Regional Forest Landscape Assessment

Upper Athabasca Region

Prepared for:

Forest Management Branch
Alberta Environment and Sustainable Resource Development

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EXECUTIVE SUMMARY

The Upper Athabasca Region is one of the seven land-use regions defined in Alberta's Land-use Framework. It spans the central north-west portion of the province and includes the upper portion of the Athabasca River watershed. This watershed includes Alberta's third largest lake, Lesser Slave Lake.

The Region contains significant development of the forest and energy sectors. Eleven of the 20 Forest Management Agreement Areas in the province are either entirely or partially located in the Region. Conventional well sites and pipelines are abundant. In addition, the Region contains five developed coal mines. Agriculture is present in the southeast portion of the Region where the landscape has been under cultivation for many decades.

Jasper National Park makes up 14% of the area of the Region and provides large expanses of undisturbed forest. The Park provides recreation and tourism opportunities in addition to the variety of provincial parks, wildland and recreation areas. In total, parks and protected areas cover 16% of the Region.

The topography of the Region is diverse, from the Rocky Mountains in the west to the undulating plains in the northeast. The Region's climate and soil have resulted in the development of primarily coniferous forests in the western portion, grading into mixedwood stands in the lower elevations of the northeast. Pure deciduous stands are found primarily on south facing slopes.

Forests are mostly above the mature stage of seral stage development, with 33% of the Region classified as mature, old or very old. In addition, the age class distribution shows 17% of the Region's forests in the age class 120 years or older.

The forest is threatened by natural populations of several pests, but current mountain pine beetle outbreak is likely to be the most damaging, and likely to reduce the future volume of wood that can be extracted. Historical defoliators continue to persist in the Region, but to date, have not had the impact observed with the current mountain pine beetle infestation.

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 II 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 II . 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 Upper Athabasca Region

The Upper Athabasca Region (1), one of seven land-use regions defined in Alberta's Land-use Framework (Alberta 2008), spans the central north-western portion of Alberta, running east from the Alberta-British Columbia border to the eastern edge of the County of Athabasca (see Figure 1-1). The western part of the region contains Jasper National Park, and the northern portion contains Slave Lake. The Region contains a variety of industrial development, agriculture, natural resource development as well as large areas of protected lands for the purposes of conservation.

The Upper Athabasca Region is the fourth largest of the seven regions, with an area of approximately 8,298,097 hectares.

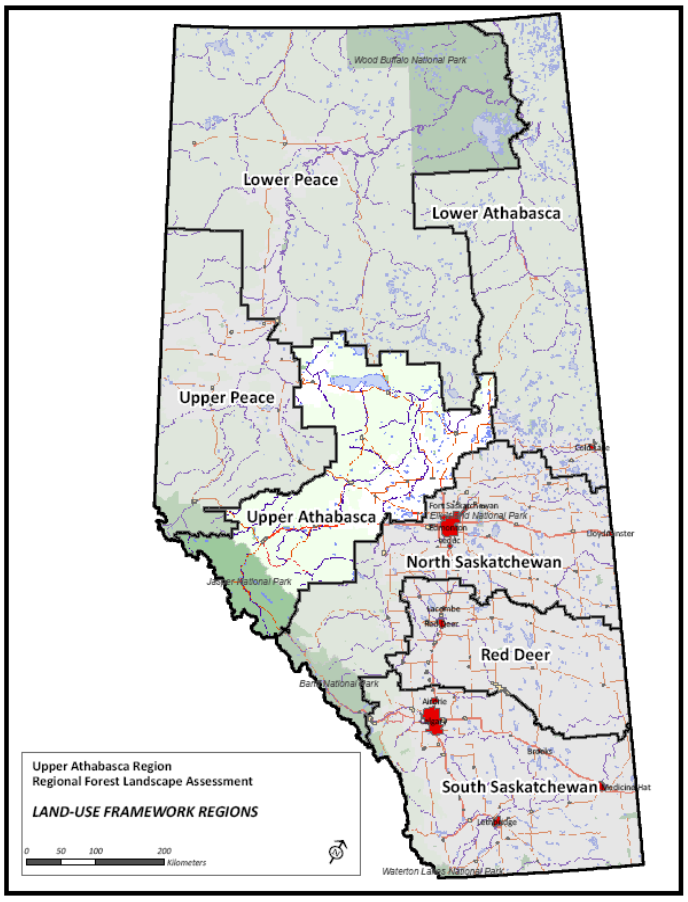


Figure 1-1 Upper Athabasca Region

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 consists primarily of private land holdings related to agricultural use. The Green Area is Crown land, and managed for natural resource development, recreation and conservation. Specifically excluded from the Green and White Areas are lands not administered by Alberta (e.g.: national parks, military installations and bases).

As summarized in Table 1-1, approximately 58% of the Upper Athabasca Region is Green Area, 28% is White Area and the remaining 14% are under federal administration. Note that while national parks are included in the Land-use Framework regions, they are 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	4,805,770	58
White Area	2,332,302	28
Federal Land	1,159,995	14
Total	8,298,067	100

The White Area is concentrated in the south-eastern portion of the region with a pocket in the north around the town of High Prairie.

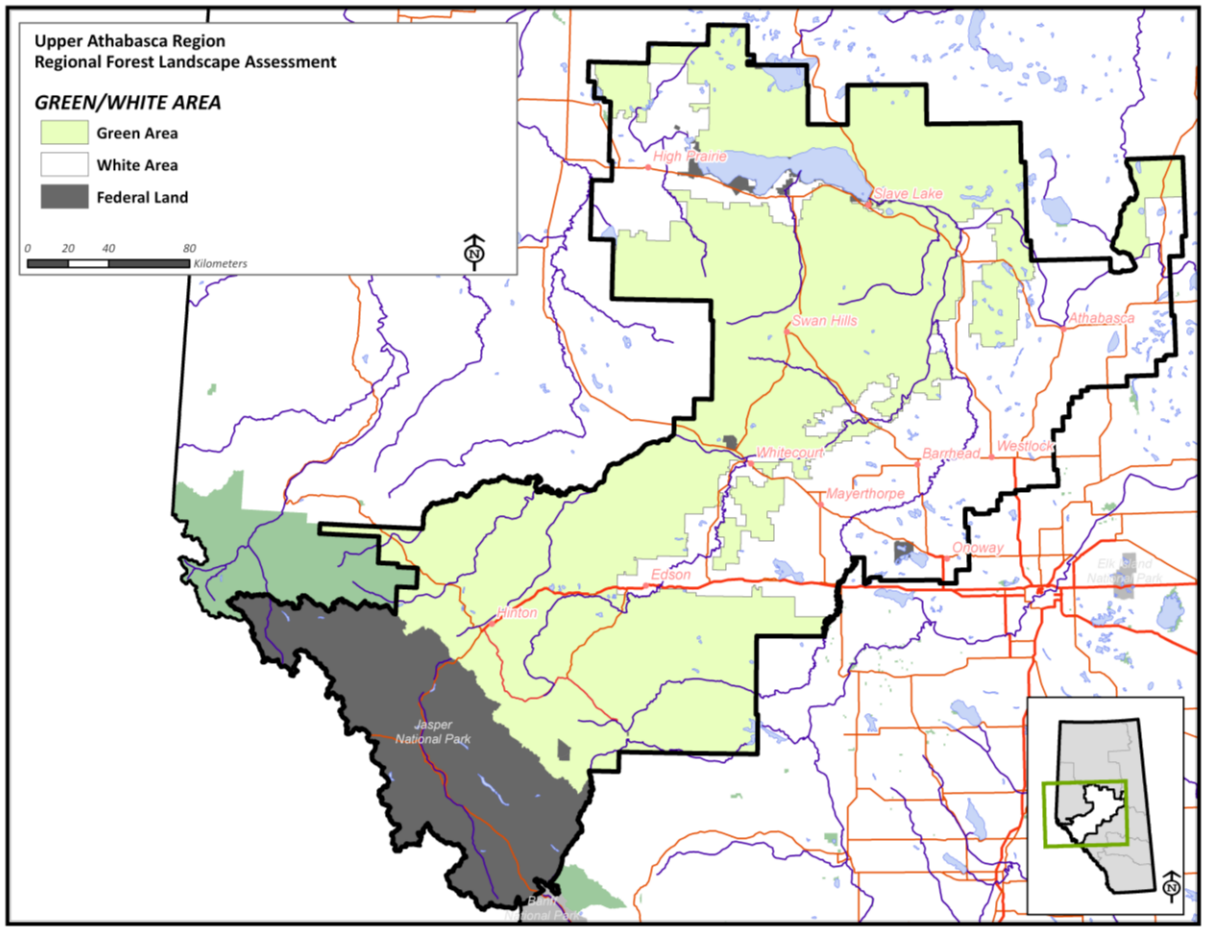


Figure 1-2 Green/White Area Distribution

1.3 Forest Management Agreement Areas

Forty-nine percent of the Upper Athabasca Region is covered by a Forest Management Agreement (FMA) (3). There are a total of 14 FMA holders with timber allocations in the Upper Athabasca Region. FMA boundaries are not coincident with the land use framework region boundaries.

Table 1-2 lists the FMAs (in alphabetical order) which have lands inside the Upper Athabasca Region, the percentage of each FMA inside the region, as well as the proportion of the Upper Athabasca Region which is covered by the respective FMA.

Figure 1-3 shows the location of the respective FMAs and their distribution within the Upper Athabasca Region.

Table 1-2 Forest Management Agreement Area summary

FMA Label	Company Name	Entire FMA	Portion of FMA located in Upper Athabasca		Proportion of Upper Athabasca occupied by FMA
		Area (ha)	Area (ha)	% of FMA	% of Upper Athabasca
ALPAC	ALPAC Forest Products Incorporated	6,530,478	241,591	4	3
ANC	ANC Timber Ltd.	373,980	44,144	12	1
BRL	Blue Ridge Lumber Inc.	661,772	327,128	49	4
BUCH/TOLK	Gordon Buchanan Enterprises Ltd. and Tolko Industries Ltd.	246,105	110,430	45	1
MWFP	Millar Western Forest Products Ltd.	391,570	369,570	94	4
SLP	Slave Lake Pulp Corporation	629,689	619,521	98	7
SUND	Sundance Forest Industries Ltd.	265,731	217,190	82	3
TOLKO	Tolko Industries Ltd. (High Prairie)	193,225	56,749	29	1
TOLK/VAN/APL	Tolko Industries Ltd., Vanderwell Contractors (1971) Ltd. and WFM. (Slave Lake)	703,749	545,102	77	7
VAND	Vanderwell Contractors (1971) Ltd.	55,961	55,961	100	1
HWP	West Fraser Mills Ltd. (Hinton)	988,614	984,842	100	12
PEMBINA	Weyerhaeuser Company Limited (Pembina Timberland)	949,719	485,411	51	6
Sub-total		11,990,593	4,057,637		49
No Forest Management Agreement Area			4,240,430		51
Total			8,298,067		100

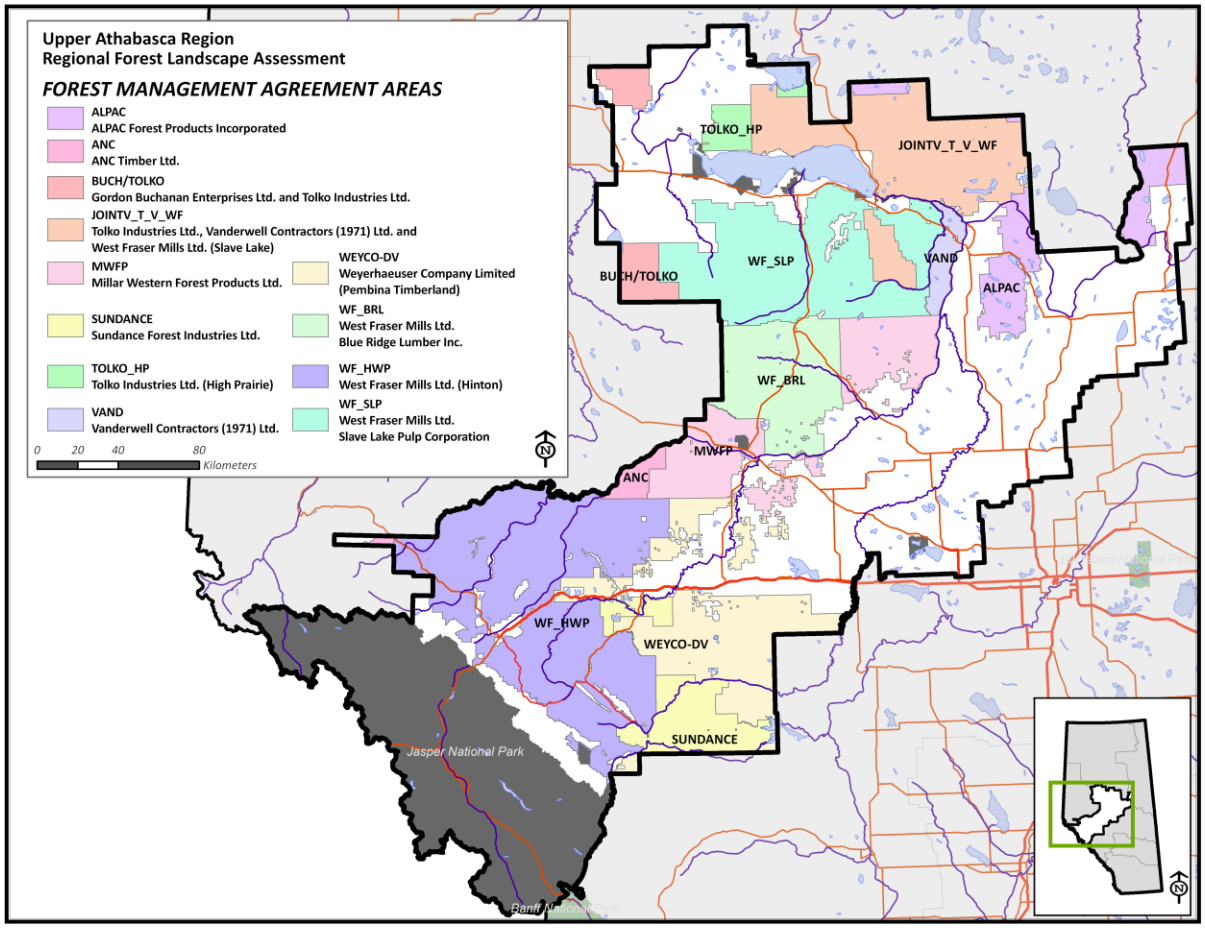


Figure 1-3 Forest Management Agreement Areas

1.4 Forest Management Units

The Upper Athabasca Region contains 36 Forest Management Units (FMU) (4), of which 13 are fully within inside the region (Table 1-3). The largest FMU in the region is E14 which makes up 12% of the Upper Athabasca. Of the 36 FMUs, 17 are managed by the Crown and 19 are managed under an FMA (see section 1.3). The FMUs M3 and M4 are coincident with the Metis Settlements of East Prairie, Gift Lake and Peavine which will be described in section 1.8. While the Metis Settlements are allocated an FMU number, Alberta does not have the mandate for forest management in these units.

The largest Crown-managed units (WO2, LO1, SO2 and SO1) are located in the White Area. The largest FMU managed as an FMA is E14 (West Fraser Timber (Hinton)).

A map of the FMUs within the Upper Athabasca Region appears as Figure 1-4.

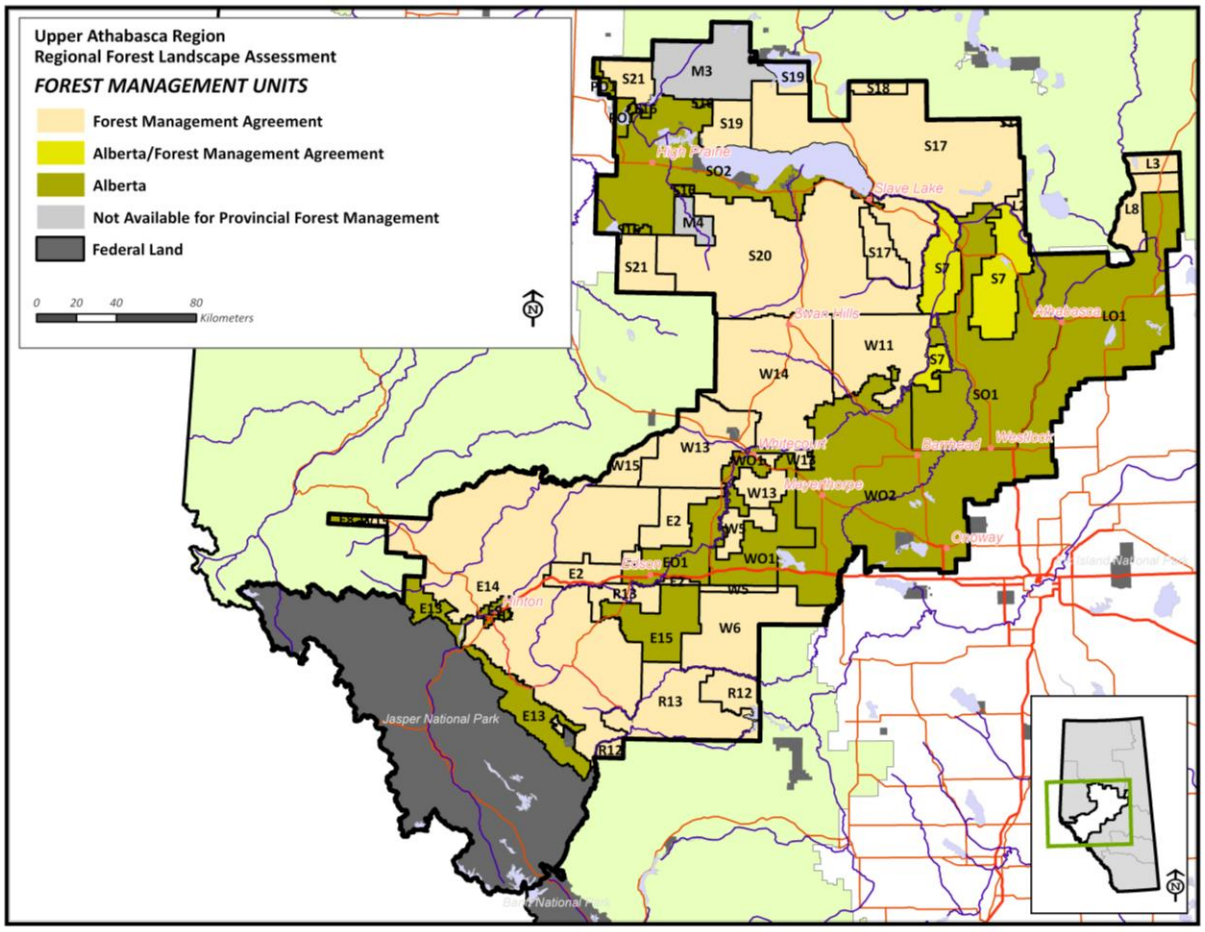


Figure 1-4 Forest Management Units

Table 1-3 Forest Management Units

FMU Name	Managed by	Entire FMU Area (ha)	Portion of FMU located in Upper Athabasca Area (ha)	Portion of FMU located in Upper Athabasca % of FMU	Proportion of Upper Athabasca occupied by FMU % of Upper Athabasca
E14	FMA	1,022,231	1,016,964	99	12
WO2	Crown	1,113,035	741,127	67	9
S20	FMA	658,367	647,817	98	8
S17	FMA	727,043	562,735	77	7
LO1	Crown	2,579,926	500,879	19	6
SO2	Crown	598,075	471,335	79	6
SO1	Crown	456,175	456,175	100	6
W14	FMA	668,335	329,021	49	4
S7	FMA	238,805	237,867	100	3
W13	FMA	301,616	228,560	76	3
R13	FMA	268,089	219,548	82	3
W6	FMA	233,762	183,972	79	2
W11	FMA	176,399	176,399	100	2
M3	Crown	170,047	169,977	100	2
WO1	Crown	165,426	165,426	100	2
E13	Crown	142,905	142,905	100	2
E2	FMA	122,524	122,524	100	1
E15	Crown	112,440	112,440	100	1
S21	FMA	247,777	112,102	45	1
EO1	Crown	107,373	107,373	100	1
S19	FMA	415,173	83,629	20	1
R12	FMA	533,183	68,517	13	1
L8	FMA	126,796	61,886	49	1
W5	FMA	72,059	50,215	70	1
W15	FMA	379,054	44,144	12	1
M4	Crown	33,321	33,321	100	0
L3	FMA	588,356	25,876	4	0
PO1	Crown	420,387	23,854	6	0
S18	FMA	610,026	21,210	3	0
S16	Crown	20,062	20,062	100	0
L2	FMA	298,744	13,014	4	0
E9	Crown	12,864	12,864	100	0
E8	Crown	219,562	8,579	4	0
H1	Crown	2,561	2,561	100	0
Sub-total		13,842,500	7,174,879		86
No Forest Management Agreement Area			1,123,188		14
Total			8,298,067		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 Upper Athabasca Region contains portions of 9 subregions. A summary of subregion distribution is in Table 1-4 (presented in order of prevalence in the Upper Athabasca Region) and a map showing the subregions in the Upper Athabasca Region appears as Figure 1-5.

