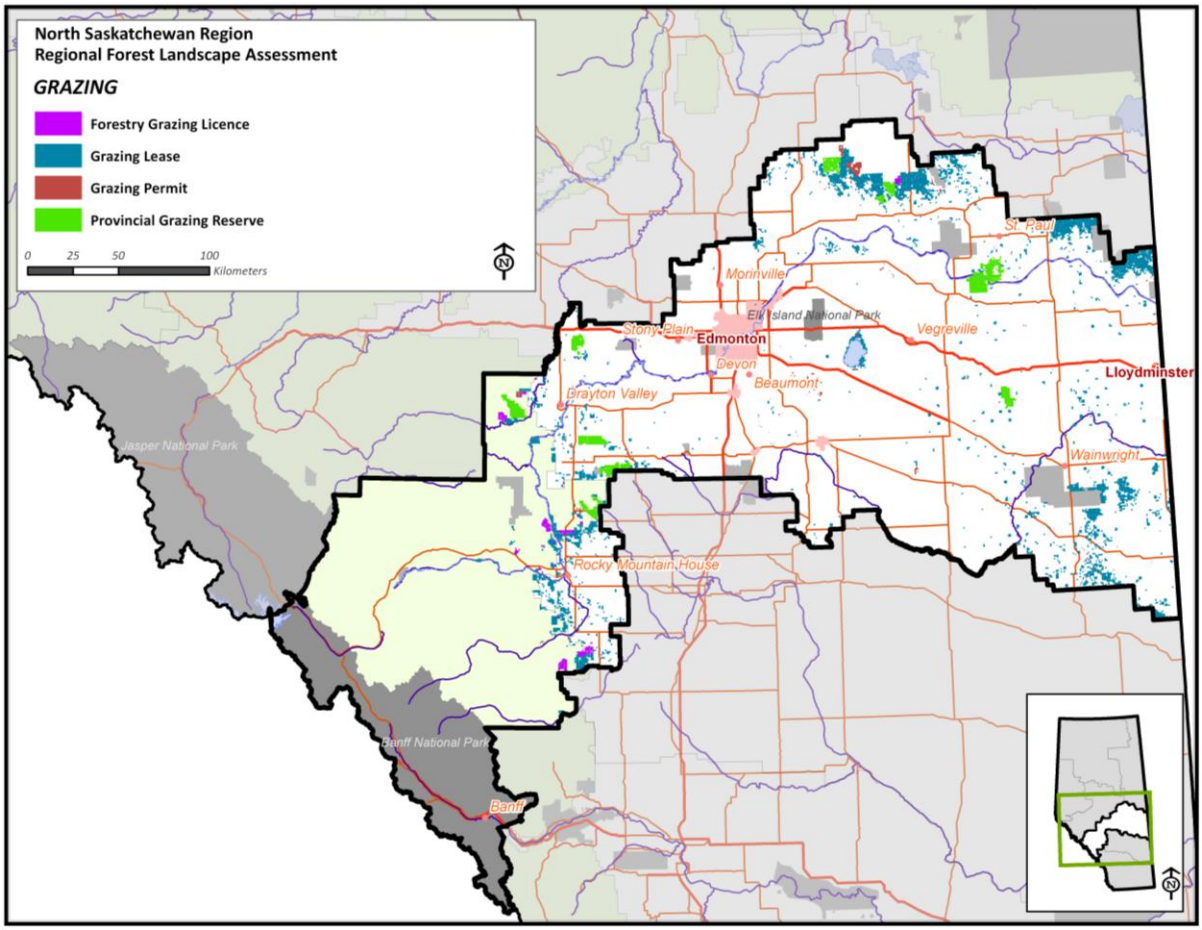


Figure 5-3 Grazing Dispositions

5.4 Guiding and Outfitting

Guides and outfitters are licensed in the province of Alberta and pay annual user fees for their allocations.

In the 1970s, the Alberta government limited bighorn sheep allocations for non-residents to conserve the resource. Up to this time, no restrictions had been placed on big game species. The Professional Outfitters Association of Alberta (POAA) was established in the late 1980's to encourage unity and consensus within the industry. Prior to this a number of organizations had existed. Since 1997, the Alberta Professional Outfitters Society (APOS) has been responsible for managing the outfitting industry on behalf of the government of Alberta.

5.5 Recreation and Tourism

Banff National Park is the primary recreation destination in the Region, encompassing 8% (see section 1.7) of the Region. Virtually all recreation opportunities except off-highway vehicles (OHV), hunting and snowmobiling can be found there.

Public recreation areas (13) along the eastern slopes offer recreational opportunities often not permitted in the mountain parks such as OHV and snowmobiling, as well as hiking and skiing trails, wildlife viewing, and many other activities.

East of Edmonton, Elk Island National Park and a number of recreation areas around the local lakes offer year-round activities. Camping and day use areas are available across the Region, many in provincial parks or provincial recreation areas.

Figure 5-4 shows the distribution of public recreation areas across the Region. Facilities run by municipalities or towns or private organizations are not included in the analysis. In the northeastern portion of the Region, a number of lakes have summer cabin communities.

Public land use zones (43) are described in Table 5-4. They were created to potentially avoid land use conflicts, often between human and wildlife but also between different user groups. The public land use zones are also presented on Figure 5-4.

Table 5-4 Public land use zones

Public Land Use Zone	Area (ha)	Camping	Hiking	OHV	Snowmobile	Equestrian	Cross-country skiing	Fishing	Hunting	Purpose
Blackstone/Wapiabi	48,577	X	X			X		X	X	Year-round trails for non-motorized and equestrian use. No motorized access
Ghost	6,966	X[1]	X		X	X	X	X	X	Address the growing demand for recreation and potential conflics with other resource values and stakeholders in area
Job/Cline	137,773	X	X	X	X	X		X	X	Non-motorized and equestrian. Seasonal access for OHV.
Kiska/Wilson	109,952	X	X	X[2]	X	X	X	X	X	Large trail network for non-motorized and equestrian use. Seasonal access for OHV
Panther Corners	17,523	X[1]				X	X	X	X	Year-round trails for non-motorized and equestrian use. No motorized access
Upper Clearwater/Ram	190,661	X	X	X	X	X	X	X	X	Year-found access for non-motorized and equestrian use. Designated seasonal access trails for OHVs.
Total	511,452									

[1] Random camping is permitted

[2] OHV designated trails temporarily closed as of date of report

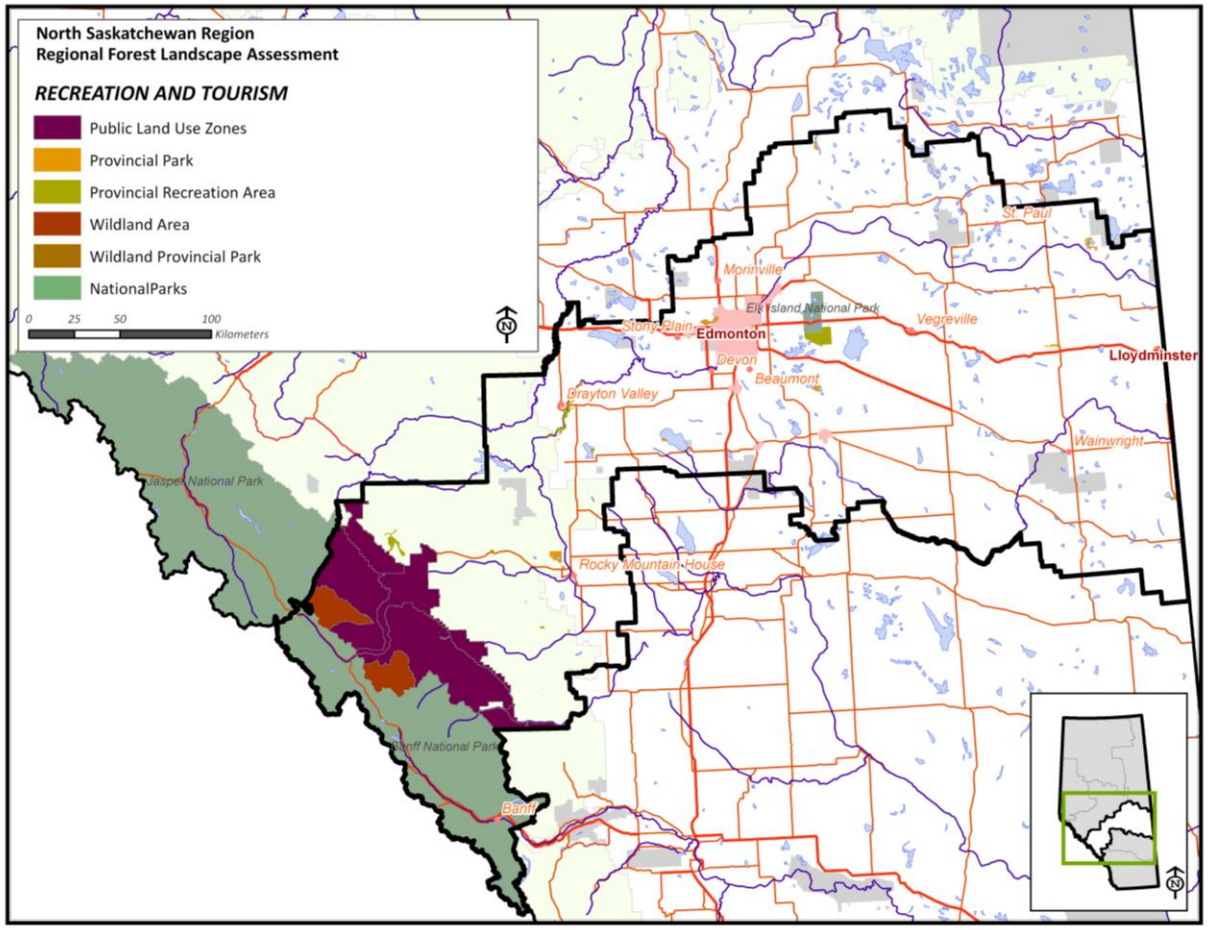


Figure 5-4 Recreation and Tourism Opportunities

5.6 Cultural and Historical Resources

The Listing of Historic Resources (44) identifies lands that contain or are believed to contain historic resources, including primarily archaeological and paleontological sites, Aboriginal traditional use sites of a historic resource nature, and historic structures (Figure 5-5). The listing provides industry and other developers with advance notification of possible historic resource concerns. The listing is constantly being updated as new resources are found and updates are issued semi-annually.

Each land parcel in the listing is assigned a Historic Resource Value (HRV) ranging from 1 to 5, reflecting their relative importance:

- HRV 1: includes lands designated as Provincial Historic Resources under the Alberta Historical Resources Act, and may identify World Heritage Sites.
- HRV 2: designated as a Municipal or Registered Historic Resource
- HRV 3: contains a significant historic resource that will likely require avoidance
- HRV 4: contains a historic resource that may require avoidance
- HRV 5: believed to contain a historic resource

Table 5-5 outlines the area covered as well as percent area of the historical resources in the Region. Approximately 2,853 ha are listed as HRV 1 (Historic). Of the relative importance values of 2 through 5, Paleontological and Archaeological sites are the most plentiful, occupying 47% and 41% respectively of the listing's total area.