Table 1-4 Natural Subregion Distribution

Natural Subregion	Area (ha)	Percentage (%)
Central Mixedwood	2,335,952	28
Lower Foothills	2,253,536	27
Dry Mixedwood	1,341,859	16
Upper Foothills	900,265	11
Subalpine	754,232	9
Alpine	549,463	7
Montane	127,819	2
Central Parkland	31,710	0
Lower Boreal Highlands	3,231	0
Total	8,298,067	100

The Central Mixedwood and Lower Foothills subregions together occupy more than half of the Upper Athabasca Region accounting for 55% of the Region (Table 1-4). The Dry Mixedwood Subregion is the next most prevalent, accounting for 16% of the region. The remaining area lies within the Upper Foothills, Subalpine, Alpine, Montane, Central Parkland and Lower Boreal Highlands Subregions.

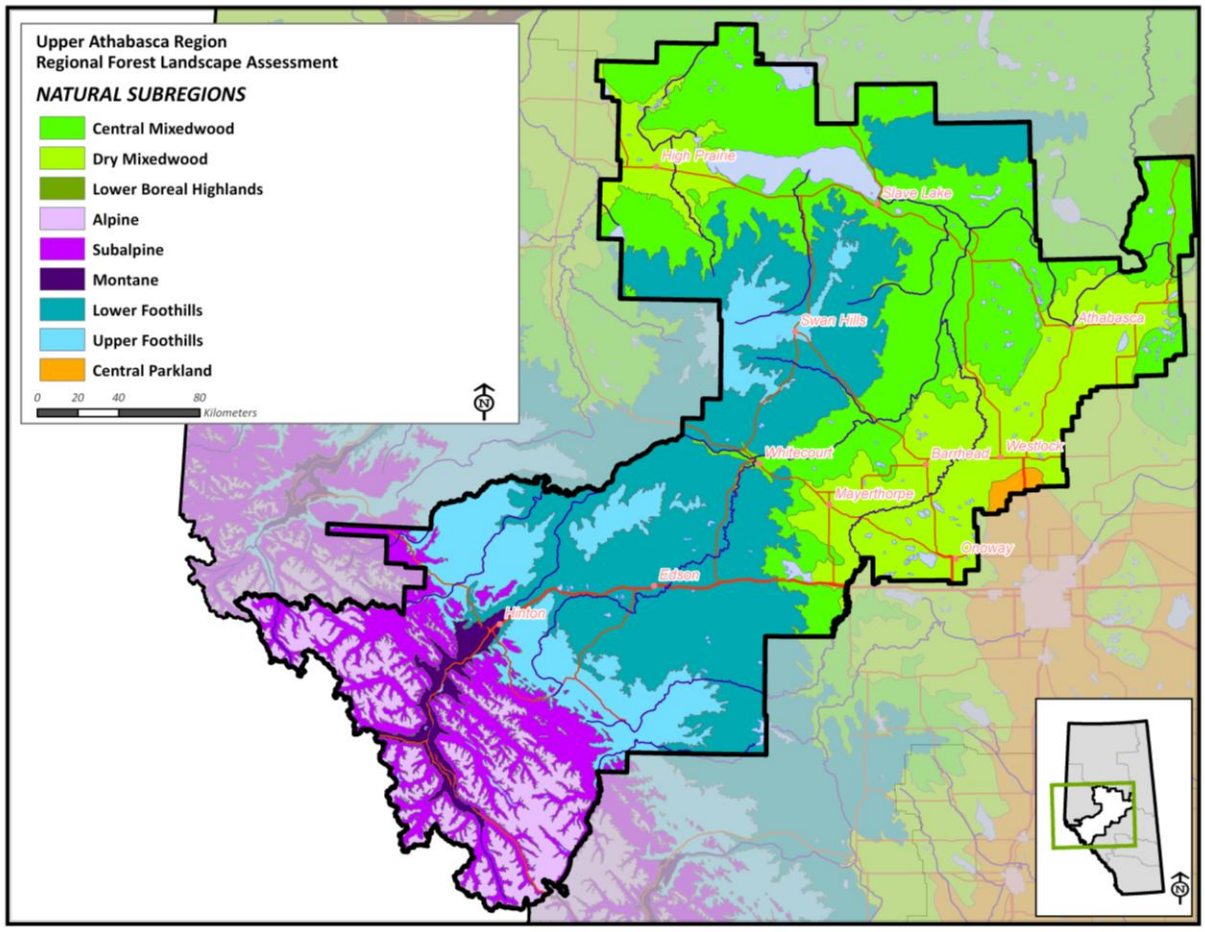


Figure 1-5 Alberta Natural Subregions

1.5.1 Central Mixedwood Natural Subregion

The Central Mixedwood Natural Subregion is the largest subregion making up 28% of the Upper Athabasca 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.

1.5.2 Lower Foothills Natural Subregion

The Lower Foothills Natural Subregion is the second largest subregion making up 27% of the Upper Athabasca Region. It occurs at lower elevations along the foothills of the Rocky Mountains, with some additional outlying area around Swan Hills as well as the Marten Hills located northeast of the Town of Slave Lake. The typical elevation range is approximately 700-800 m in the north to approximately 1500 m in the southern 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.

1.5.3 Dry Mixedwood Natural Subregion

The Dry Mixedwood Natural Subregion is characterized by undulating plains, aspen dominated forests and fens. There are two geologically different areas of Dry Mixedwood Subregion in the Province, and parts of both occur in the Upper Athabasca Region. In the north-eastern part of the Upper Athabasca, the subregion is primarily undulating plains and somewhat hummocky uplands. In the north-western portion, the topography consists more of gently rolling plains. 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.

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.

1.5.4 Upper Foothills Natural Subregion

The Upper Foothills Natural Subregion primarily rests below the Subalpine Subregion, but also has pockets in the central and north-western areas of the Upper Athabasca Region. 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. Strongly rolling to steep terrain with thin glacial deposits and exposed bedrock are 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 than the Lower Foothills and receives heavier summer 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, wildfire-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.

1.5.5 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.

1.5.6 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.

1.5.7 Montane Natural Subregion

The Montane Subregion sits below the Subalpine Subregion. Lodgepole pine, Douglas fir and aspen stands occur on eastern and northern aspects. Grasslands can occur on southern and western 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.

1.5.8 Central Parkland Natural Subregion

Only a small portion of the Central Parkland Subregion occurs in the Upper Athabasca Region. The Central Parkland covers a large portion of the central part of Alberta and is mostly under cultivation. In addition, the Central Parkland contains 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 northern 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.

The climate in this part of the Central Parkland Natural Subregion (within the Upper Athabasca Region) will be similar to the neighbouring Dry Mixedwood Natural Subregion.

1.5.9 Lower Boreal Highlands Natural Subregion

Only a very small portion of the Lower Boreal Highlands occurs in the Upper Athabasca Region, in the north-eastern corner. This Subregion is characterized by diverse mixedwood forests on moist lower slopes of northern hill systems and extensive wetlands at slope bases and on adjacent lowlands. Grey Luvisols are the dominant soil type, with Organic soils and Gleysols in the wetlands.

The climate in this Subregion is cooler and slightly more moist than Dry Mixedwood and Central Mixedwood Natural Subregions. July sees the majority of precipitation and summers are warmer but winters are much colder than in comparable Lower Foothills Natural Subregion.

This Subregion is a major zone of pine hybridization as well as having distinct pure white birch stands at upper elevations. Diverse young forests of aspen, balsam poplar, black and white spruce, white birch and pine hybrids occur on the slopes.

1.6 Municipal Districts/Counties

The Upper Athabasca contains types of municipal jurisdictions (6):

- 8 Municipal Districts (MD);
- 1 Improvement District (ID);
- 1 Special Municipality;
- 11 towns;
- 56 hamlets; and
- 158 smaller populated centers.

A list of the registered municipal entities is presented in Table 1-5. Table 1-5 includes the population of each of the registered areas according to the most recent census (7). Figure 1-6 shows the ID, MD and Special Municipality boundaries. Figure 1-7 shows the location of the 11 towns (labeled by name), 56 hamlets and 158 smaller populated centers (e.g.: villages, summer villages) in the Upper Athabasca 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; no MD or ID is split by the Region.

Note that the Special Municipality of Jasper includes a weighted population based on high levels of seasonal employment typical of this town. The ID of Jasper includes all of Jasper National Park with the exclusion of the Special Municipality.

Table 1-5 Summary of Municipal Locations

Municipal Classification	Name	Population (2010)
Municipal District	Athabasca No. 12, County of	7,592
	Barrhead No. 11, County of	5,845
	Big Lakes, M.D. of	4,030
	Lac Ste. Anne County	10,220
	Lesser Slave River No. 124, M.D. of	2,820
	Westlock County	6,910
	Woodlands County	4,158
	Yellowhead County	10,045
	Sub-total	51,620
Improvement District	I.D. No. 12 Jasper	24
	Sub-total	24
Special Municipality	Municipality of Jasper	4,745
	Sub-total	4,745
Town	Athabasca	2,734
	Barrhead	4,209
	Edson	8,365
	High Prairie	2,836
	Hinton	9,825
	Mayerthorpe	1,474
	Onoway	1,021
	Slave Lake	7,031
	Swan Hills	1,858
	Westlock	4,964
	Whitecourt	9,202
	Sub-total	53,519
Village	Alberta Beach	884
	Boyle	918
	Clyde	493
	Sub-total	2,295
Total		112,203

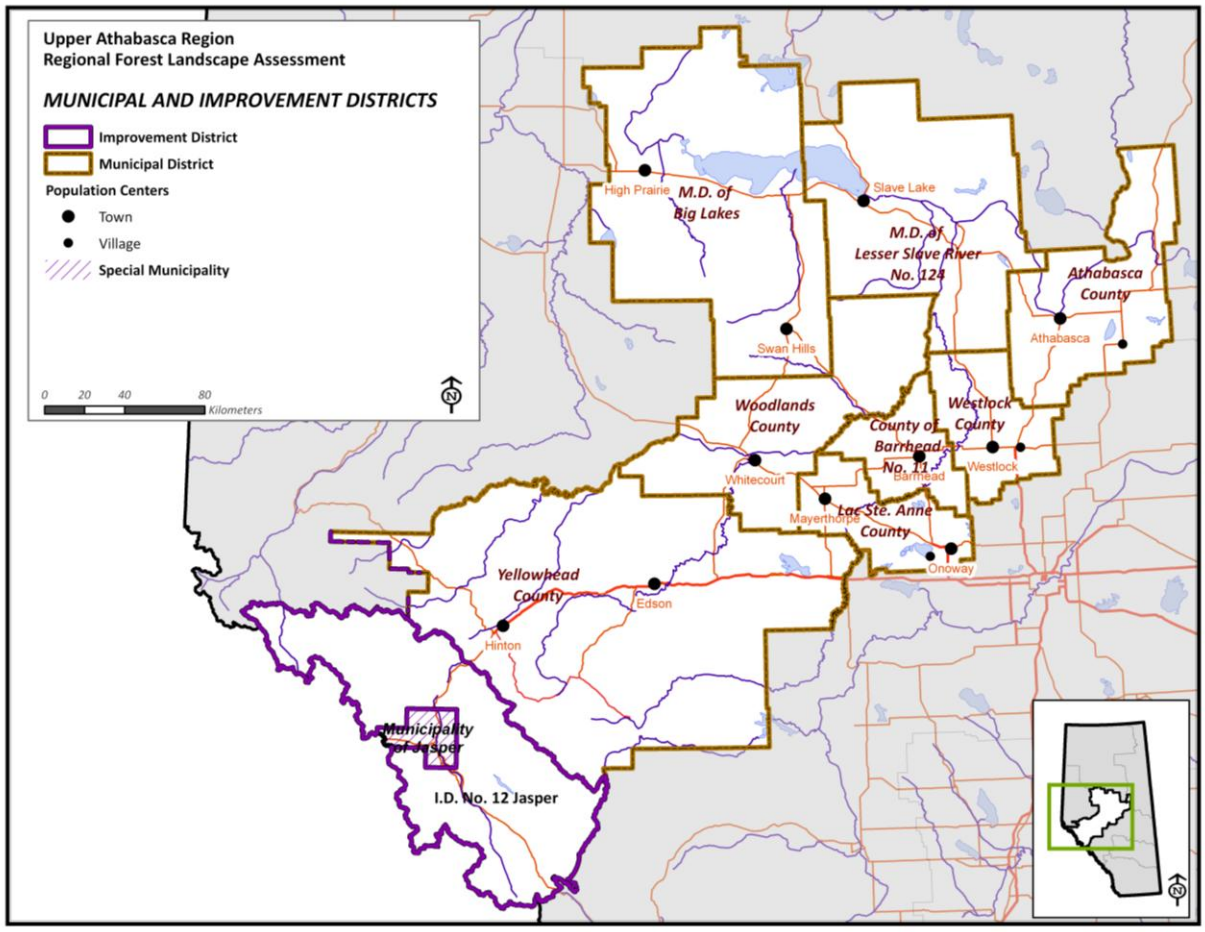


Figure 1-6 Municipal Jurisdictions

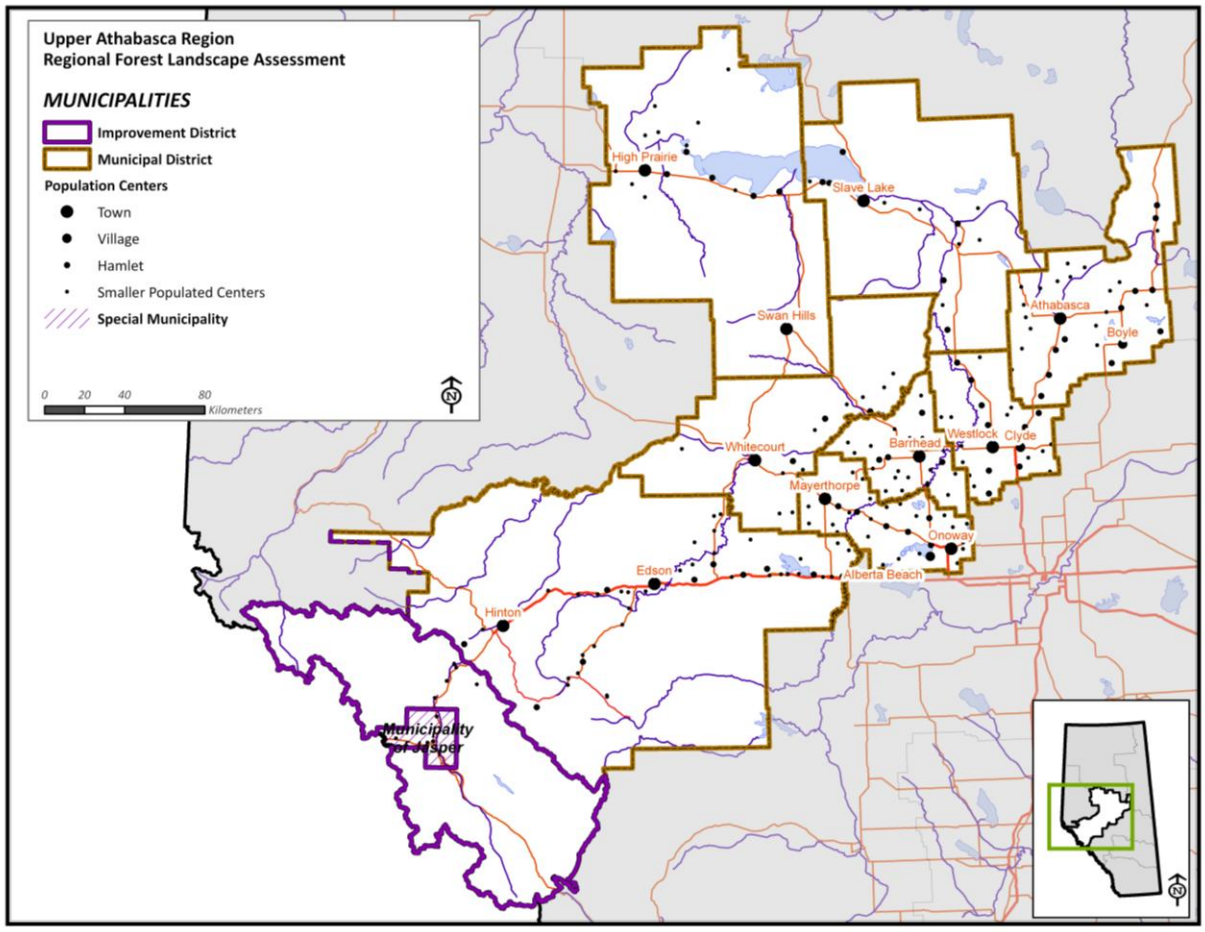


Figure 1-7 Towns and Other Populated Centers

1.7 Federal Government Lands

With the exception of First Nations lands (see section 1.8), the only federally managed land in the Upper Athabasca Region is Jasper National Park (8). Encompassing 1,123,096 hectares, Jasper National Park represents 14% of the Region (Table 1-1 and Figure 1-2).

1.8 First Nations

First Nation communities (10) cover 36,823 hectares of the Upper Athabasca Region. The geographic distribution of these communities appears in Figure 1-8.

Each First Nation is listed in Table 1-6, with its number of reservations. The population and source of population details are provided for each First Nation. A population survey was completed in 2011 by the

Federal government, but some bands were not represented. In those cases, the 2009 census data from Alberta (Alberta 2010) was used.

First Nation lands total 36,823 hectares representing 0.5% of the Upper Athabasca Region. The largest single First Nation is Alexis at 14,914 hectares, and is comprised of 4 separate reserves located across the Region. The majority of First Nations reservation land (19,775 hectares or 54% of all the First Nation lands in the region) touch on the shores of Slave Lake. These First Nations are: Assineau, Sucker Creek, Drift Pile River, Sawridge and Swan River.