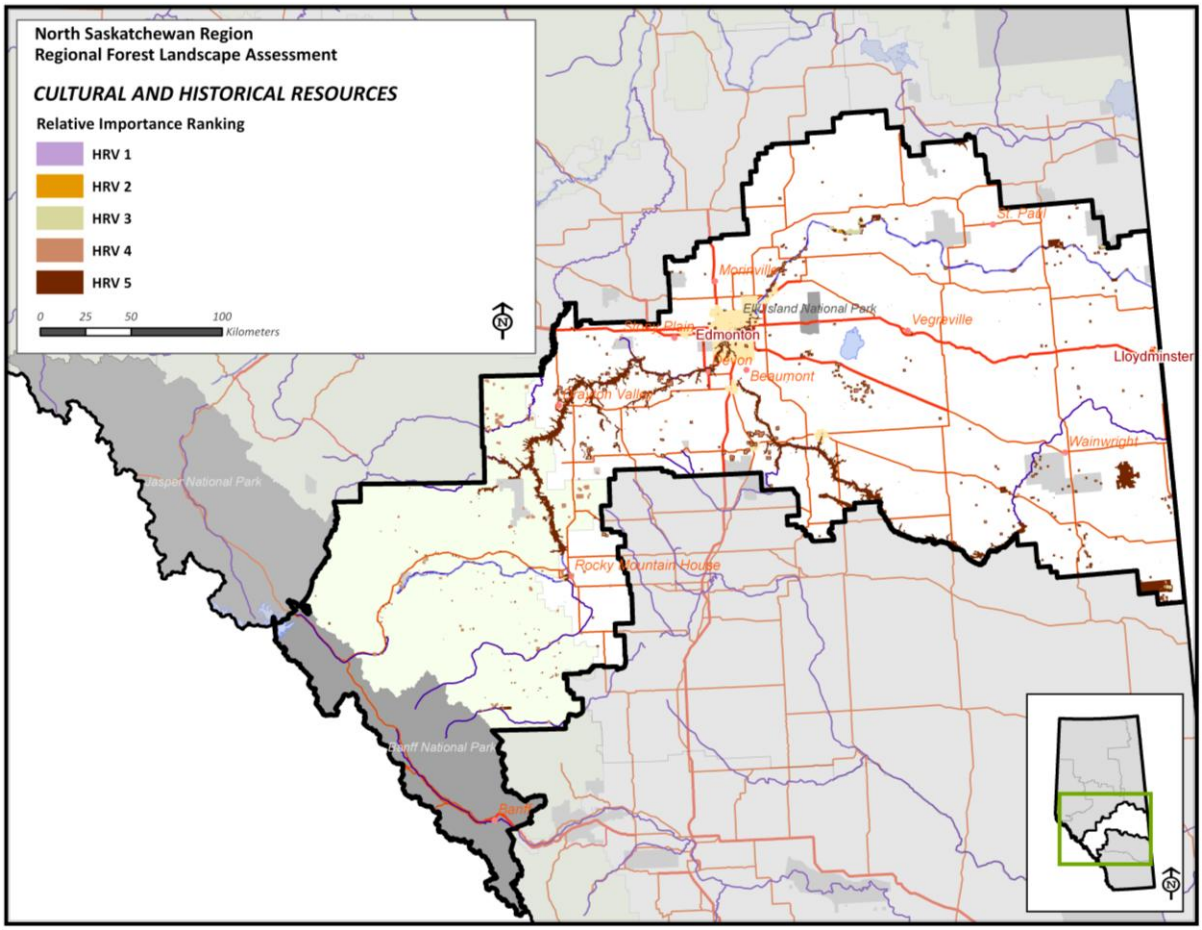


Figure 5-5 Areas of Historic Resource Value

Table 5-5 Categories and Relative Importance Value

	Relative Importance Ranking (HRV)											
	1		2		3		4		5		Total	
Category	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)
Archaeological	726	0		-	2,633	1	25,409	8	105,033	32	133,801	41
Arch, Cultural, Historical					114	0		-	65	0	180	0
Archaeological, Historical		-		-		-		-	2,832	1	2,832	1
Archaeological, Natural		-		-		-		-	2,680	1	2,680	1
Cultural		-		-		-	20,184	6		-	20,184	6
Cultural, Historical		-		-		-	82	0		-	82	0
Historical	2,093	1	2,748	1	6,317	2	232	0		-	11,390	4
Historical, Archaeological	33	0		-		-		-	167	0	200	0
Palaeontological		-		-	16	0	1,601	0	150,969	47	152,586	47
Total	2,853	1	2,748	1	9,081	3	47,509	15	261,747	81	323,937	100

5.7 Visual Resources

Numerous high value visual areas are known to exist in the Region but no formal inventory has been compiled. These typically occur along travel corridors and recreational areas. Banff National Park encompasses most of the mountainous terrain in the Region which provides users of the park with scenic vistas and landscapes. Highway 93 (Icefields Parkway) runs through the mountain parks between Jasper and Lake Louise. Highway 11 west of Rocky Mountain House is well known for its visual resources.

The region supports a number of lakes and rivers surrounded by boreal and parkland forest, affording seasonal views from both sides of the waters edge.

5.8 Fish and Wildlife Resources

5.8.1 Management Zones

Fish and Wildlife management and regulation is divided into zones across the province. Table 5-6 outlines the size of each Management zone (45) within the North Saskatchewan region. Figure 5-6 shows the distribution of those districts.

Table 5-6 Fish and Wildlife Districts

Fish and Wildlife District Name	Entire District Area (ha)	Portion of District in North Saskatchewan Area (ha)	Portion of District in North Saskatchewan (%)	Proportion of North Saskatchewan occupied by District (%)
Athabasca	1,504,338	64,272	4	1
Barrhead	656,891	4,042	1	0
Bonnyville	291,007	4,255	1	0
Camrose	725,066	706,976	98	8
Drayton Valley	279,737	275,110	98	3
Edmonton	247,017	247,017	100	3
Edson	1,023,570	9,145	1	0
Evansburg	666,861	90,123	14	1
Lloydminster	514,947	514,946	100	6
Nordegg	843,691	804,818	95	9
Ponoka	452,323	34,260	8	0
Provost	374,886	374,886	100	4
Rocky Mountain House	802,822	797,919	99	9
Smoky Lake	669,021	632,217	94	7
St. Paul	502,552	432,204	86	5
Stettler	571,973	12,782	2	0
Stony Plain	341,176	322,138	94	4
Sundre	415,694	316,067	76	4
Vegreville	813,433	813,433	100	9
Vermilion	761,823	761,823	100	9
Wetaskiwin	672,679	655,937	98	8
Sub-total	13,131,505	7,874,369		92
No Fish and Wildlife District		704,337		8
Total		8,578,706		100