The Utikoomak Lake First Nation and some portions of the Alexis and Sawridge First Nations are located in the Green Area, with the balance all occurring in the White Area. Three of the Alexis First Nation reserves are located in Treaty 6 along with the Stony Plain First Nation. The balance of First Nation communities in the Upper Athabasca Region are part of Treaty 8.

Table 1-6 First Nation Communities

First Nation Name	Treaty Number	Area (ha)	Percentage of all First Nations (%)	Number of Reserves	Population	Population Source
Alexander	8 (1899)	3	0	1	1,027	Canada (n.d.)
Alexis	6 (1876) & 8 (1899)	14,914	41	4	979	Alberta (2010)
Assineau	8 (1899)	62	0	1		n/a
Drift Pile River	8 (1899)	6,785	18	1	800	Canada (n.d.)
Kapawe'no	8 (1899)	1,551	4	6	108	Alberta (2010)
Sawridge	8 (1899)	2,116	6	2	48	Alberta (2010)
Stony Plain	6 (1876)	2	0	1	987	Canada (n.d.)
Sucker Creek	8 (1899)	6,540	18	1	701	Alberta (2010)
Swan River	8 (1899)	4,253	12	1	312	Canada (n.d.)
Utikoomak Lake	8 (1899)	597	2	1	765	Canada (n.d.)
Total		36,823	100	19	5,727	

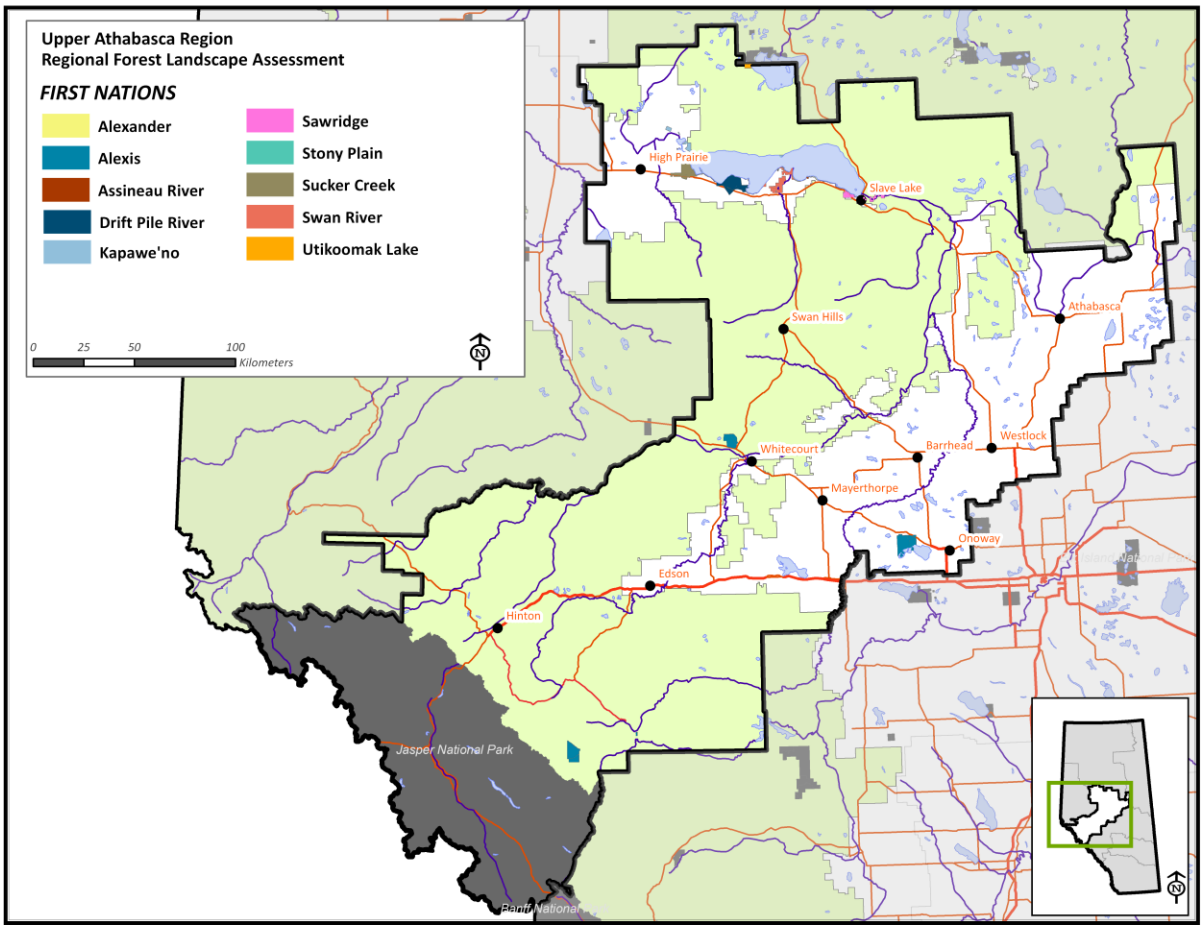


Figure 1-8 First Nations

1.9 Metis Settlements

There are 3 Metis settlements (11) contained in the Upper Athabasca Region and these are listed in Table 1-7, together with population figures.

All are located in the MD of Big Lakes, in the north-eastern portion of the region (Figure 1-9). The area of Metis settlements exceeds the total of First Nations lands, with 203,129 hectares, or about 2% of the Region's area.

Table 1-7 Metis Settlements

Metis Settlement	Area (ha)	Percentage of Metis (%)	Percentage of Region (%)	Population	Population Source
East Prairie	33,321	16	0	906	Alberta (2010)
Gift Lake	85,951	42	1	1,115	Alberta (2010)
Peavine	83,858	41	1	905	Alberta (2010)
Total	203,129	100	2	2,926	

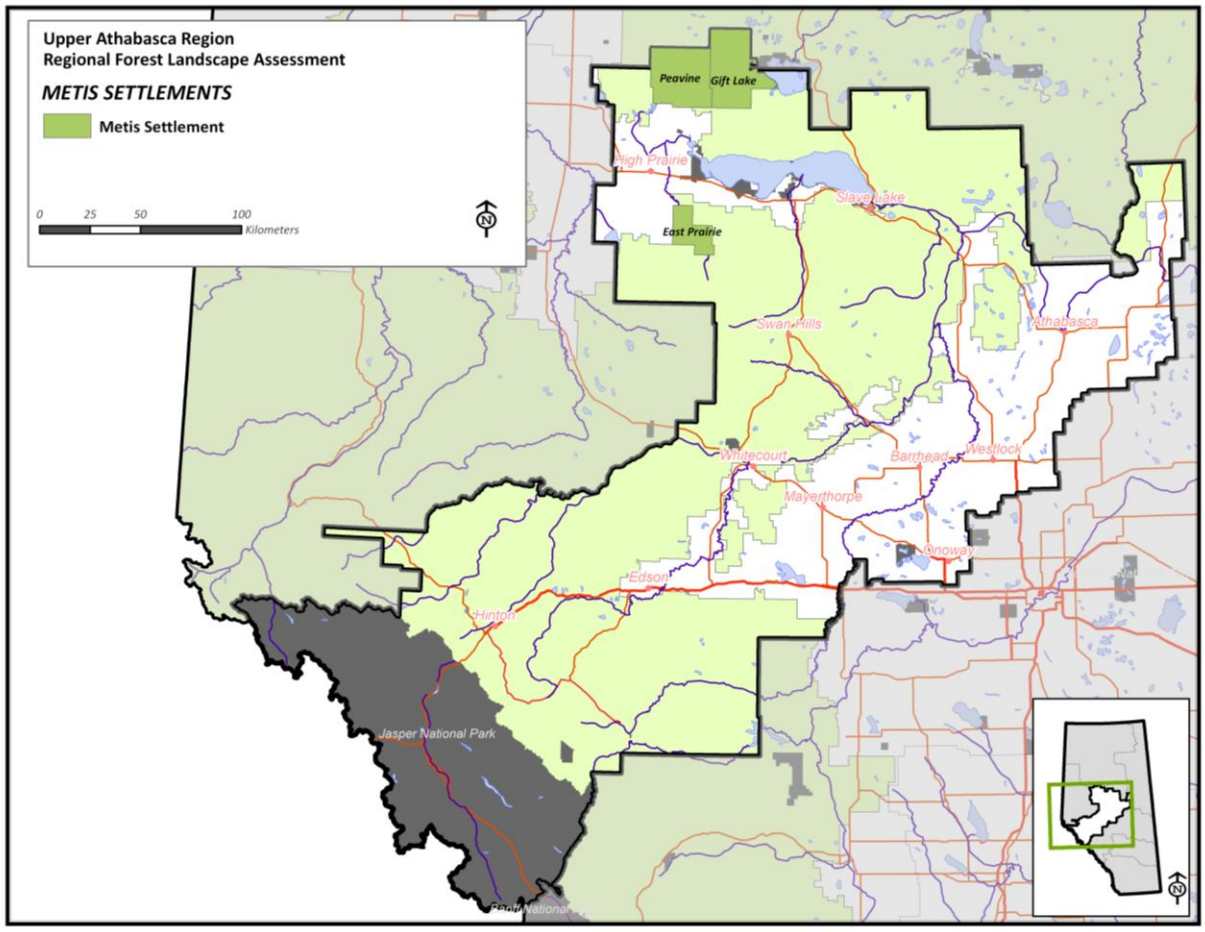


Figure 1-9 Metis Settlements

1.10 Parks and Protected Areas

There are many different designations of parks and protected areas in Alberta (13). These are defined in Table 1-8.

Table 1-8 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 Upper Athabasca Region contains several of the park and protected area designations noted above. The largest feature is Jasper National Park which occupies approximately 14% (Table 1-9) of the region. A total of 16% of the region (1,296,713 ha) is under some form of protection. In addition, another 0.25% of the region (20,413 ha) is under protective or consultative notations to allow Alberta 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 1-10).

The location of parks and protected areas in the Upper Athabasca Region is presented in Figure 1-10.

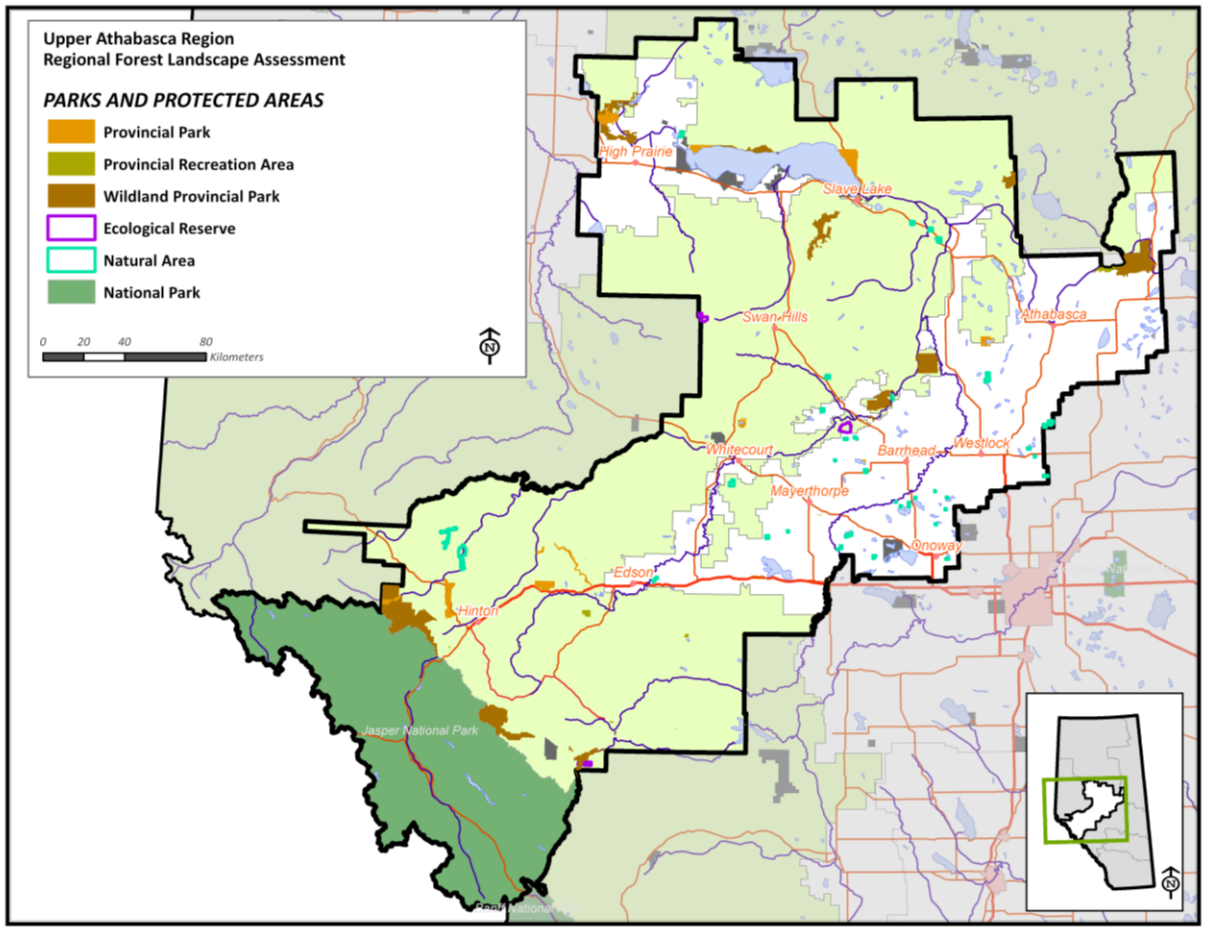


Figure 1-10 Parks and Protected Area

Table 1-9 Park and Protected Area Allocations

Classification	Type of Park/Protected Area	Number	Area in Region (ha)	Percentage of PPA (%)	Percentage of Region (%)
Parks	National Park	1	1,123,183	87	14
	Provincial Park	11	34,126	3	0
	Provincial Recreation Area	32	4,533	0	0
	Wildland Park	10	120,885	9	1
	Sub-total	54	1,282,728	99	15
Protected Areas	Natural Area	32	10,177	1	0
	Ecological Reserve	3	3,808	0	0
	Sub-total	35	13,985	1	0
Total		89	1,296,713	100	16

Table 1-10 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	1	1,449	7	0
	Provincial Recreation Area	2	4,382	21	0
	Sub-total	3	5,831	29	0
Protected Areas	Natural Area	20	10,305	50	0
	Special Management Zone Buffer	1	4,277	21	0
	Sub-total	21	14,582	71	0
Total		24	20,413	100	0

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

1.11 Wildfire Management Areas

Wildfire management areas (15) are those areas which define wildfire management responsibilities. These areas are listed in Table 1-11 (sorted by the area within the Upper Athabasca Region) and mapped in Figure 1-11.

The two predominant wildfire management areas are Lesser Slave and Foothills, together occupying about 51% of the Upper Athabasca Region. The Lac La Biche and Woodlands wildfire management areas cover a total of 32% of this region. Smaller portions of the Peace and Clearwater regions make up the balance of wildfire management areas inside the Upper Athabasca Region.

Table 1-11 Alberta Wildfire Management Areas

	Entire Region	Portion of ESRD Region located in Upper Athabasca		Proportion of Upper Athabasca occupied by ESRD Region
ESRD Region Name	Area (ha)	Area (ha)	(%)	(%)
Lesser Slave	5,614,687	2,123,444	38	26
Foothills	3,058,620	2,085,320	68	25
Woodlands	2,609,414	1,606,660	62	19
Lac La Biche	6,380,629	1,071,681	17	13
Clearwater	2,472,268	180,855	7	2
Peace	5,313,685	70,112	1	1
Sub-total	25,449,303	7,138,072		86
Federal Lands		1,159,995		14
Total		8,298,067		100

In terms of the influence of Upper Athabasca planning activities on the wildfire management areas, the majority of both Foothills and Woodlands Regions are located in the Upper Athabasca Region.

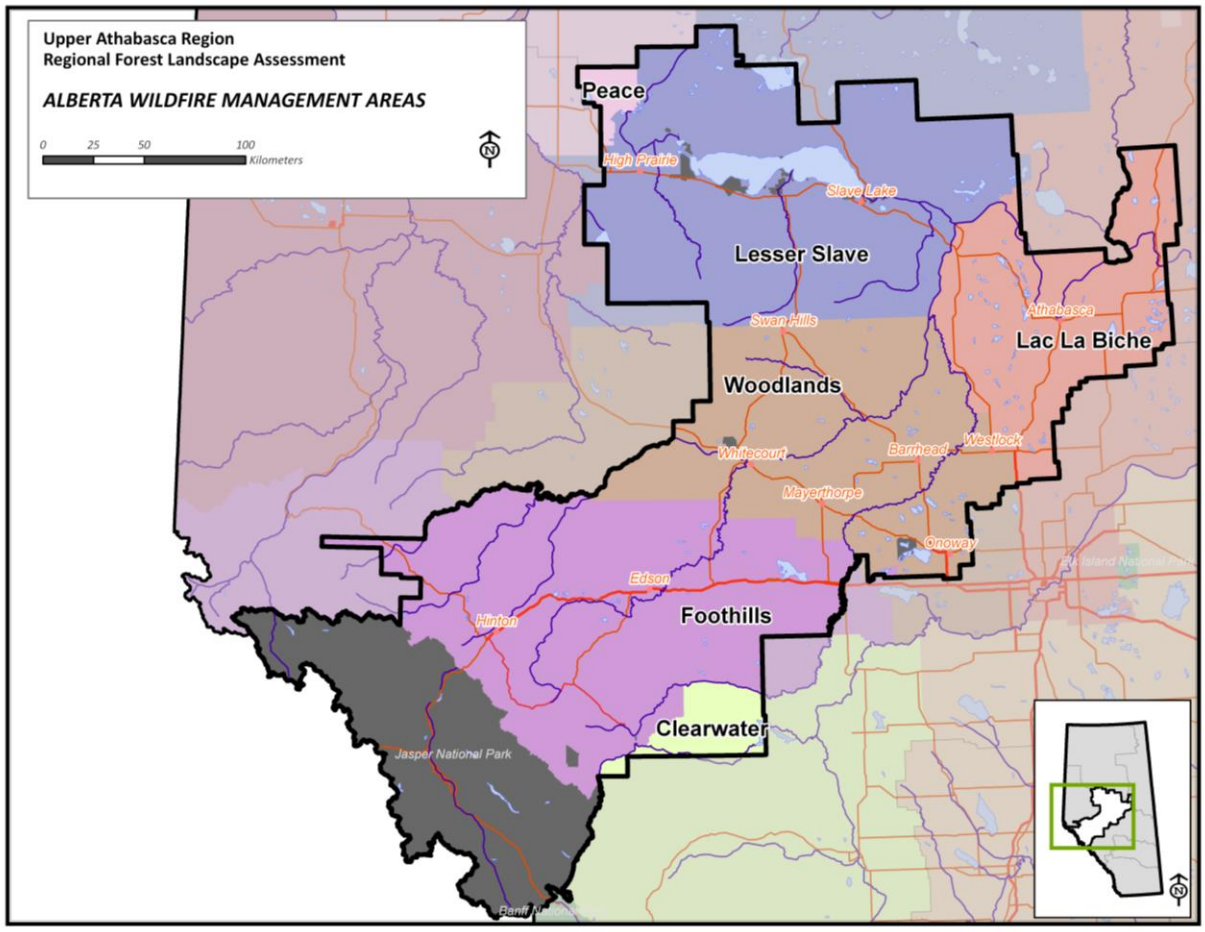


Figure 1-11 Alberta Wildfire Management Areas

2. Physical Conditions

2.1 Topography

The Upper Athabasca Region has a wide range of landscapes (16) as it extends from the Rocky Mountains easterly down to boreal plains. Several major river channels (Athabasca, Berland, McLeod and Wildhay) have created deeper valleys where they occur in the foothills, broadening out to more shallow valleys as they flow north and east.