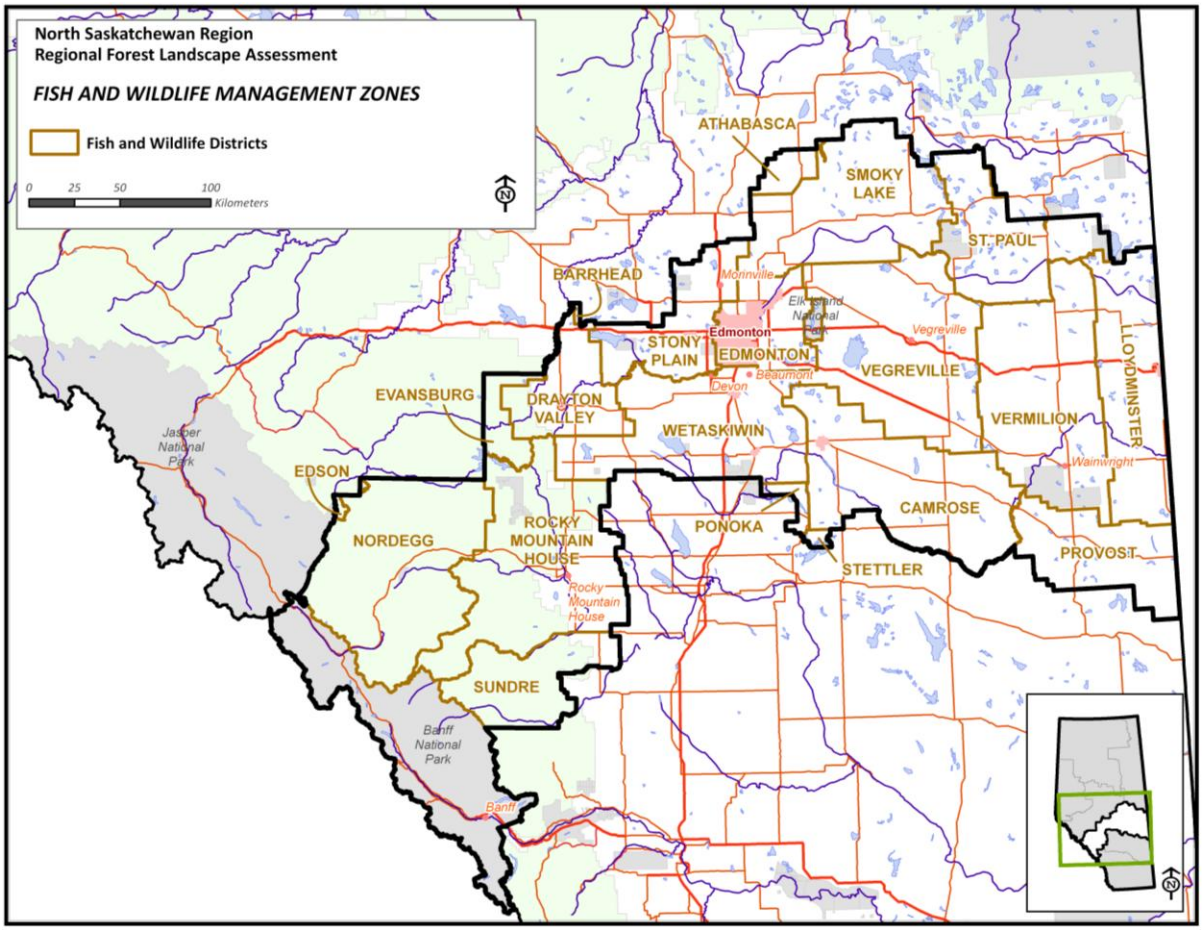


Figure 5-6 Fish and Wildlife Districts

5.8.2 Fisheries

Fish Management Zones (46) are used to determine fisheries health, regulate sport and commercial fishing, and determine fish stocking. Fish Management Zones are further subdivided into Fish Watershed Units which are based on specific river basins. Sport fishing regulations apply at the Watershed Unit level, or in some cases regulations are site specific to locations (lakes, streams) within a Watershed Unit.

Table 5-7 Fish Management Zones

	Entire Zone	Portion of Zone in North Saskatchewan		Proportion of North Saskatchewan occupied by Zone
Fish Management Zone	Area (ha)	Area (ha)	(%)	(%)
Northern Boreal Zone	32,972,500	1,056,217	3	12
Eastern Slopes Zone	12,264,460	2,017,525	16	24
Parkland-Prairie Zone	15,539,920	4,819,942	31	56
Sub-total	60,776,880	7,893,684		92
No Fish Management Zone		685,022		8
Total		8,578,706		100

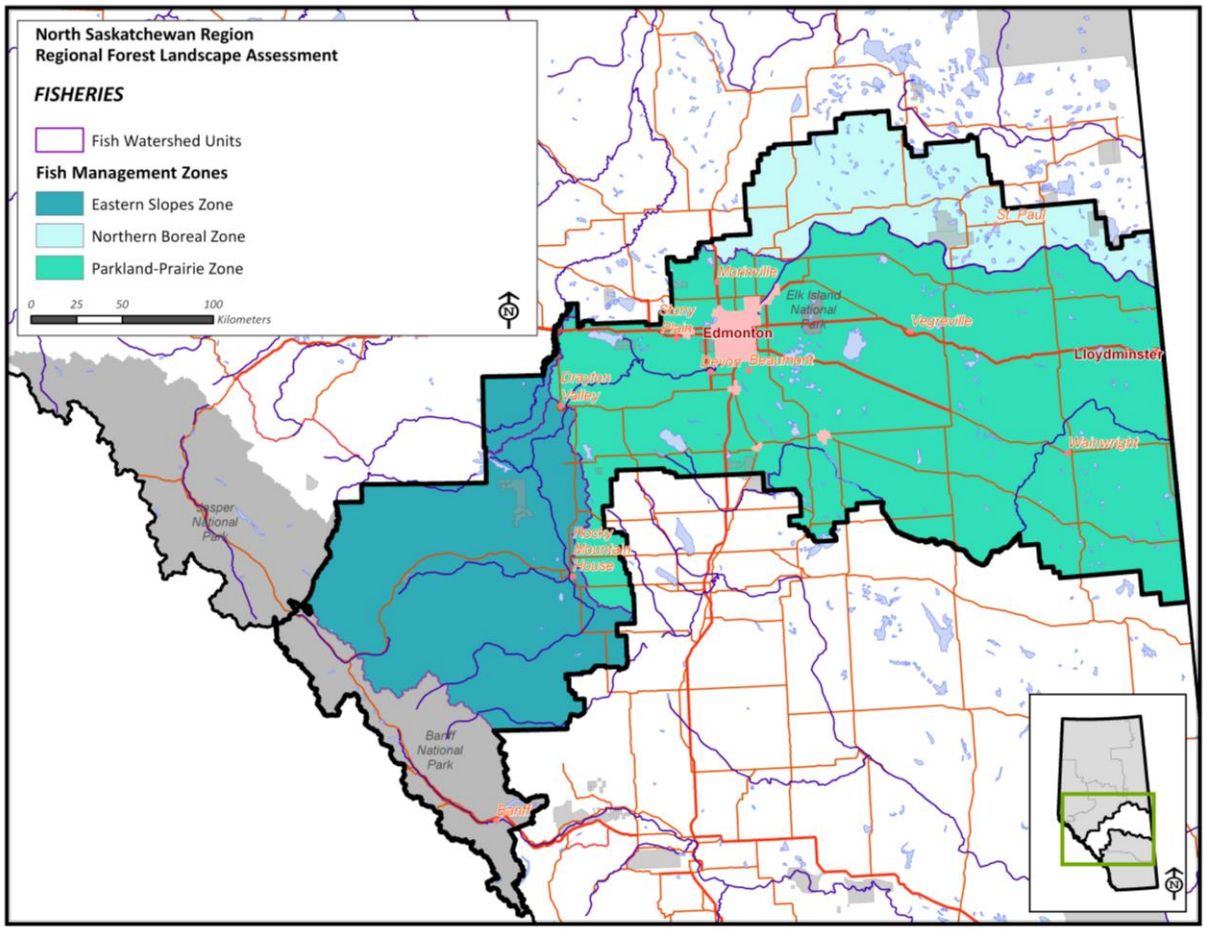


Figure 5-7 Fish Management Units and Fish Watershed Units

5.8.3 Wildlife

Wildlife sensitivity zones (Table 5-8 and Figure 5-8) are derived from aerial surveys, historical information, movements of collared animals and specific habitat type requirements. They are used by industrial operators and government departments in operational decision making on Crown land. In addition, these zones provide everyone with the best information currently available on the extent of wildlife sensitivities in Alberta.

The list of species is not exhaustive for the Region but identifies species that ESRD has listed as a concern when it comes to industrial activities. A Landscape Analysis Tool (LAT) has been developed to incorporate the Wildlife Sensitivity zones (47) when planning industrial activity. Reporting from the LAT allows for informed decisions, risk mitigation and adherence to standards.

Table 5-8 Areas of Wildlife Sensitivity Zones[1]

Wildlife Species	Area of Wildlife Sensitivity within Alberta (ha)	Portion of Wildlife Sensitivity Zone in North Saskatchewan (ha)[1]	(%)	Proportion of North Saskatchewan occupied by Sensitivity Zone (%)
Grizzly Bear (*Ursus arctos horribilis*)				
- Core Habitat	3,726,439	986,909	12	26
- Secondary Habitat	2,476,588	292,359	3	12
Mountain Goat (*Oreamnos americanus)* and Sheep (*Ovis canadensis*)	1,246,003	565,777	7	45
Piping Plover (*Charadruis melodus*) Habitat	154,770	56,740	1	37
Sharp-tailed Grouse (*Pedioecetes phasianellus*)	15,810,566	3,824,367	45	24
Trumpeter Swan (*Cygnus buccinator*)	538,615	14,976	0	3
Colonial Nesting Birds	46,319	14,651		
American White Pelican (*Pelecanus erythrorhynchos*)	14,911	2,516	0	17
- Great Blue Heron (*Ardea herodias*)	31,408	12,135	0	39
Sensitive Raptor Range	33,006,540	1,792,814	21	5
- Bald Eagle (*Haliaeetus leucocephalus*)	4,382,724	1,784,287	21	41
- Peregrine Falcon (*Falco peregrinus*)	13,246	1,439	0	11
- Prairie Falcon (*Falco mexicanus*)	10,840,613	7,088	0	0
Key Wildlife and Biodiversity Zone	4,689,713	544,319	6	12
Special Access Zone	1,763,820	2,767	0	0
Total Area of North Saskatchewan		8,578,706		