The highest elevation in the Region is 3,782 m, which is represented by Mount Columbia, located on the continental divide at the head of the Athabasca River Valley. The lowest elevation is approximately 515m where the Athabasca River leaves the Region, northeast of the town of Athabasca. Figure 2-1 illustrates the general topography of the Region.

Important elements of topography for natural resource management are 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 machine operability 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

There is very little inoperable area within the Green Area portion of this Region (Table 2-1), meaning that there should be very few constraints to mechanical operations. As expected, the majority of steep slopes are found in Jasper National Park.

Table 2-1 Slope Class Distribution

Location	Slope Class (percentage)								Total	
	0 - 30%		31 - 45%		46 - 60%		60% +			
Code	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)
Green Area	4,727,472	98	44,685	1	18,571	0	15,042	0	4,805,770	100
White Area	2,332,237	100	64	0	1	0	-	-	2,332,302	100
Jasper National Park	552,194	48	212,840	18	159,714	14	235,247	20	1,159,995	100
Total	7,611,904	92	257,588	3	178,286	2	250,289	3	8,298,067	100

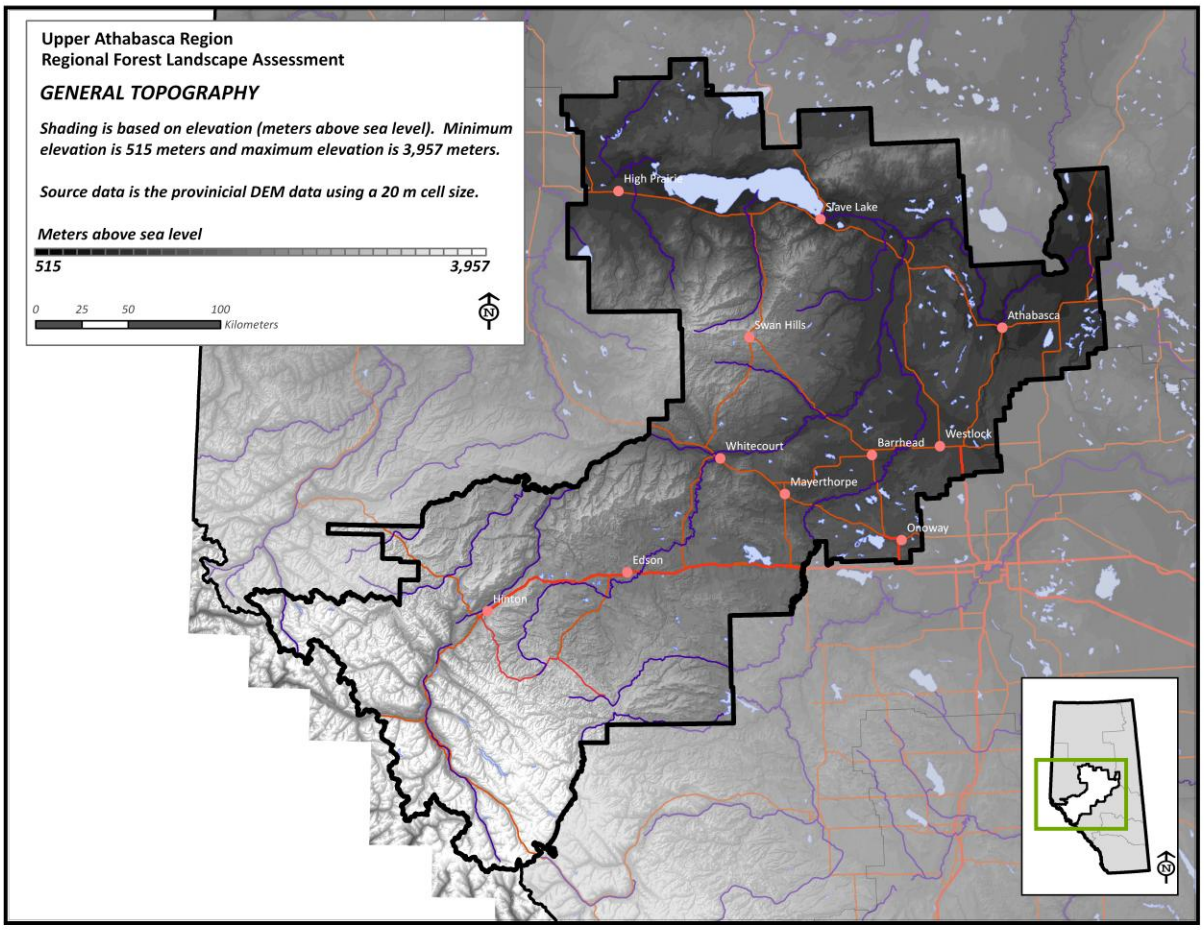


Figure 2-1 Topography

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 Luvisolic (17), which covers approximately 66% of the Region (Table 2-2). Luvisols, along with Brunisols (the second most common soil order in this Region) 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.

Table 2-2 Soil Types

Soil Type			Area (ha)	Percentage (%)
Soil Order	**Soil Group**	**Soil Subgroup**		
Brunisolic	Dystric Brunisol	Eluviated Dystric Brunisol	327,641	4
Brunisolic	Eutric Brunisol	Eluviated Eutric Brunisol	384,163	5
Brunisolic	Eutric Brunisol	Orthic Eutric Brunisol	68,702	1
Sub-total			780,506	9
Chernozemic	Black Chernozem	Eluviated Black Chernozem	19,090	0
Chernozemic	Black Chernozem	Rego Black Chernozem	6,436	0
Chernozemic	Dark Gray Chernozem	Gleyed Dark Gray Chernozem	86,128	1
Chernozemic	Dark Gray Chernozem	Orthic Dark Gray Chernozem	122,432	1
Sub-total			234,086	3
Gleysolic	Gleysol	Orthic Gleysol	32,802	0
Gleysolic	Humic Gleysol	Orthic Humic Gleysol	222,732	3
Gleysolic	Luvic Gleysol	Orthic Luvic Gleysol	9,253	0
Sub-total			264,787	3
Luvisolic	Gray Luvisol	Brunisolic Gray Luvisol	510,730	6
Luvisolic	Gray Luvisol	Dark Gray Luvisol	263,937	3
Luvisolic	Gray Luvisol	Gleyed Dark Gray Luvisol	24,973	0
Luvisolic	Gray Luvisol	Gleyed Gray Luvisol	343,824	4
Luvisolic	Gray Luvisol	Gleyed Solonetzic Gray Luvisol	14,276	0
Luvisolic	Gray Luvisol	Orthic Gray Luvisol	3,893,711	47
Luvisolic	Gray Luvisol	Podzolic Gray Luvisol	444,400	5
Sub-total			5,495,851	66
Organic	Mesisol	Terric Humic Mesisol	137,651	2
Organic	Mesisol	Terric Mesisol	200,152	2
Organic	Mesisol	Typic Mesisol	238,439	3
Sub-total			576,242	7
Regosolic	Humic Regosol	Orthic Humic Regosol	12,685	0
Regosolic	Regosol	Orthic Regosol	42,160	1
Sub-total			54,845	1
Solonetzic	Solodized Solonetz	Black Solodized Solonetz	12,620	0
No Significant Soil Development			879,131	11
Total			8,298,067	100

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. The presence of many gleyed subgroups indicates that much of the Region is exposed to prolonged or frequent water saturation of the soil profile.

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

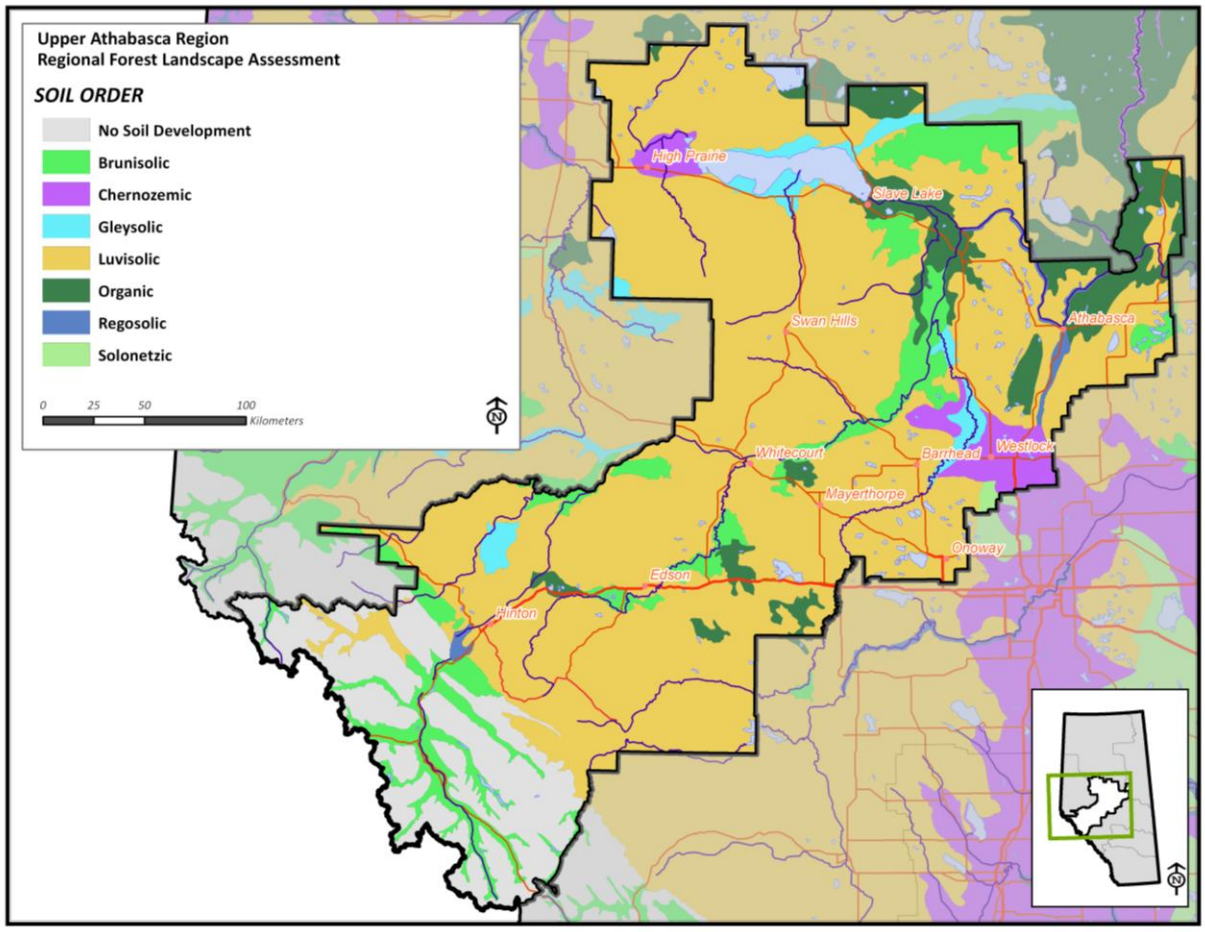
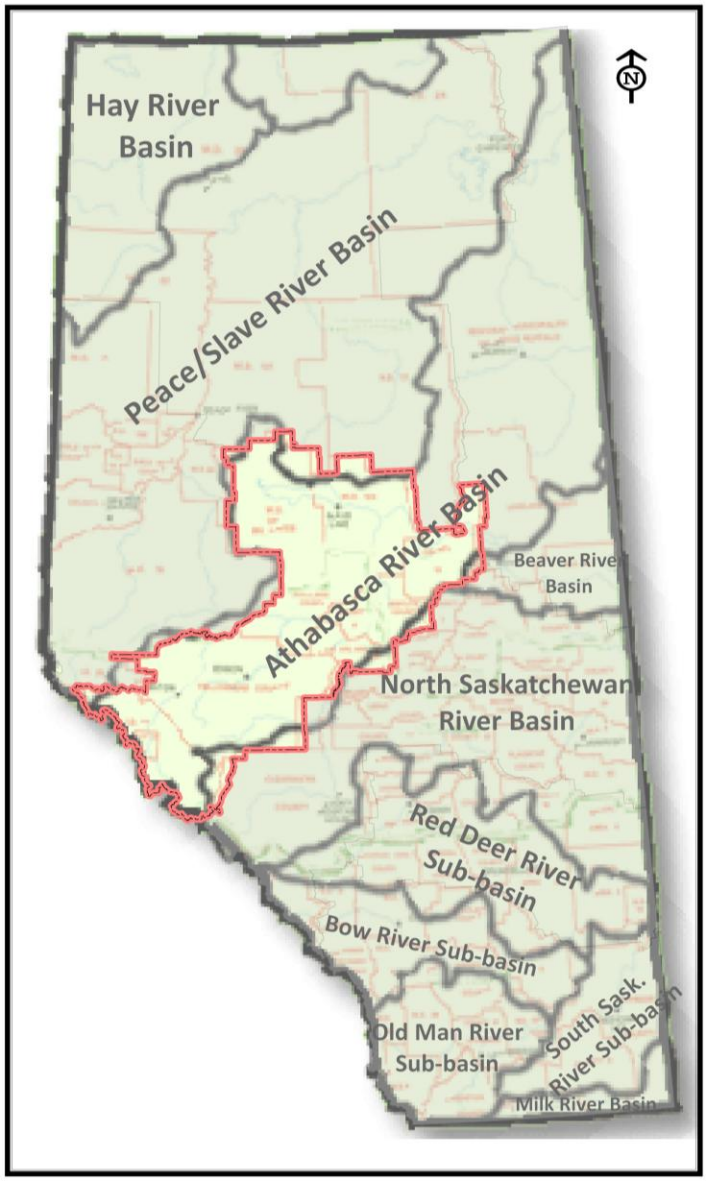


Figure 2-2 Soil Order

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 Upper Athabasca Region (shown in ***red*** on Figure 2-3) represents the upper reaches of the Athabasca River basin, which stretches 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 Alberta and are classified according to their water status (e.g.: permanent, recurring). Many man-made features are identified by type (e.g.: canal, reservoir, quarry), 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 Upper Athabasca Region within each of the Green and White Areas as well as within 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 specifically excludes wetlands as these are described separately in subsequent sections.

Table 2-3 Waterbody Classification

	Area of Waterbody Features (ha)			
Waterbody Class	**Green Area**	**White Area**	**Federal Lands**	**Total**
Major River	20,574	11,974	3,680	36,228
Lake (Permanent)	187,790	67,919	10,533	266,241
Lake (Recurring)	10,039	13,889	1,130	25,059
Oxbow (Permanent)	572	1,122	89	1,783
Oxbow (Recurring)	455	484	82	1,021
Man-made Features	6,161	2,060	7	8,228
Icefield			55,489	55,489
Total	225,591	97,448	71,010	394,049

Table 2-4 River/Stream Network Classification

	Length of River/Streams (km)			
River/Stream Class	**Green Area**	**White Area**	**Federal Lands**	**Total**
Stream (Permanent)	8,075	3,268	6,745	18,087
Stream (Recurring)	15,988	6,447	1,872	24,307
Stream (Indefinite)	21,886	5,720	360	27,967
Oxbow (Permanent)	54	65	2	121
Oxbow (Recurring)	100	112	4	215
Man-made Features	49	1,267	5	1,321
Total	46,152	16,879	8,988	72,018

Figure 2-4 shows the distribution of *permanent* water features in the Upper Athabasca Region. In addition, the significant rivers draining the Region are labeled. In total, there are 380 named lakes in the Region, of which the largest is Lesser Slave Lake (119,826 ha). The 10 most significant river 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)**
Lesser Slave Lake	119,826	Pembina River	739
Utikuma Lake	20,719	Athabasca River	727
Chip Lake	7,429	McLeod River	372
Lac St Anne	5,659	South Heart River	227
Snipe Lake	3,823	Saulteaux River	215
Winagami Lake	3,613	West Prairie River	194
Fawcett Lake	3,445	Brazeau River	193
Flat Lake	3,402	Paddle River	190
North Buck Lake	2,068	Pine Creek	188
Maligne Lake	2,058	East Prairie River	187

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

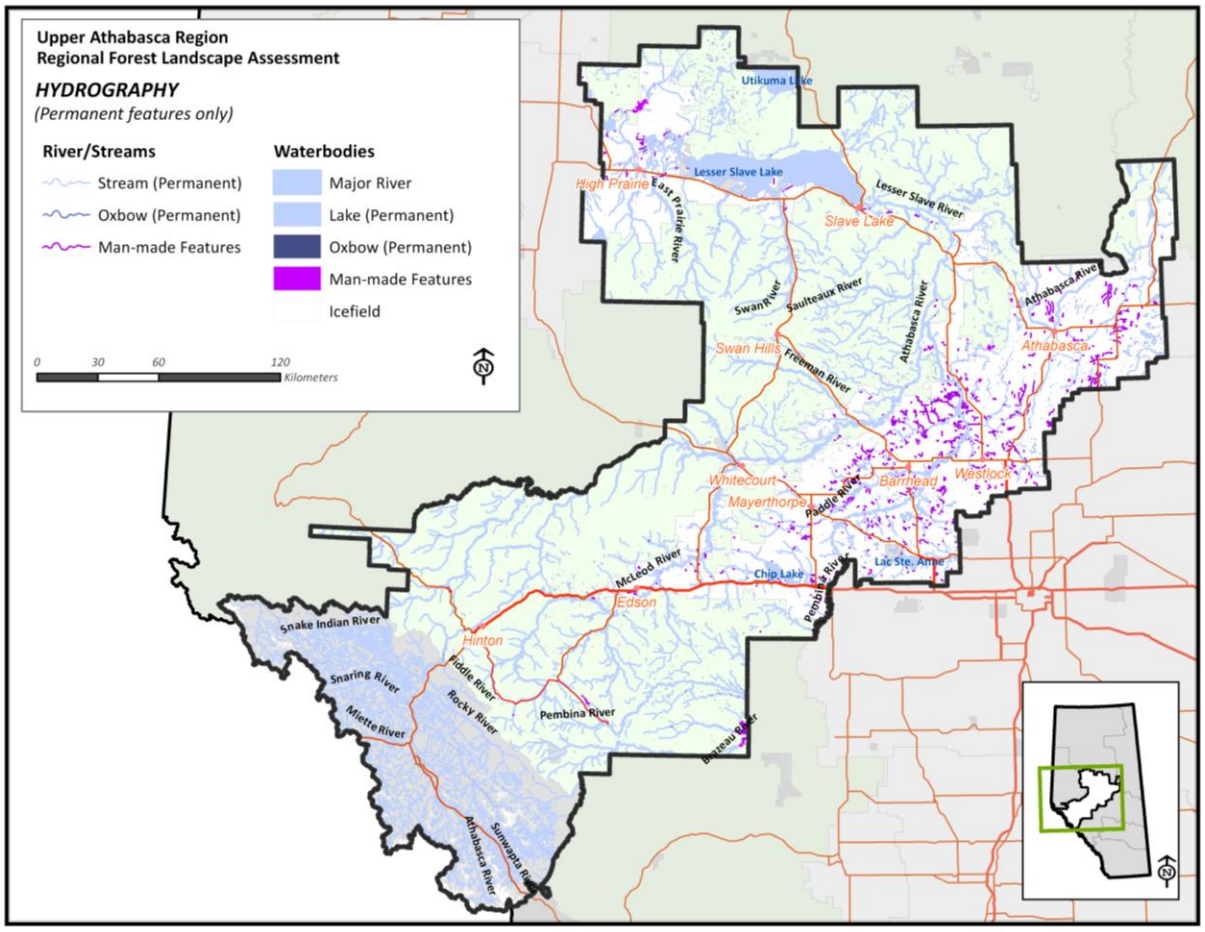


Figure 2-4 Permanent Waterbodies and Rivers

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 (23) 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 vegetative cover (Alberta 2006b)

The Upper Athabasca region contains approximately 18,136 hectares of wetland (Table 2-6). The majority of identified wetland is located in the White Area. The largest wetland of interest is located on the western end of Lesser Slave Lake (Figure 2-5). This 7,717 hectare complex covers the lowland area around the South Heart River and East Prairie River. A considerable distribution of wetlands also occurs in Jasper National Park.