[1] Zones overlap each other (see Figure 5-8), so the areas are not additive

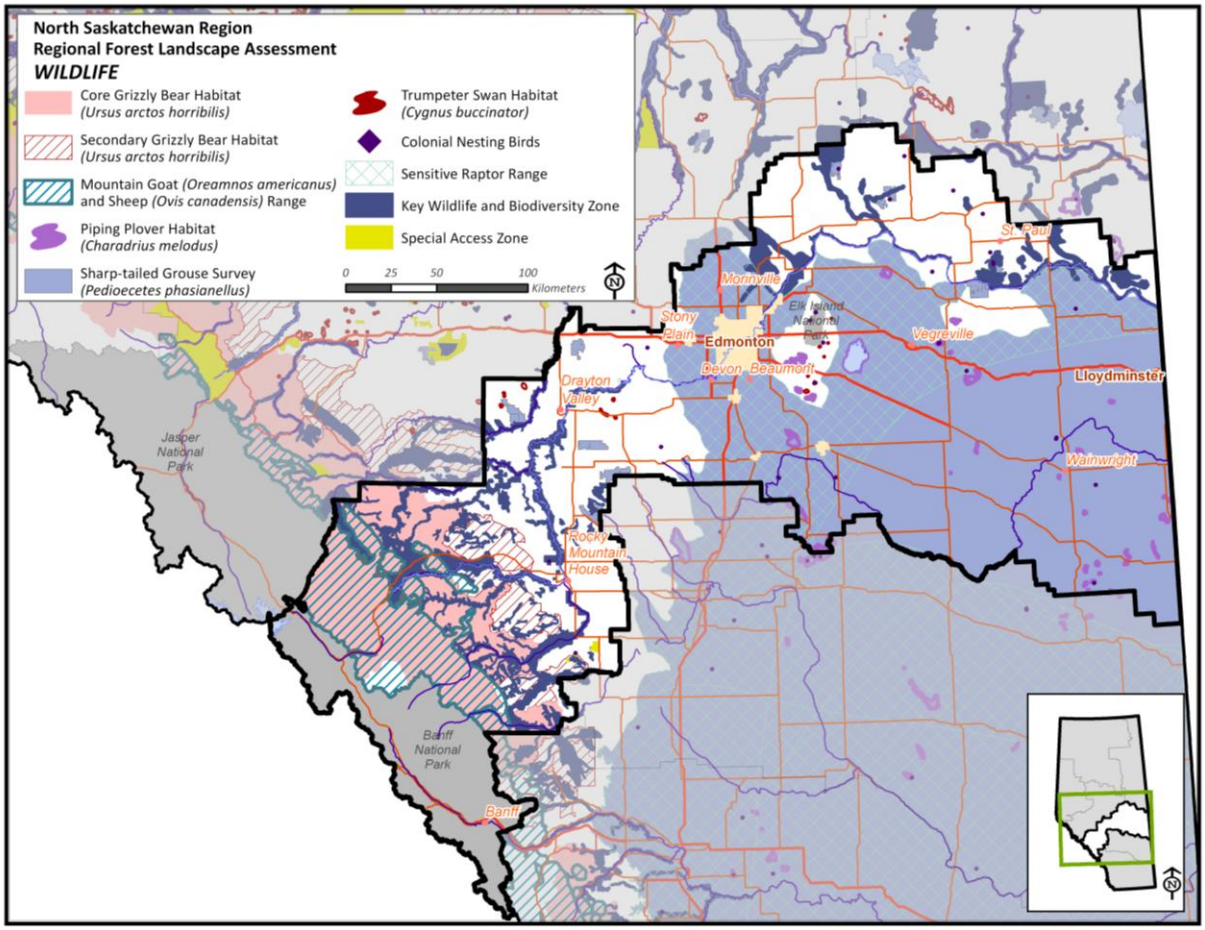


Figure 5-8 Wildlife Sensitivity Zones

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7. Glossary

Glossary	
Term	**Definition**
ABMI	See Alberta Biodiversity Monitoring Institute
AVI	see Alberta Vegetation Inventory
Alberta Biodiversity Monitoring Institute (ABMI)	The ABMI was incorporated in 2007 as a registered not-for-profit member-based organization.. The ABMI measures and provides information on the state of Alberta's biodiversity in order to facilitate the responsible management of the environment.
Alberta Vegetation Inventory (AVI)	AVI is an air-photo based inventory in the province of Alberta. The inventory includes a set of defined specifications for the classification of vegetation as well as specifications for the digital capture of polygon boundaries.
Brunisolic	Very poorly developed soil with a thin topsoil layer. One of three soil orders for forested soils in Canada. Typically developed from sandy parent materials and will often have a slightly acidic or basic pH.
Chernozemic	A productive, well-developed soil with a thick, rich topsoil layer. Typically develop in parent materials ranging from coarse sands to fine-textured silts and clay loams. These soils are found in the grassland and aspen parkland natural regions. The best agricultural land in Alberta is on this soil type.
Cryosolic	Mineral or organic soils that have a permanently frozen layer within one metre of the soil's surface.
ecoclimate	Classification using climate as an ecological factor.
ecoclimatic province	A broad complex of ecoclimatic areas that have similar climatic conditions as reflected by vegetation (Strong 1992).
FMA	see Forest Management Agreement
FMU	see Forest Management Unit
FMP	see Forest Planning Manual
Forest Management Agreement (FMA)	A large, area-based agreement between Alberta and a company, giving the company rights to establish, grow, harvest and removed timber from a defined area of land. An FMA is typically granted for 20 years and are renewable.
Forest Management Unit (FMU)	A forest management unit is a Crown-defined area which is the basis of calculating a sustainable supply of timber. Allowable harvest levels within an FMU are then allocated under the Alberta forest tenure system.
Forest Planning Manual (FMP)	The Forest Planning Manual is the short-name title of the "Alberta Forest Management Planning Standard" (version 4.1, dated April 2006). This document and its annexes, bulletins and updates comprise the standard for preparing and implementing forest management plans in Alberta.
FRAGSTATS	FRAGSTATS is a computer program designed to quantify landscape metrics. Chosen metrics are those typically associated with habitat characteristics (patch size, shape, contiguity, connectivity, etc.). It was developed at the University of Massachusetts, first released for public use in 1995 and currently is published as version 4.0.

Glossary	
Term	**Definition**
Gleysolic	A distinctive soil that results from being saturated with water for long periods of time. This soil is not productive, and is unable to retain nutrients. The water-saturated conditions also reduce the rate of transformation of organic matter which can lead to the build up of organic matter on the surface of mineral Gleysolic soils.
HRV	see Historic Resource Value
Historic Resource Value	An index related to relative importance of historical and cultural features as identified and assigned by Alberta Culture.
National Forest Inventory (NFI)	Canada's National Forest Inventory (NFI) monitors a network of sampling points covering one percent of Canada's land mass on an ongoing basis to provide accurate, timely and consistent information on the state and sustainable development of Canada's forests. This information is shared with collaborators and the public and is used to provide credible information to inform domestic forest policies and positions, and to support science initiatives, and regional, national and international reporting commitments.
NFI	see National Forest Inventory
LAT	see Landscape Analysis Tool
Landscape Analysis Tool	The Landscape Analysis Tool is a web-enabled tool allowing users to plan activities on Alberta land with the purpose of identifying operational constraints which may apply to the activity. The generated report provides provinicial and sensitivity section approval standards and operating conditions that are specific to a proposed activity.
Luvisolic	Soil that has large organic but low humus content. Nutrients are easily washed out of the topsoil and therefore this type of soil is not as productive as the Chernozems soils. Parent materials of Luvisolic soils are typically well supplied with base cations and have loamy or clay domiinated soil textures.
Organic	A soil that is made up of mostly organic, natural material. Usually refers to peat, bog or fen soils. The wetland variants of Organic soils are associated with landscape positions where water accumulates and saturates the soil. Upland versions of these soils are composed of leaf litter and other woody debris.
Permanent Sample Plot (PSP)	A sampling program installed with the express purpose to measure biological metrics on a repeated basis. Such plots are typically revisited on a fixed schedule, depending on the purpose of the programme. In many cases, the plot locations are protected under a provincial disposition, requiring authority from the plot owner for the plot to be accessed or disturbed.
Podzolic	Podzols are forested soils found primarily on sandy parent materials in areas underlain by igneous rocks. Can be prone to cementation of layers within the soil profile. Cemented layers anc form barriers to vertical penetration of tree roots and water, leading to water saturation above the cemented layer.

Glossary	
Term	**Definition**
PSP	See Permanent Sample Plot
Regosolic	Poorly developed soil that has a thin topsoil layer. This soil does not retain nutrients well. Commonly associated with landforms where the land surface is (or has recently been) unstable. Because of the instability, the soils has had little time to develop and hence soil horizons are weakly expressed.
Solonetzic	A typical grassland soil usually found in a subhumid or semiarid climate under grass and shrub vegetation. These typically occur in the same ecozones as Chernozemic soils. Developed primarily from glacial re-working of sedimentary rocks. Typcially the A horizon is depleted of clay which has been deposited in the B horizon.
Seral stage	The series of progressive plant communities that develop during ecological succession from bare ground to the climax stage. A seral stage is defined by species composition and time since stand development.
Vertisolic	Vertisolic soils are found on parent materials high in clay. Lacustrine sediments high in clay were often deposited in the deepest parts of glacial lakes. Vertisolic soils are associated with these flat, level lacustrine surfaces.The mixing of soil material caused by wet/dry cycles (leading to swelling/contraction of the soil layers) is characterisitic of Vertisolic soils. Common throughout the Pairies, but have a limited extent in other regions of Canada.

APPENDIX I Named Towns and Villages in the North Saskatchewan

These detailed lists (Table 7-1, Table 7-2) are supplementary information to the summary of municipal governments provided in section 1.6.

Table 7-1 List of Towns

Town Name	Population (2010)
Banff	8,721
Bashaw	868
Beaumont	12,586
Bon Accord	1,534
Bruderheim	1,215
Calmar	2,033
Daysland	818
Devon	6,534
Drayton Valley	6,893
Elk Point	1,512
Gibbons	2,848
Hardisty	761
Killam	1,019
Lamont	1,664
Legal	1,192
Millet	2,125
Morinville	7,636
Mundare	823
Provost	2,078
Redwater	2,192
Rocky Mountain House	7,231
Sedgewick	891
Smoky Lake	1,010
St. Paul	5,632
Stony Plain	14,177
Tofield	1,876
Two Hills	1,232
Vegreville	5,834
Vermilion	4,472
Viking	1,085
Wainwright	5,775
Total	114,267

Table 7-2 List of Villages

Village Name	Population (2010)
Alliance	197
Amixk	172
Andrew	465
Bawlf	374
Bittern Lake	232
Breton	579
Caroline	515
Chauvin	321
Chipman	294
Czar	175
Dewberry	219
Edberg	155
Edgerton	393
Ferintosh	193
Forestburg	895
Galahad	134
Hay Lakes	429
Heisler	150
Holden	398
Hughenden	266
Innisfree	233
Irma	444
Kitscoty	847
Lougheed	254
Mannville	761
Marwayne	569
Minburn	65
Myrnam	362
New Norway	323
Paradise Valley	183
Rosalind	214
Ryley	458
Spring Lake	592
Strome	252
Thorsby	988
Vilna	274
Wabamun	662
Warburg	696
Waskatenau	278
Willingdon	295
Total	15,306

APPENDIX II Parks and Protected Areas in the North Saskatchewan

Detailed lists of parks and protected features are provided. The registered park/protected area is noted along with any additional areas that are under Crown Reservation and subject to referral if any industrial activity is being planned for the area. Note that some parks/protected features are not wholly contained in the North Saskatchewan and these are noted in footnotes under each table.

Table 7-3 List of Provincial Parks

Provincial Park	Registered Area in Region (ha)	Percentage (%)	Additional PNT/CNT Area (ha)
Crimson Lake	3,195	23	0
Dillberry Lake	1,210	9	0
Eagle Point	1,953	14	0
Garner Lake	64	0	0
Kootenay-Cline	0	0	51,522
Lois Hole Centennial	1,796	13	0
Long Lake	754	5	320
Miquelon Lake	1,273	9	0
Pembina River	97	1	0
Pigeon Lake	449	3	0
Ram Falls	412	3	0
Strathcona Science	110	1	0
Vermilion	753	5	0
Wabamun Lake	231	2	0
Whitney Lakes	1,483	11	0
Total	13,782	100	51,842

Table 7-4 List of Wildland Parks

Wildland Park	Registered Area in Region (ha)	Percentage (%)	Additional PNT/CNT Area (ha)
Brazeau Canyon Wildland[1]	190	100	0
Total	190	100	0

[1] The majority (96%) of Brazeau Canyon Wildland is in the Upper Athabasca Region

Table 7-5 List of Wildland Areas

Wildland Area	Registered Area in Region (ha)	Percentage (%)	Additional PNT/CNT Area (ha)
Siffleur	42,534	49	0
White Goat	44,557	51	0
Total	87,091	100	0

Table 7-6 List of Provincial Recreation Areas

Provincial Recreation Area	Registered Area in Region (ha)	Percentage (%)	Additional PNT/CNT Area (ha)
Aylmer	7	0	0
Beaverdam	107	1	0
Blackstone	3	0	0
Blue Rapids	3,616	18	0
Bott Lake	0	0	107
Brazeau Reservoir[1]	85	0	0
Brown Creek	4	0	0
Buck Lake	49	0	0
Calhoun Bay	391	2	0
Cartier Creek	42	0	0
Chambers Creek (incl Group Camp)	107	1	0
Coal Lake North	5	0	0
Cooking Lake - Blackfoot	9,886	49	0
Crescent Falls	262	1	0
Deer Creek	5	0	0
Dry Haven	2	0	0
Elk Creek	16	0	0
Elk Creek Fish Pond	8	0	0
Fish Lake	408	2	0
Goldeye Lake	51	0	0
Harlech	12	0	0
Horburg	12	0	0
Jackfish Lake	194	1	0
James - Wilson	16	0	0
James River Bridge	1	0	0
Kehiwin	4	0	0
Kitscoty	1	0	0
Kootenay Plains	104	1	0
Leslieville	1	0	0
Mallaig	2	0	0
Medicine Lake	40	0	0
Mitchell Lake	22	0	0
Newbrook	2	0	0
North Ram River	15	0	0
Peaceful Valley	5	0	0
Peppers Lake (incl Staging)	31	0	0
Phyllis Lake	109	1	0
Prairie Creek (incl Group Camp)	51	0	0
Red Deer River	119	1	0
Saunders	9	0	0
Seven Mile	37	0	0
Shunda Viewpoint	16	0	0
Snow Creek	64	0	0
Strachan	32	0	0
Swan Lake	248	1	0
Tay River	2	0	0
Thompson Creek	116	1	0
Wallaby Lake	0	0	326
Wapiabi	4,028	20	0
Wild Horse	5	0	0
Total	20,354	100	433