Table 2-6 Wetland Summary

Wetland Classification	Area of Defined Wetland (ha)			
	Green Area	White Area	National Parks	Total
AVI				
Herbaceous Forbs/Grasses	3,435	4,329		7,763
Shrubs	69	14		83
Scattered Larch	0	69		69
Hydrography				
Wetlands	5	7,742	2,475	10,221
Total	3,509	12,153	2,475	18,136

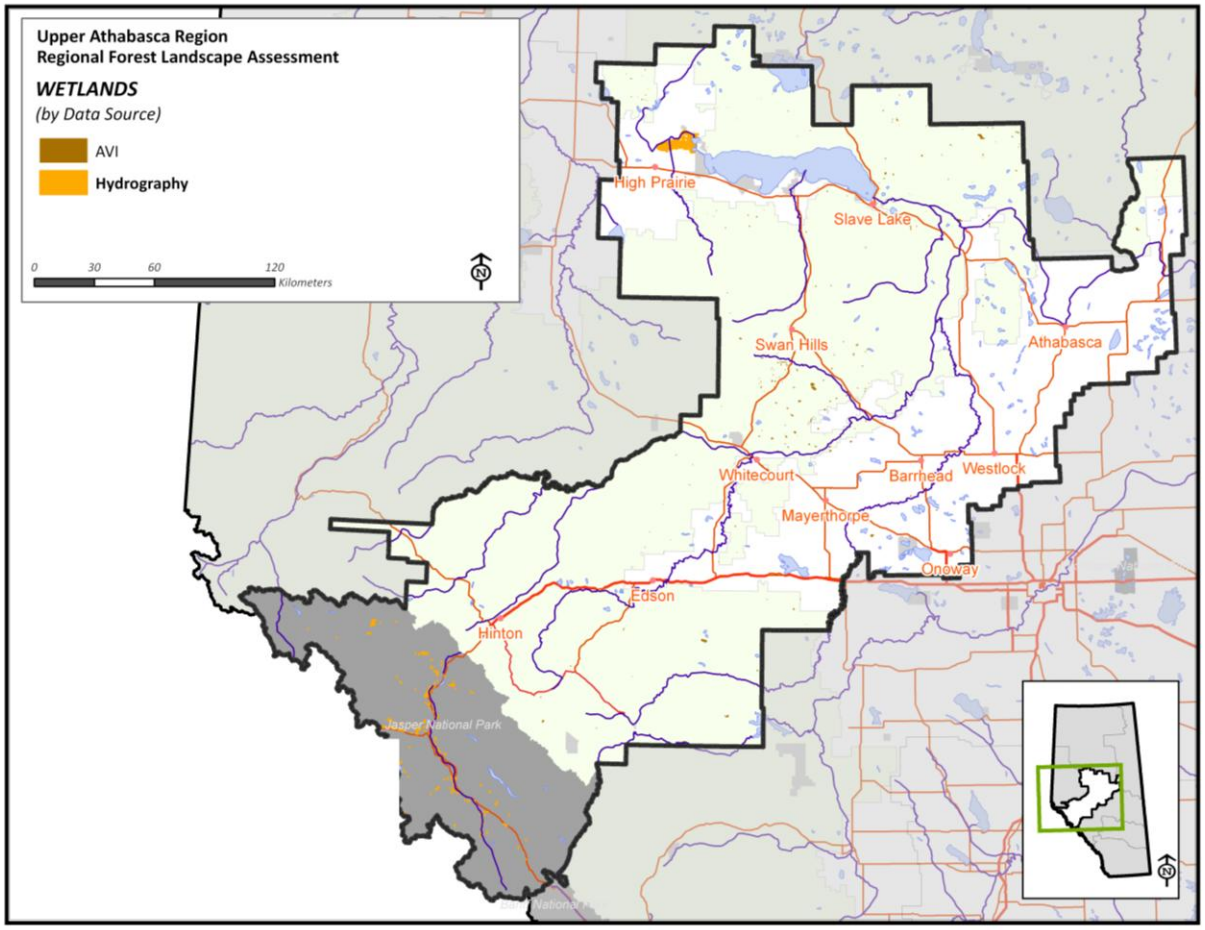


Figure 2-5 Wetlands

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 Upper Athabasca due to the variety of topography from the Rocky Mountains in the west, to the boreal plains in the north 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 2-6, Figure 2-7, Figure 2-8 and Figure 2-9 (respectively).

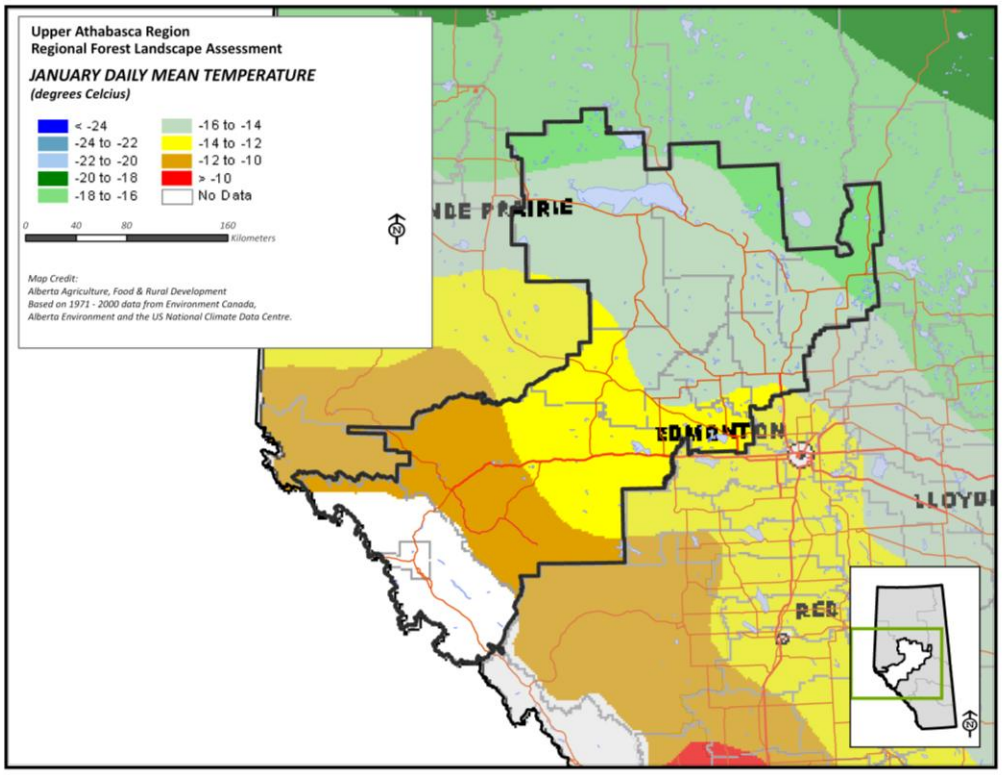


Figure 2-6 Daily Mean January Temperature

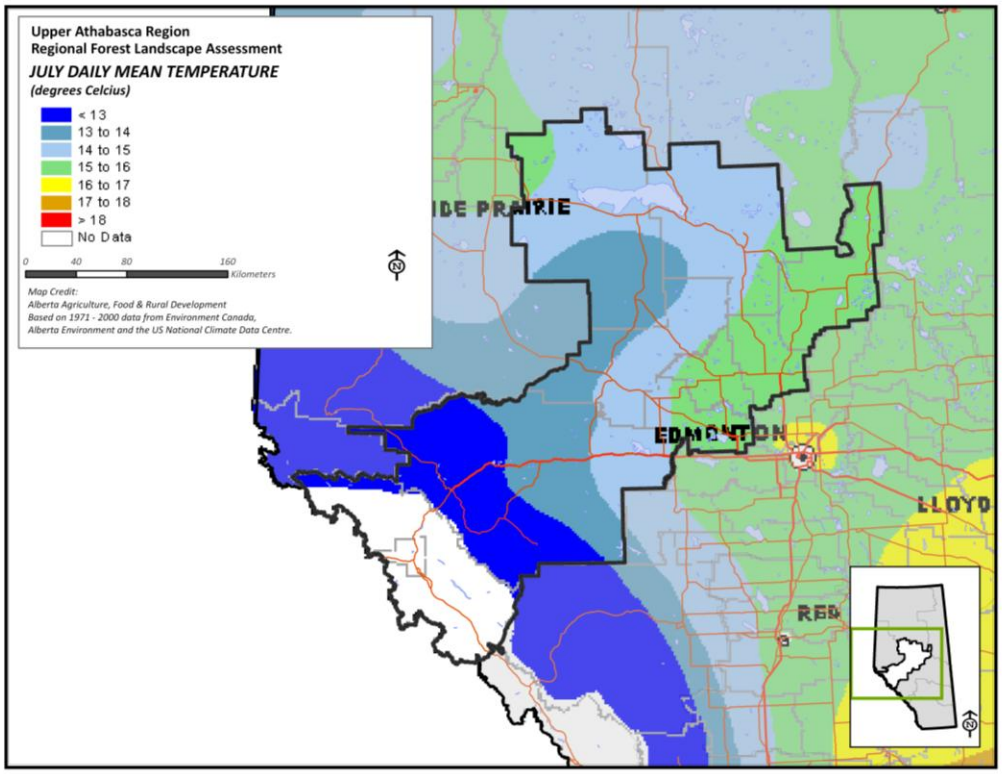


Figure 2-7 Daily Mean July Temperature

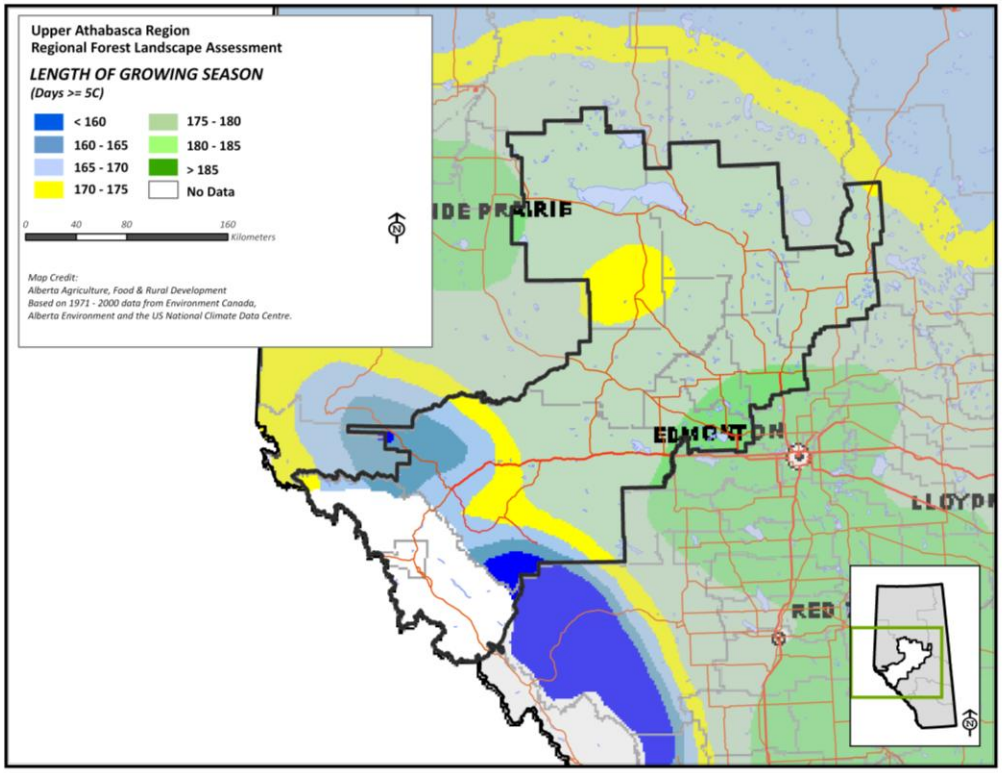


Figure 2-8 Length of Growing Season

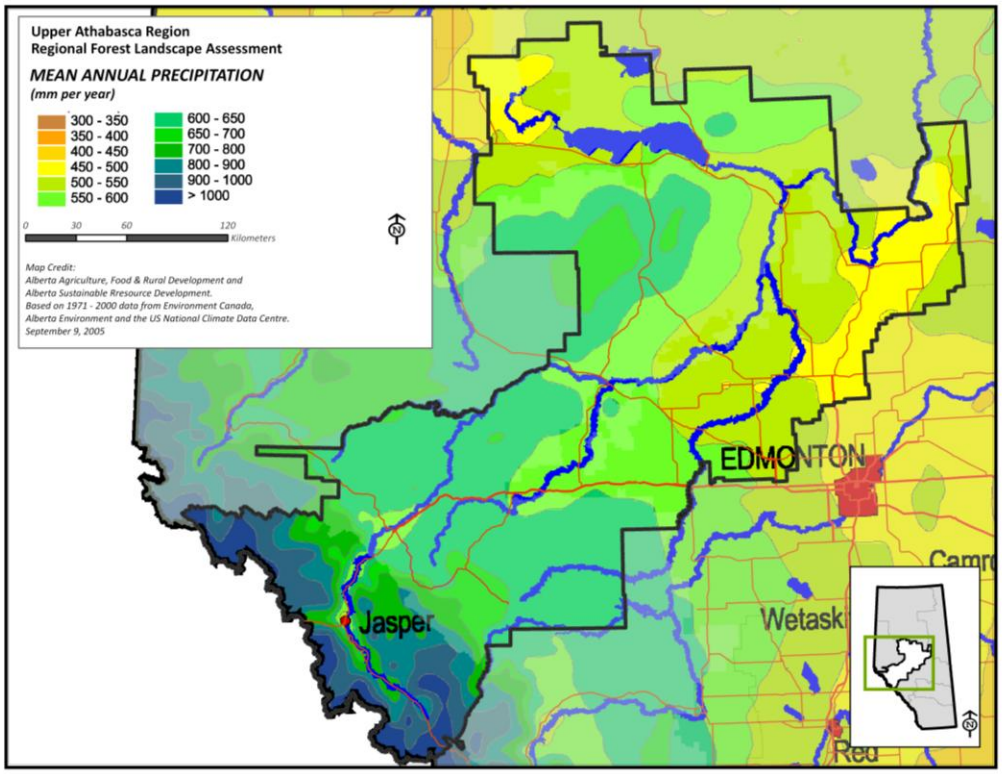


Figure 2-9 Mean Annual Precipitation

The provincial ecological classification identifies two ecoclimatic provinces present within the Upper Athabasca Region: Boreal and Cordilleran. The Cordilleran regime is typical in the Alpine, Subalpine and Montane Natural Subregions. The Boreal regime is largely in the north part of the Upper Athabasca Region which is occupied by the Central Mixedwood and Dry Mixedwood Natural Subregions. The Lower Foothills Subregion, which occupies 27% of the Upper Athabasca Region (Table 1-4) is considered a transitional zone between Boreal and Cordilleran ecoclimates.

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 2-10.

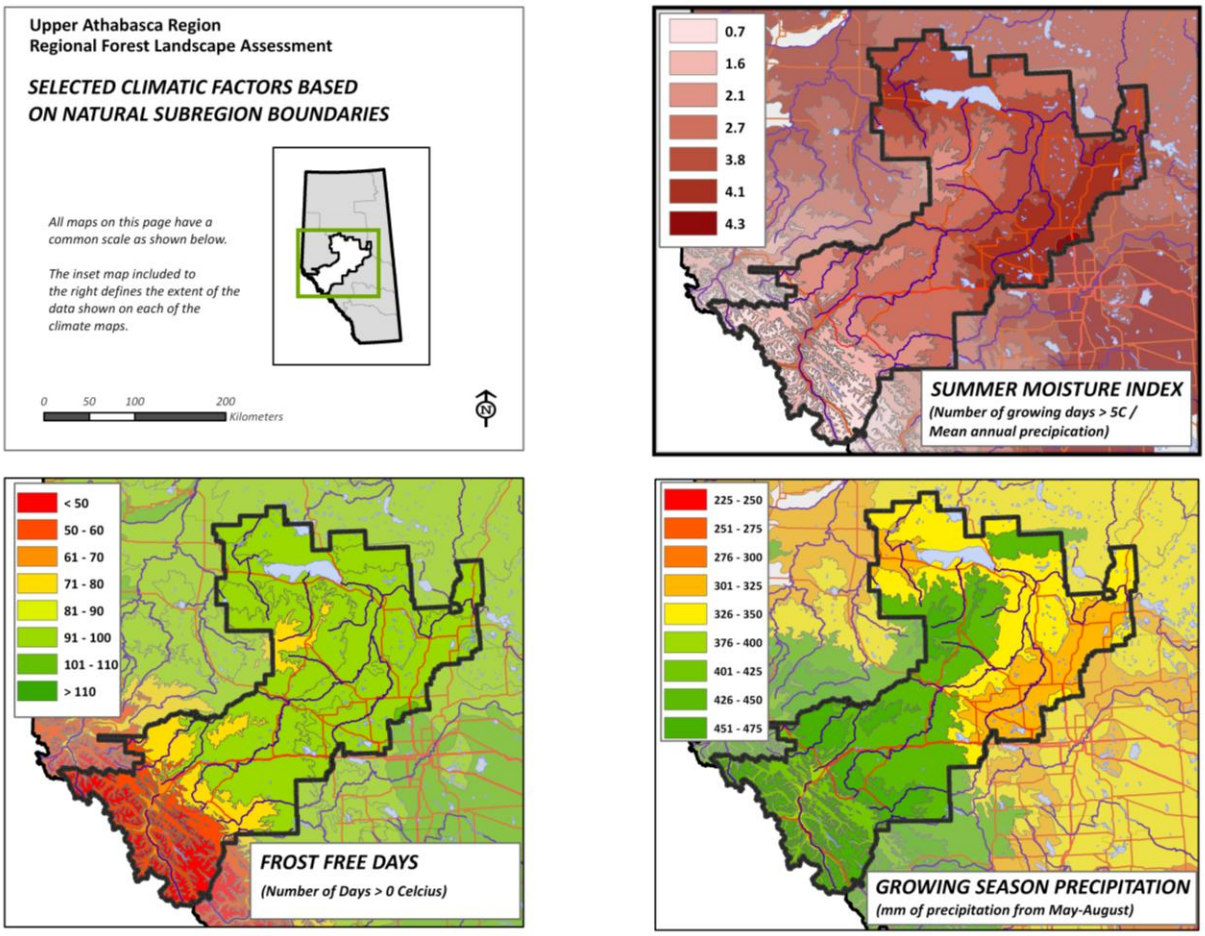


Figure 2-10 Climatic Factors Associated with Natural Subregions

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 70% of the Upper Athabasca Region has detailed AVI data available. Figure 3-1 indicates the relative coverage of AVI detail across the Upper Athabasca Region and the source of that information. All AVI specifications data meet the minimum standard for vegetation classification as described in Alberta (2005).

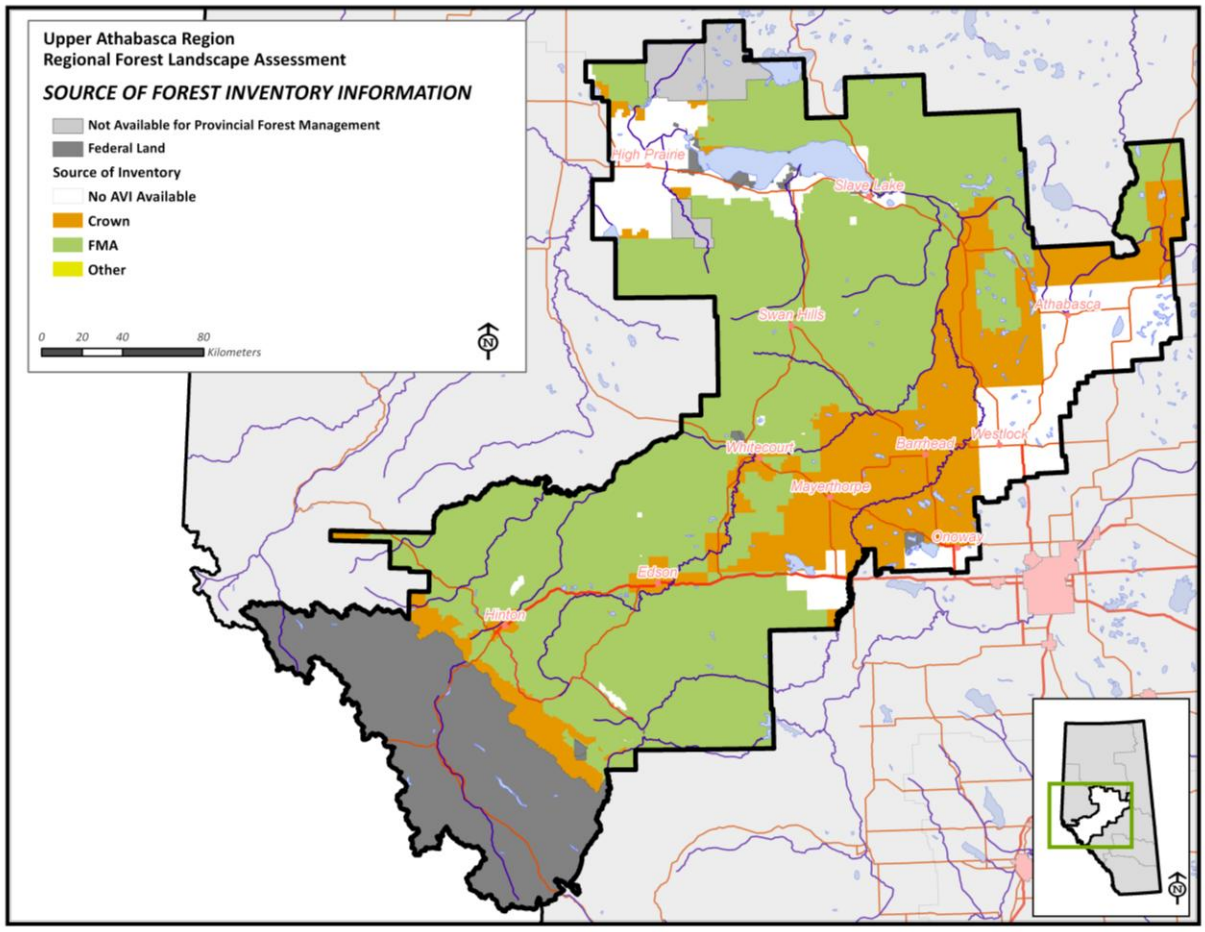


Figure 3-1 Source of AVI Information

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, there is no prevalent age of the AVI

in this Region; the age is proportionally allocated over the 4 five-year classes. Approximately 77% of the inventory is greater than 10 years old, indicating that it is approaching the need for an 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 largely comprised of Jasper National Park (1,123,096 ha). 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.: Metis communities , First Nations).

Table 3-1 Age of AVI Information

Age of AVI (years)	Area (ha)	Percentage (%)
5 to 10 years	1,314,467	23
11 - 15 years	1,472,775	25
16 - 20 years	1,812,691	31
Greater than 20 years	1,230,838	21
Total	5,830,771	100
No AVI Available	2,467,297	
Total	8,298,067	

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 overstory 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 simply the inability to differentiate tree form on the imagery used for interpretation.

While coniferous species as a group are more prevalent, aspen-leading stand types are the most common over the area of inventoried lands. Aspen occurs in mixedwood stands in the west and central areas of the Region, but will form pure stands in the eastern and southern parts of the Region. Pine is the most prevalent leading coniferous species, forming both pure stands as well as occurring in mixed coniferous stands in the western areas. Pine – aspen mixes are more common in the northern and eastern areas.

White and black spruces occur commonly throughout the Region. White spruce occurs in mixed coniferous, mixedwoods and in pure stands. Black spruce occurs primarily on lowland areas. Note that

there may be large areas of sparse black spruce and larch occurring in wetlands. These areas would typically be classified as "Not Forested" due to the wetland being the dominant feature.

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*	475,779
Engelmann spruce	*Picea engelmannii*	57,241
Black spruce	*Picea mariana*	796,807
Pine - undiff	*Pinus sp.*	87,432
Lodgepole pine	*Pinus contorta*	992,040
Jack pine	*Pinus banksiana*	26,431
Balsam fir	*Abies balsamea*	11,127
Alpine fir	*Abies lasiocarpa*	2,812
Tamarack	*Larix laricina*	257,585
Sub-total: Coniferous		2,707,254
Deciduous		
Hardwood - undiff	*Populus sp.*	1,445
Trembling aspen	*Populus tremuloides*	1,392,028
Balsam poplar	*Populus balsamifera*	137,703
Paper birch	*Betula papyrifera*	35,753
Sub-total: Deciduous		1,566,929
Regeneration		
Undeclared species		384,704
Sub-total: Regeneration		384,704
Sub-Total Forested Land		4,658,887
Not Forested		1,334,296
No Inventory Data		2,304,885
Total		8,298,067

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 Forested" in the south central part of the Region is primarily agricultural land.

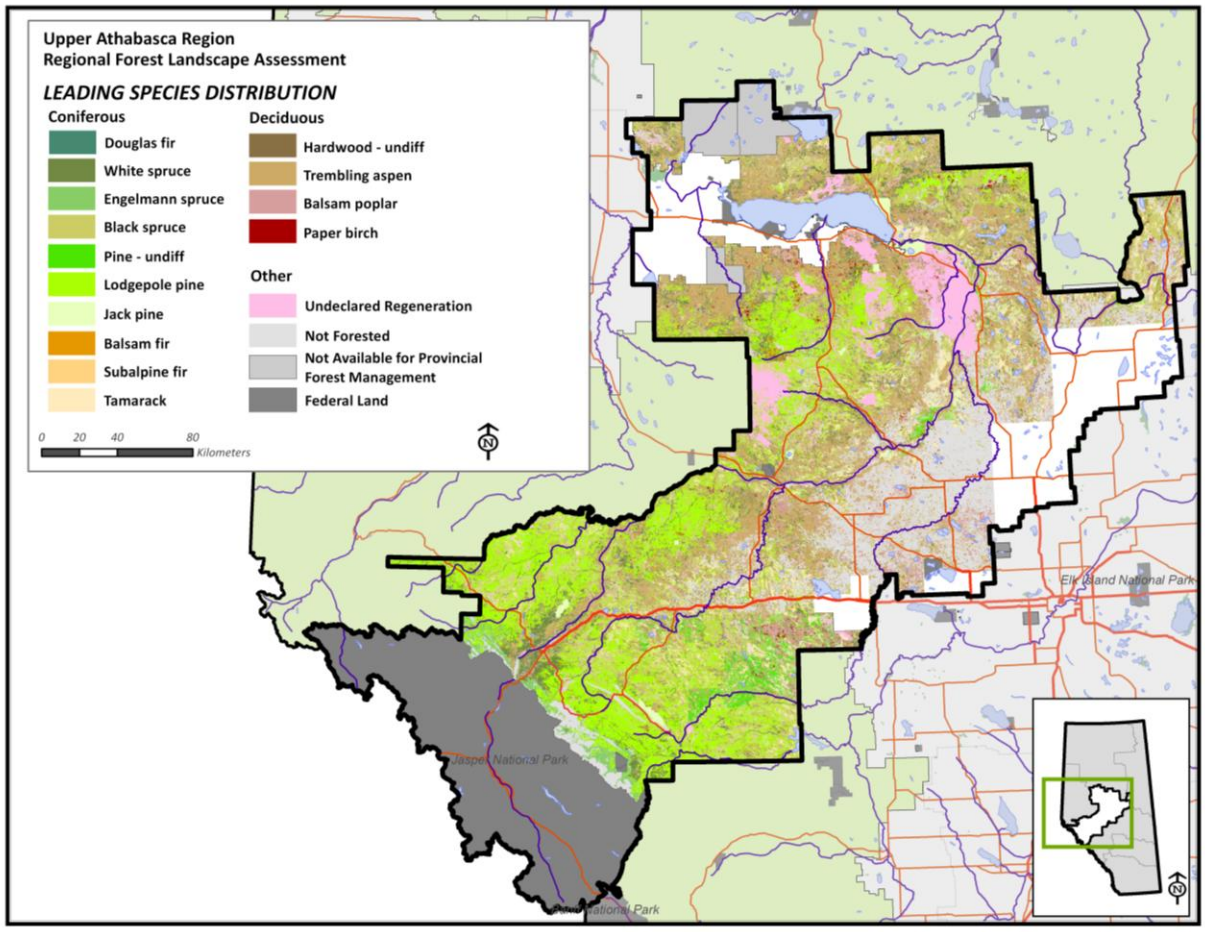


Figure 3-2 Leading Tree Species

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 only cover type not represented in the inventoried area of the Upper Athabasca Region is the Douglas fir leading, coniferous stand type.

The Region is dominated by primarily coniferous stand types (Table 3-3), with 53% of the inventoried area covered by spruce and pine 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 (28%) and are generally found in the central and north part of the region. The "Regeneration" category includes 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 Upper Athabasca Region.

Table 3-3 Forest Cover Type Summary

Description	Code	Area (ha)
Forested Land		
Pine pure or leading	C-P	1,006,949
Black spruce pure or leading	C-Sb	1,042,542
White spruce pure or leading	C-Sw	403,011
Pine/Hardwood	CD-P	101,914
Black spruce/Hardwood	CD-Sb	12,951
White spruce/Hardwood	CD-Sw	144,383
Hardwood/Pine	DC-P	79,870
Hardwood/Spruce	DC-S	184,924
Deciduous	D	1,297,639
Regeneration (undeclared strata)		384,704
Sub-total		4,658,887
Not Forested		1,334,296
No Inventory Data		2,304,885
Total		8,298,067

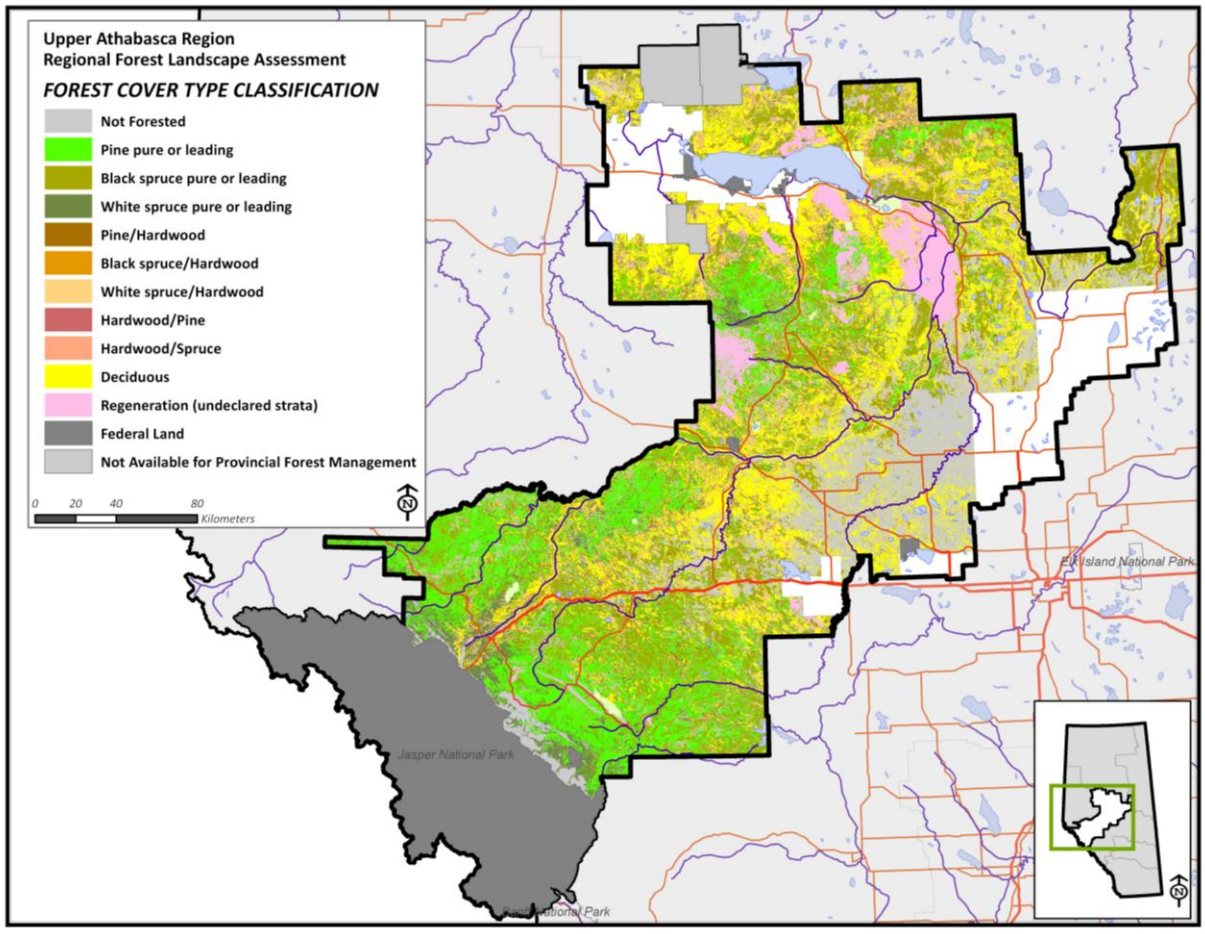


Figure 3-3 Forest Cover Type Distribution

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 24% representing the greater than 100 year age class. The second largest grouping of ages is the amalgamation of the 70-79 and 80-89 classes, which represent 12% of the total landbase for which detailed information is available. The prevalence of these two age classes is consistent with the wildfire history in the region, with several large fires having occurred in the 1940's (see section 4.5).

An overview map of the distribution of age classes appears as Figure 3-5 and a graphical representation appears as Figure 3-4.

Table 3-4 Age Class Distribution

Age Class (years)	Area (ha)
Forested Land	
0 - 9	189,214
10 - 19	432,891
20 - 29	110,698
30 - 39	109,982
40 - 49	205,727
50 - 59	167,799
60 - 69	218,415
70 - 79	466,689
80 - 89	458,710
90 - 99	318,032
100 - 109	265,438
110 - 119	372,372
120 - 129	565,360
130 - 139	250,947
140 - 149	154,549
150 - 159	148,810
160 - 169	93,245
170 - 179	58,164
180 - 189	16,344
190 - 199	13,244
200 +	42,256
Sub-total	4,658,887
Not Forested	1,334,296
No Inventory Data	2,304,885
Total	8,298,067

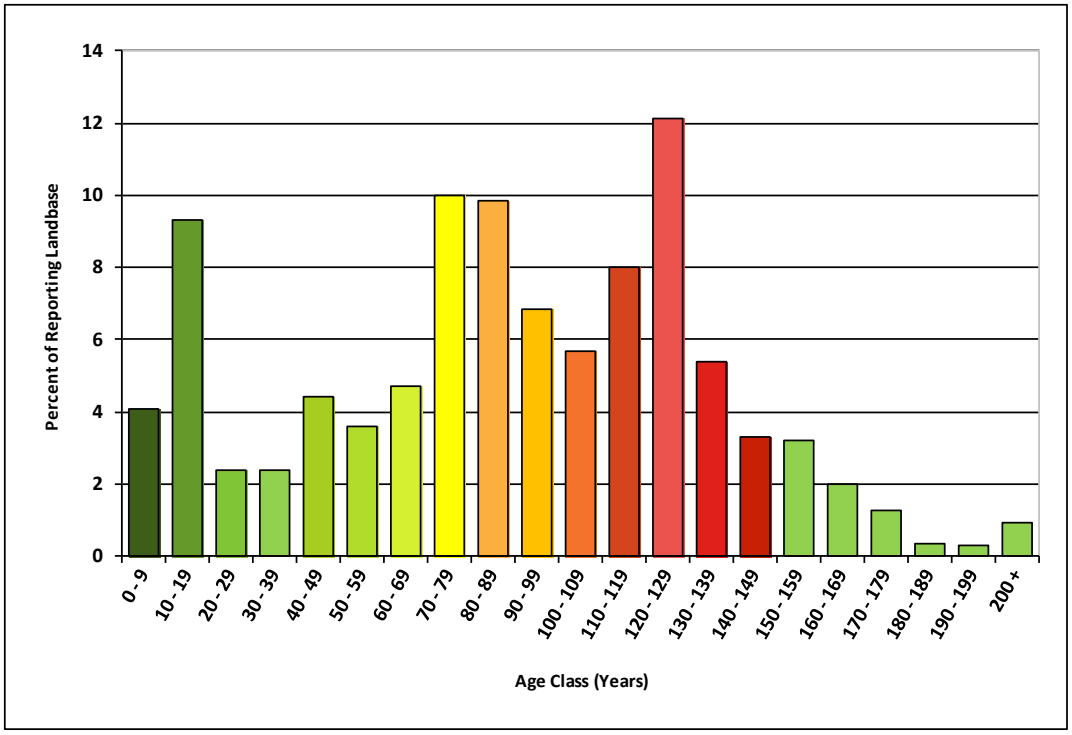


Figure 3-4 Distribution of Age Classes in Reporting Area

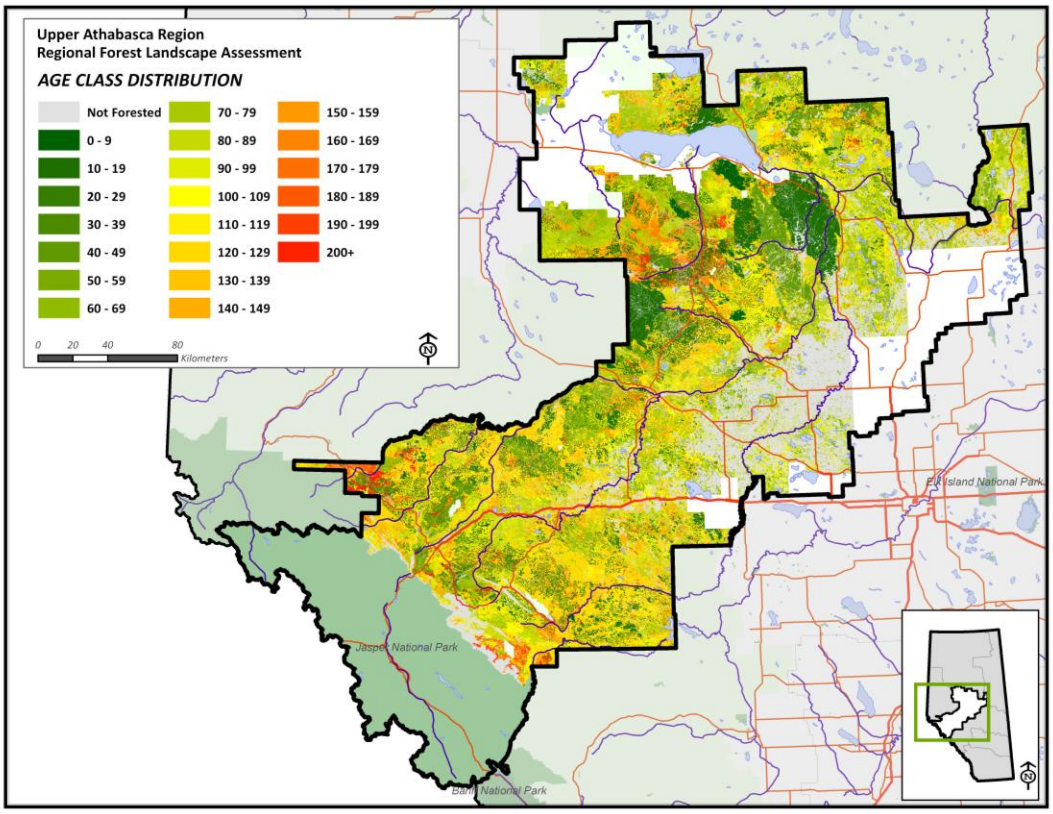


Figure 3-5 Age Class Distribution

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 Upper Athabasca Region are represented proportionately by Immature, Mature and Old forest (Table 3-5). The Young class is made up primarily of regenerating harvest areas and wildfires, and occupies approximately 13% of the forest land base. Very Old growth forest makes up approximately 2% of the Region.