[1] 44% of Brazeau Reservoir Recreation Area is in the Upper Athabasca Region

Table 7-7 List of Natural Areas

Natural Area	Registered Area in Region (ha)	Percentage (%)	Additional PNT/CNT Area (ha)
Alexo	42	0	
Alsike Bat Lake	120	0	
Antler Lake Island	3	0	
Aurora	907	2	
Battle Lake	65	0	48
Battle River	0	0	125
Beaverhill	322	1	
Beaverhill Lake Heritage Rangeland	17,499	39	
Bellis Lake	62	0	431
Bellis North	1,109	2	
Bigoray	65	0	
Buck Lake	110	0	
Buck Lake Creek	129	0	
Burtonsville Island	276	1	
Caroline	0	0	30
Carnwood Modeste	65	0	
Chedderville	232	1	123
Clearwater Ricinus	81	0	
Clifford E. Lee	11	0	
Cow Lake	390	1	
Coyote Lake	295	1	976
Crippsdale	64	0	
Douglas Fir	316	1	
Dussault Lake	57	0	
Eagle Creek	0	0	655
Easyford	113	0	
Easyford Creek	113	0	
Edgar T. Jones	88	0	
Edgerton	0	0	65
Genesee	180	0	
Halfmoon Lake	203	0	
Halfway Lake	65	0	
Hastings Lake Islands[1]	14	0	61
Hollow Lake	0	0	78
Horseshoe Creek	326	1	
Isle Lake	128	0	
Kilini Creek	0	0	129
Killarney-Reflex Lakes Heritage Rangeland	2,740	6	
Lac Tremble	0	0	260
Lake of the Falls	0	0	1,052
Landslide Lake	0	0	2,290
Lloyd Creek	578	1	

Manly Corner	0	0	258
Matthews Crossing	311	1	
Mill Island	108	0	
Modeste Creek	388	1	
Modeste Saskatchewan	361	1	
Mount Butte	63	0	343
North Bruderheim	178	0	265
North Cooking Lake	212	0	
North Ram - Nice Creek	0	0	1,566
Northwest of Bruderheim	260	1	
O'Chiese	375	1	
Opal	371	1	252
Oxville	0	0	170
Parkland	259	1	
Pembina Bigoray	0	0	315
Pembina River Moon Lake	107	0	
Perch Lake Lac Canard	0	0	223
Poplar Creek	322	1	194
Prairie Creek Clearwater	0	0	61
Redwater	1,836	4	389
Redwater River	65	0	
Ribstone Creek Heritage Rangeland	8,333	19	
Riverlot 56	109	0	
Rocky Mountain House	0	0	211
Rocky Rapids	65	0	
Round Valley	129	0	
Scalp Creek	716	2	
Sherwood Park	68	0	
Smithfield	0	0	129
St. Francis	81	0	32
Strawberry Creek	0	0	129
Sundance	128	0	
Tawatinaw	131	0	
Taylor Lake	40	0	
Telfordville	0	0	64
Thorsby	65	0	
Torlea	0	0	259
Town Creek	258	1	
Ukalta Dunes	0	0	64
Upper Mann Lake	130	0	
Victoria Settlement	12	0	
Wabamun Lake	0	0	25
Wagner	221	0	
Wanisan Lake	0	0	5
Washout Creek	125	0	
West Stony Creek	0	0	200
White Earth Valley	2,009	5	65
Winfield	0	0	64
Total	44,606	100	11,604

[1] PNT is named Hastings Lake

Table 7-8 List of Ecological Reserves

Ecological Reserve	Registered Area in Region (ha)	Percentage (%)	Additional PNT/CNT Area (ha)
Kootenay Plains	3,728	56	
Wainwright Dunes	2,971	44	
Total	6,699	100	0

Table 7-9 List of National Parks

National Park	Registered Area in Region (ha)	Percentage (%)	Additional PNT/CNT Area (ha)
Banff National Park	685,020	97	0
Elk Island National Park	19,230	3	0
Total	704,250	100	0

APPENDIX III Data References

	Data Source
1.	Alberta. Resource Information Management Branch. 2012. "BF_LAND_USE_FRAMEWORK" Downloaded from http://www.altalis.com
2.	Alberta. Resource Information Management Branch. 2012. "BF_GREEN_WHITE_POLYGON" Downloaded from http://www.altalis.com
3.	Alberta. Resource Information Management Branch. 2012. "BF_FMA_POLYGON" Downloaded from http://www.altalis.com
4.	Alberta. Resource Information Management Branch. 2012. "BF_FMU_POLYGON" Downloaded from http://www.altalis.com
5.	Alberta. Resource Information Management Branch. 2012. "BF_NATURAL_AREA_POLYGON" Downloaded from http://www.altalis.com
6.	Alberta. Resource Information Management Branch. 2012. "Municipal/City/Town/Settlement/Special Area/Urban Service Area/Village Shape files" Provided directly by source.
7.	Alberta. Municipal Affairs. 2012. "Population_2010.xls" Downloaded from http://municipalaffairs.gov.ab.ca/mc_official_populations.cfm
8.	Alberta. Resource Information Management Branch. 2012. "National Park.shp" Provided directly by source.
9.	Alberta Spatial Data Warehouse "Fed_Military.shp" Downloaded from: http://www.altalis.com
10.	Alberta. Resource Information Management Branch. 2012. "Indian Reserve.shp" Provided directly by source.
11.	Alberta. Resource Information Management Branch. 2012. "Metis Settlement.shp" Provided directly by source.
12.	Alberta. Municipal Affairs. 2012. "Population_2010.xls" Downloaded from http://municipalaffairs.gov.ab.ca/mc_official_populations.cfm
13.	Alberta. Resource Information Management Branch. 2012. "Provincial Park/Provincial Recreation Area/Natural Area/Wildland Park/Wilderness Park/Wilderness Area/Ecological Reserve/Crown Reservations" Provided directly by source.
14.	Alberta. Alberta Parks. Park designations. Download from http://www.albertaparks.ca/albertaparksca/management-land-use/current-parks-system.aspx.
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18. University of Saskatchewan. Referenced from http://soilsofcanada.ca/orders/vertisolic/index.php

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