Table 3-5 Distribution of Seral Stage

Seral Stage	Definition	Area (ha)
Forested Land		
Young	Stand age < 20 years	622,105
Immature	Stand age 20 to 79 years	1,279,309
Mature	Stand age 80 to 119 years	1,414,552
Old	Stand age 120 to 179 years	1,271,075
Very Old	Stand age >= 180 years	71,845
Sub-total		4,658,887
Not Forested		1,334,296
No Inventory Data		2,304,885
Total		8,298,067

The spatial distribution of seral stage is shown in Figure 3-6.

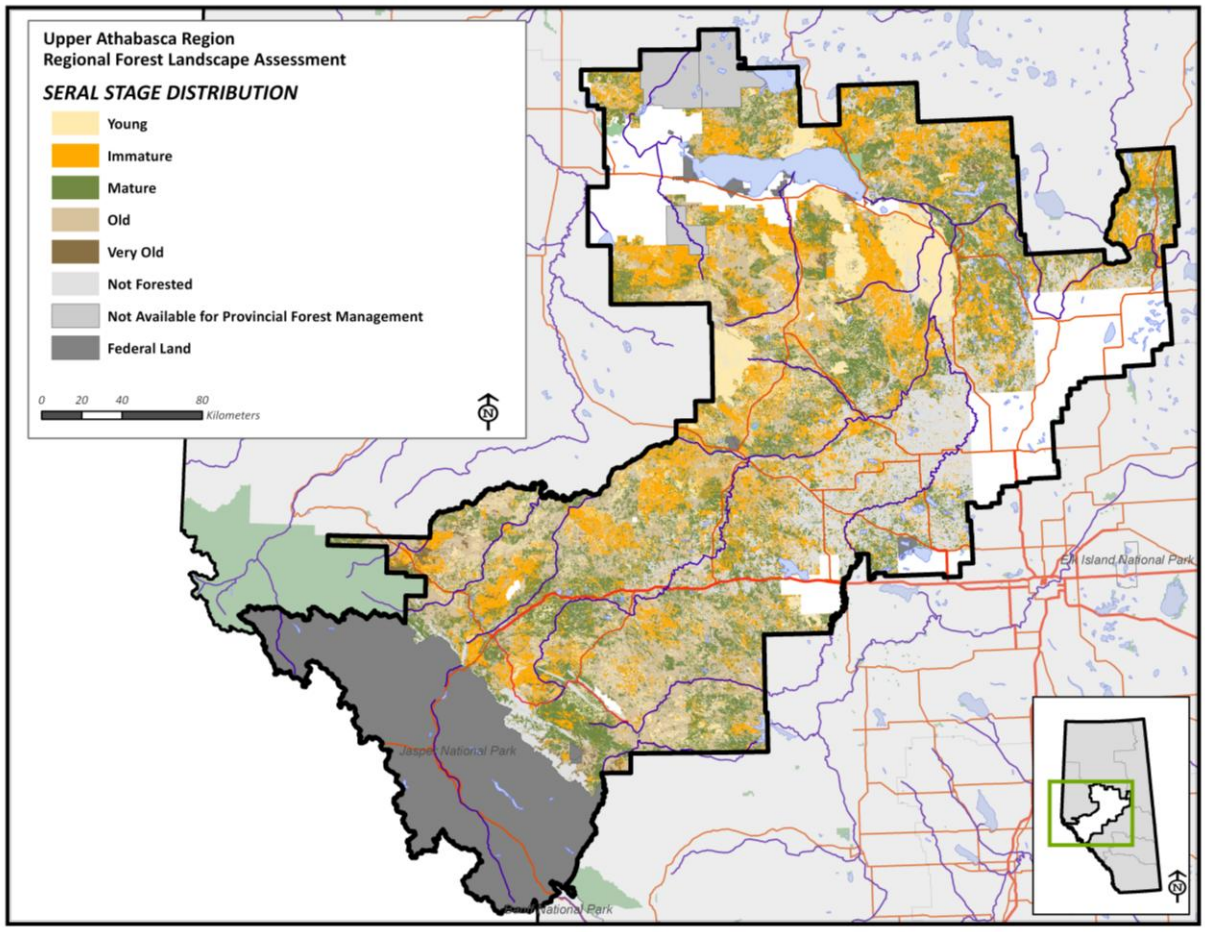


Figure 3-6 Seral Stage

3.6 Forest Patches

3.6.1 Patch Distribution of Young Stands

Patches are forest stands of the same seral stage (23) and 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 - 19	201,707	120,855
20 - 99	5,071	200,490
100 - 249	510	76,307
250 +	310	367,923

The large area represented by the patch size class of greater than 250 hectares, is primarily due to large fires in the Upper Athabasca Region which occurred within the last 20 years (see Figure 4-8).

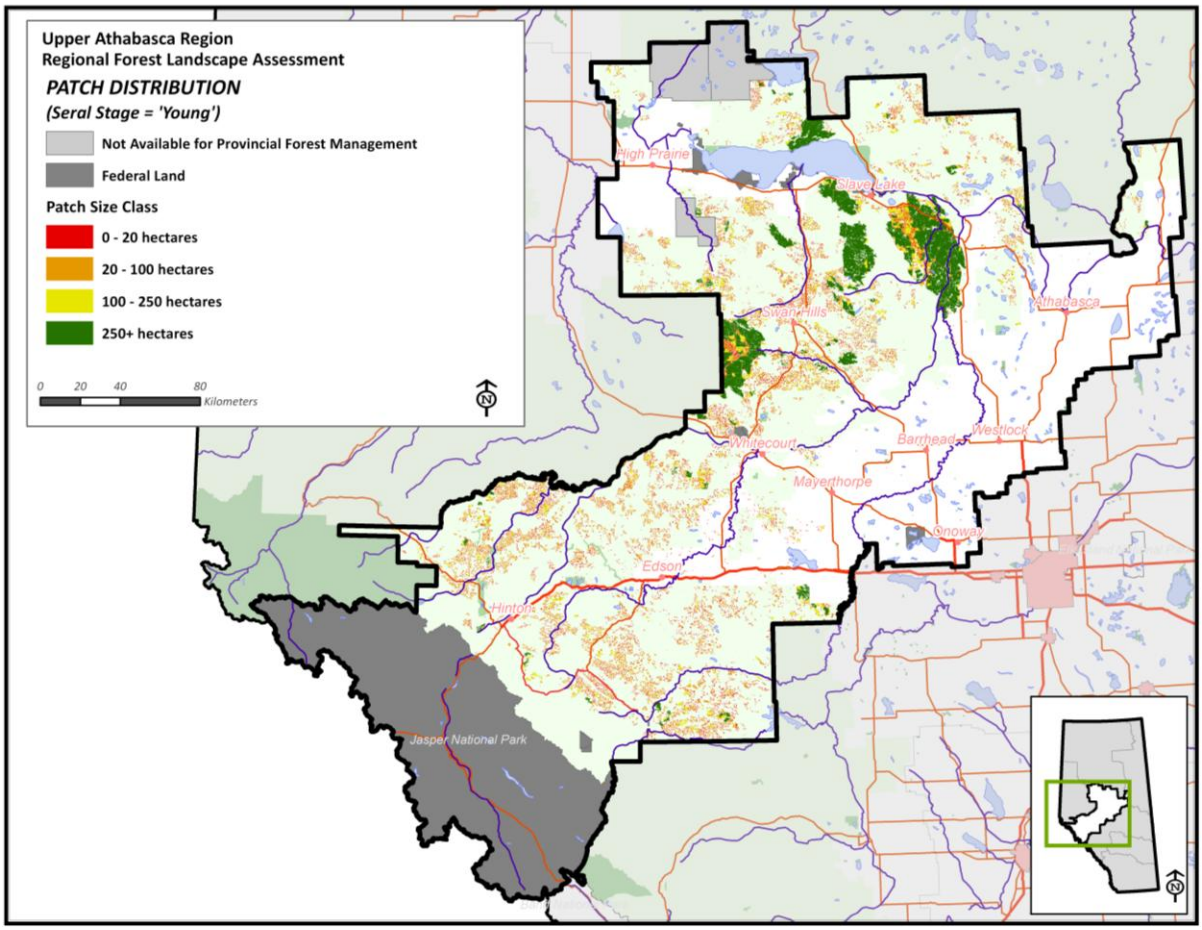


Figure 3-7 Patch Distribution of Young Stands

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 mature, old or very old forest. Using these rules, the resulting interior forest was determined for the Upper Athabasca Region. The area summary is displayed in Table 3-7, and a map of the calculated interior forest 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	14	2,495
Mature	1,577	496,450
Old	1,353	445,820
Very Old	68	20,862

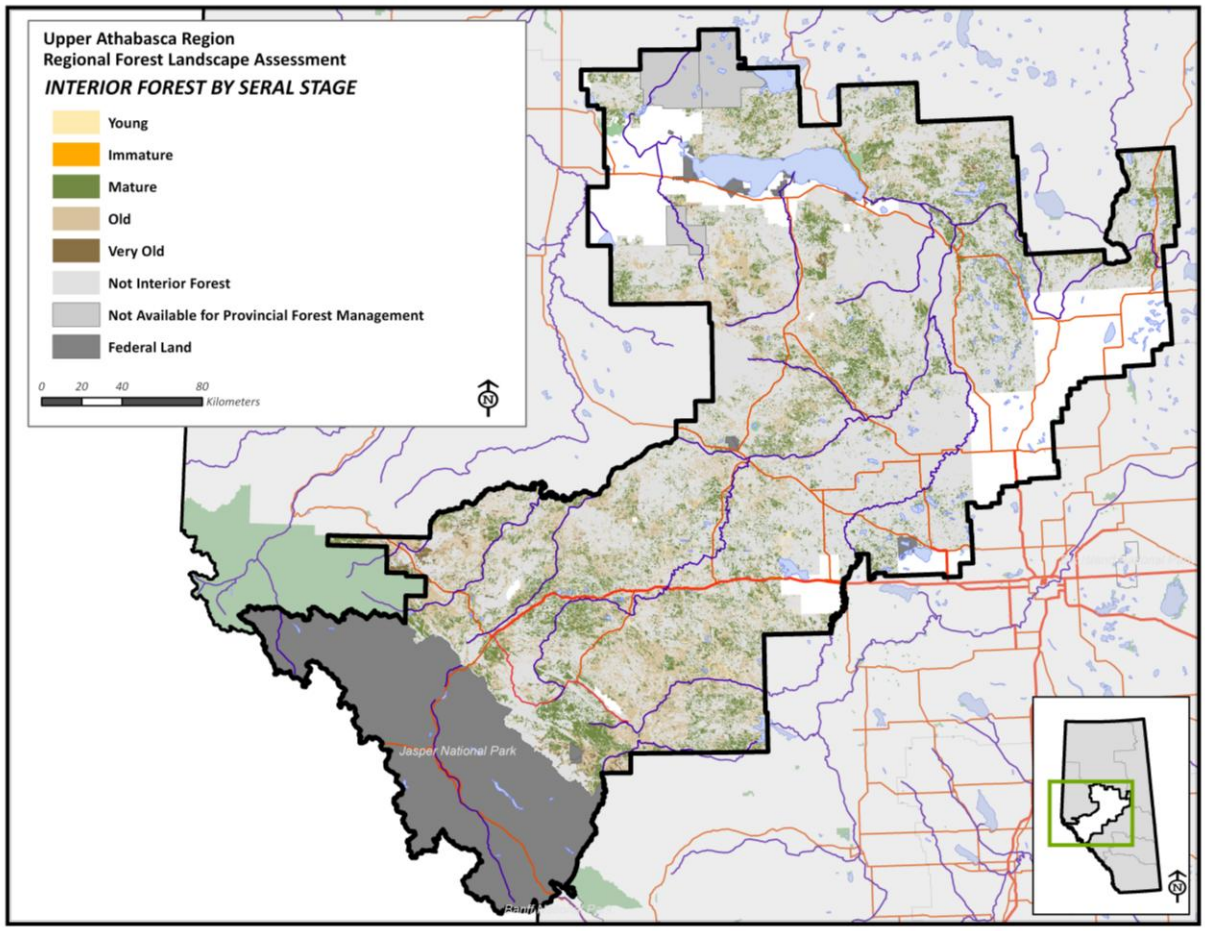


Figure 3-8 Interior Forest by Seral Stage

4. Landscape Disturbance and Succession

4.1 Inherent Disturbance Regime

The natural disturbance regime in the Upper Athabasca 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:

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

4.2.1 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 are the preferred host, but as populations increase, smaller-sized 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 attacking beetles.

Figure 4-1 shows the historical spread of mountain pine beetle into the Upper Athabasca Region since annual surveys were undertaken in 2006 (24). The Upper Athabasca Region forests were seriously impacted by in-flight of beetles from British Columbia the in the summer 2009. However, the area shows significant 2011 over-winter mortality and lower risk of beetle spread along the eastern front of the infestation.

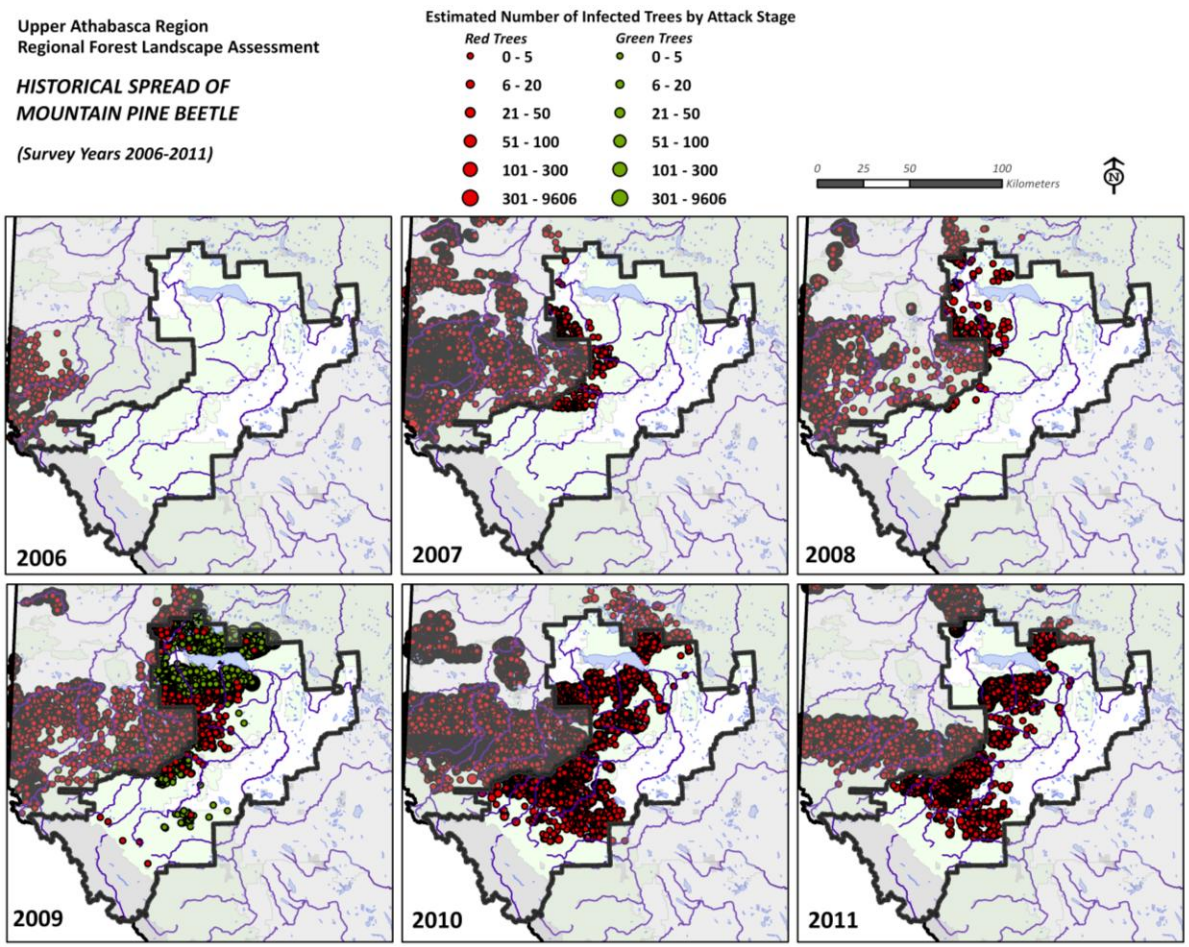


Figure 4-1 Historical Spread of Mountain Pine Beetle

In terms of control mechanisms, there was moderate beetle success throughout the region over the 2011 winter and results indicate a stable population aside from the eastern edge of the infestation, where populations continue to decline. The region remains a high priority for control work in 2012 because it contains a large volume of pine and there is potential for infestations to spread.

4.2.2 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 65% 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 Upper Athabasca Region, but no surveys have detected any populations worth noting.

Table 4-1 Summary of Hardwood Defoliation Agents

Insect Pest - 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*	379,818	16	979,237	40	235,571	10	1,594,626	65
Bruce spanworm	*Operophtera bruceata*	301,744	12	267,229	11	45,779	2	614,752	25
Aspen leafroller	*Epinotia solandriana*		-	186,630	8		-	186,630	8
Forest tent caterpillar	*Malacosoma disstria*	1,586	0	16,021	1	11,953	0	29,561	1
Aspen defoliators		16,334	1		-		-	16,334	1
Other			-	60	0	129	0	189	0
Total[1]		699,482	29	1,449,177	59	293,433	12	2,442,091	100

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

Figure 4-2 is an overview of the history of the presence of hardwood defoliator outbreaks impacting forests in the Upper Athabasca Region. As these defoliators tend to occur in cycles, only the last 8 years of infestation are mapped. A detail summary of the most important of these insect species (large aspen tortrix, Bruce spanworm and tent caterpillar) is presented in following sections.

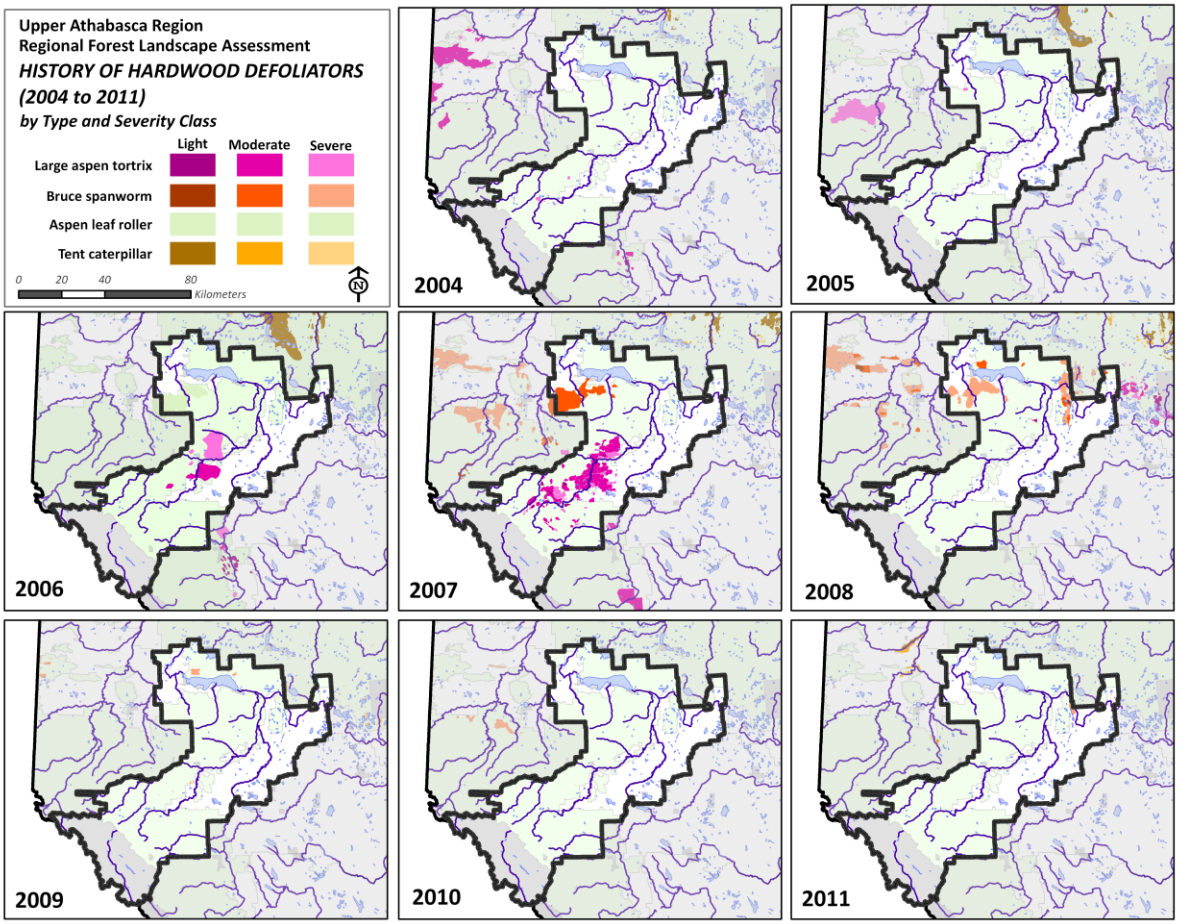


Figure 4-2 History of Hardwood Defoliation Outbreaks (2004-2011)

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 Upper Athabasca can account for over half of the overall provincial infestation. This indicates that regionally, the tortrix is more prevalent here than in the other surveyed land-use framework Regions.

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. While the overall provincial incidence of Bruce spanworm is relatively low, it's prevalence in the Upper Athabasca Region is important. Even in periods of low infestation, the proportion of infected forests located in the Upper Athabasca Region is typically greater than 50%.

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 2-4 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 Upper Athabasca Region would be considered low, relative to the impact of other hardwood defoliators.

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.

4.2.3 Spruce Budworm

The spruce budworm is the most important defoliator pest of spruce-fir forests in North America. In Alberta, white spruce is the preferred host, but black spruce, tamarack and balsam fir can also be attacked. While attacks are more visible in pure host stands, mixedwood stands are also prone to attack once an infestation is underway. Re-occurrence and length of infestations vary widely. Damage to trees is considerable, as the budworms attack new needle growth as well as buds. After 4-5 years of defoliation, dead tops can appear on trees. Additional years of infestation may result in mortality.

Table 4-2 indicates the summary of historical infestations of spruce budworm in the Upper Athabasca Region (26). The budworm is not a serious pest in this Region. As indicated in Figure 4-3, the budworm appears only in the north east area of the Region, as an extension of infestations occurring farther to the north. The most recent infestation noted was in 2010 with no budworm activity observed in this region in the 2011 surveys.

Table 4-2 Summary of Spruce Budworm Presence

Insect Pest - Spruce Budworm		Severity of Impact						Total	
		Light		Moderate		Severe			
Common Name	Latin Name	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)
Spruce budworm	*Choristoneura fumiferana*	176	-	5,074	-	893	-	6,143	-
Total[1]		176	-	5,074	-	893	-	6,143	-

[1] Sum of infestation survey records 1997 to 2011 inclusive

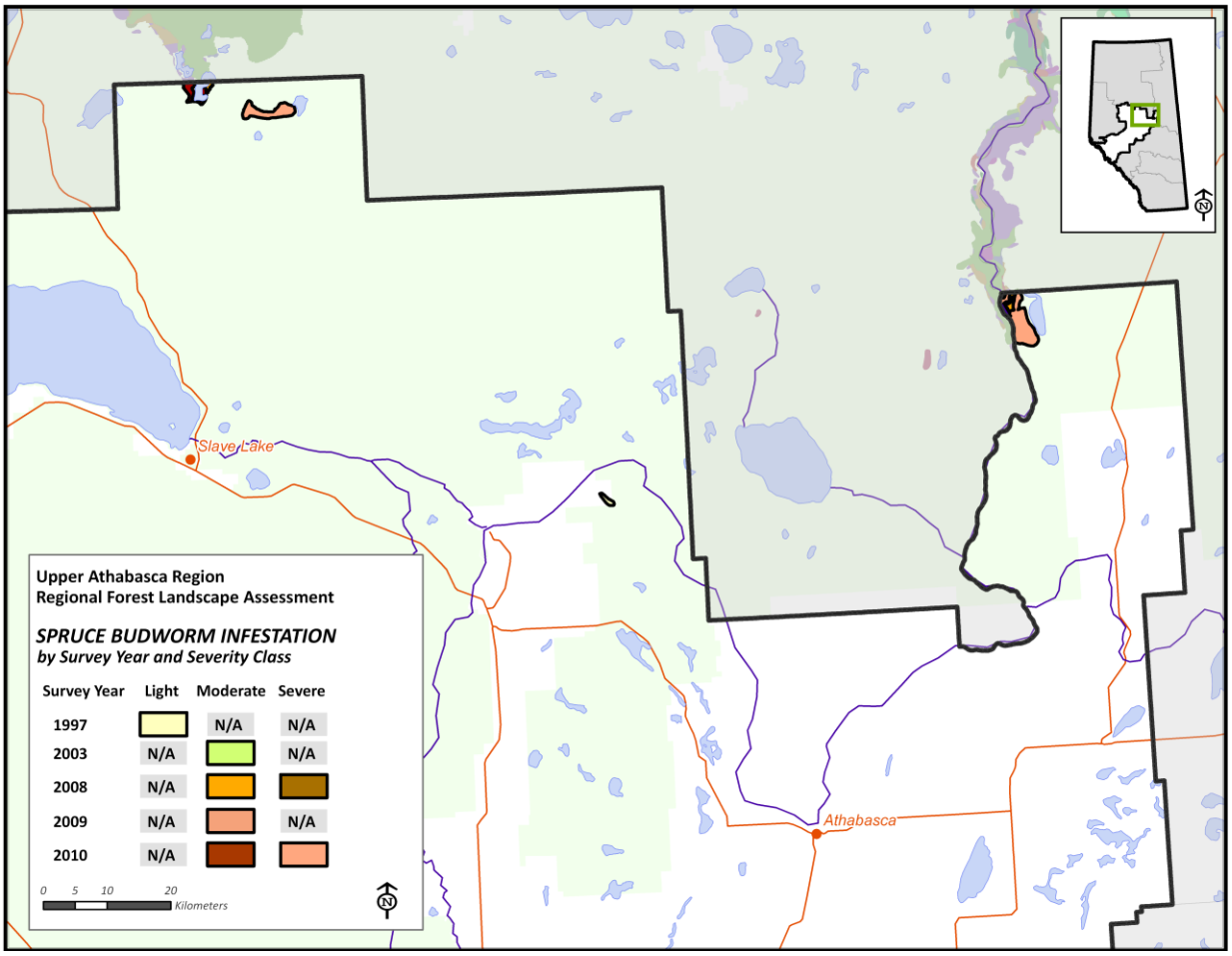


Figure 4-3 History of Spruce Budworm

4.2.4 Other Forest Health Agents

Surveys in 2010 and 2011 indicate that other agents were present which impacted forest growth (48). Table 4-3 summaries the other agents that were found in the Upper Athabasca Region and their level of severity. Because these agents are unrelated to each other, the percentage calculated reflects the percentage area of each agent across the levels of severity. Locations of the surveyed agents are shown in Figure 4-4.

Table 4-3 Other Forest Health Agents

Other Health Agents	Severity of Impact						Total	
	Light		Moderate		Severe			
Common Name	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)
Aspen Dieback	465	77	139	23		-	604	100
Blowdown	125	22	423	75	13	2	562	100
Climatic Factors	5,683	99	77	1		-	5,760	100
Drought	446	100		-		-	446	100
Flooding	37	100		-		-	37	100
Hail	3,525	14	20,298	82	986	4	24,808	100
Lightening		-		-	3	100	3	100
Dwarf mistletoe	7,544	100		-		-	7,544	100
Red belt	126	15	624	76	72	9	822	100
Total[1]	17,949	44	21,562	53	1,075	3	40,586	100

[1] Sum of survey records 2010 to 2011 inclusive

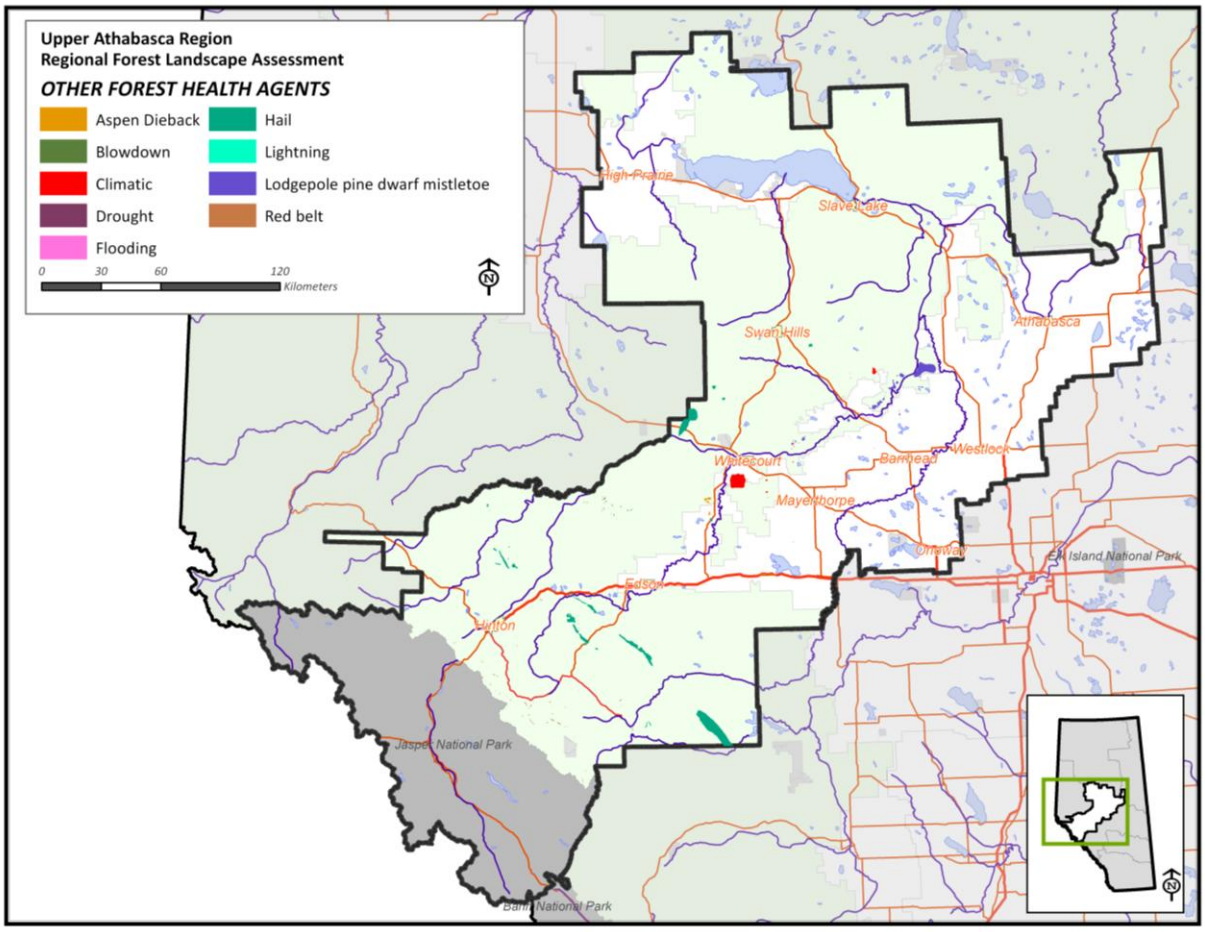


Figure 4-4 Other Forest Health Agents

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. 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 5,688 sites of observed invasive species in the Upper Athabasca region (27). 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 4-4 shows the invasive plants status for the Region, by class (prohibited, noxious, nuisance).

No problem weeds were observed on 25% of the sites visited. Fortunately, the occurrences of prohibited noxious plants is very low; the 10 occurrences account for less than one half of one percent of all observations. Incidences of noxious plants are the highest category at 74% of all observed invasive plants, with the most common problem species being Canada Thistle and Oxeye Daisy.

Figure 4-5 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.

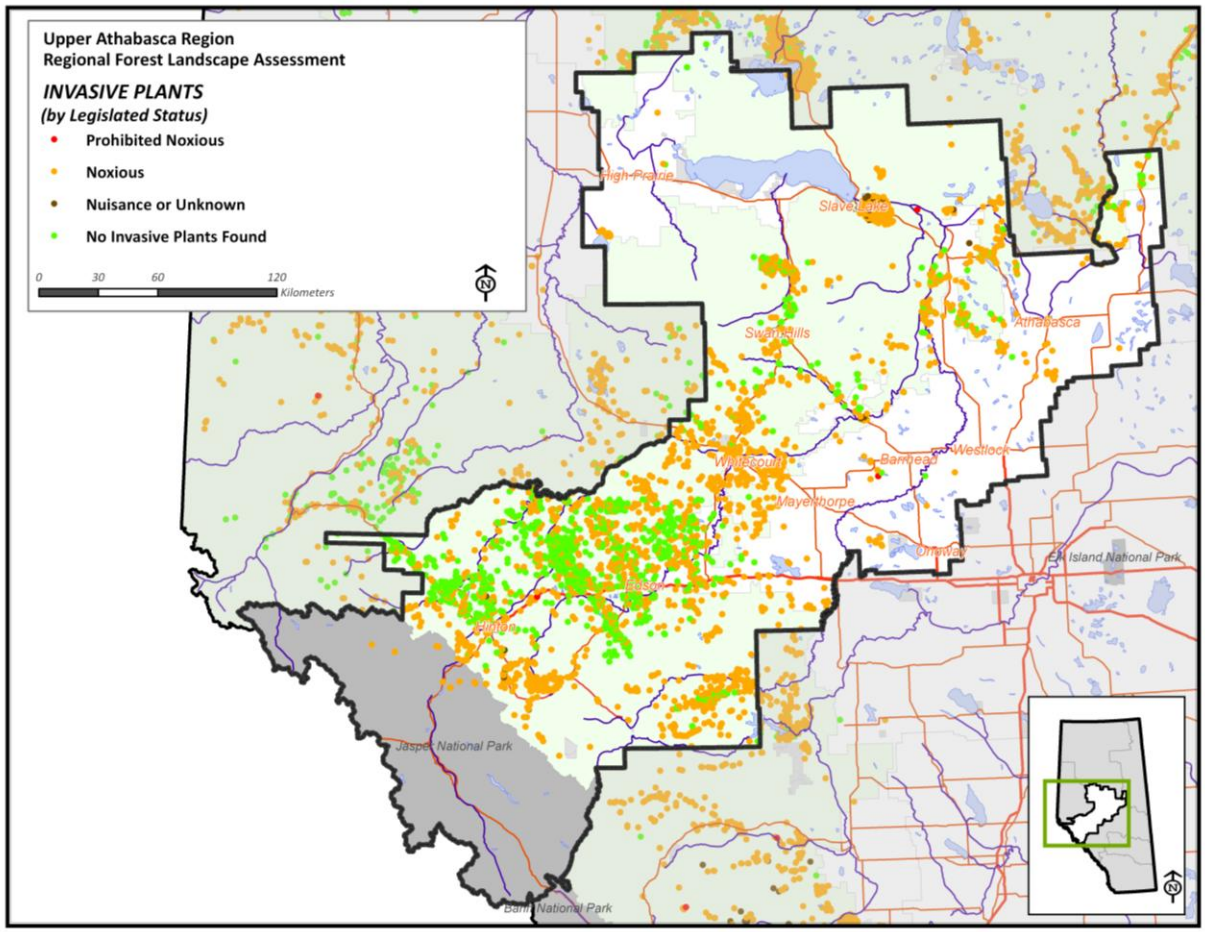


Figure 4-5 Invasive Plant Distribution

Table 4-4 Ranking of Invasive Plant Species

Classification and Weed Name	Incidence of Observed Weeds	Percentage of All Obs. (%)
No Weeds Found		
None	1,653	25
Sub-total No Weeds Found	1,653	25
Prohibited Noxious		
Hawkweed	3	0
Meadow Hawkweed	2	0
Nodding Thistle	2	0
Orange Hawkweed	1	0
Purple Loosestrife	1	0
Spotted Knapweed	1	0
Sub-total Prohibited	10	0
Noxious		
Annual Sow Thistle	4	0
Blueweed	1	0
Canada Thistle	1,326	20
Common Tansy	286	4
Common Toadflax	8	0
Leafy Spurge	2	0
Oxeye Daisy	906	13
Perennial Sow Thistle	829	12
Scentless Chamomile	726	11
Sow Thistle	5	0
Tall Buttercup	825	12
Toadflax	26	0
White Cockle	11	0
Yellow Hawkweed	1	0
Yellow Toadflax	1	0
Sub-total Noxious	4,957	74
Nuisance/Unknown Status		
Bladder Campion	1	0
Bull Thistle	2	0
Cleavers	5	0
Dog Mustard	9	0
False Cleavers	25	0
Foxtail Barley	1	0
Stork's Bill	18	0
Tall Hawkweed	2	0
Tall Larkspur	1	0
Wild Caraway	34	1
Sub-total Nuisance	98	1
Total	6,718	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) and 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 indicates 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).

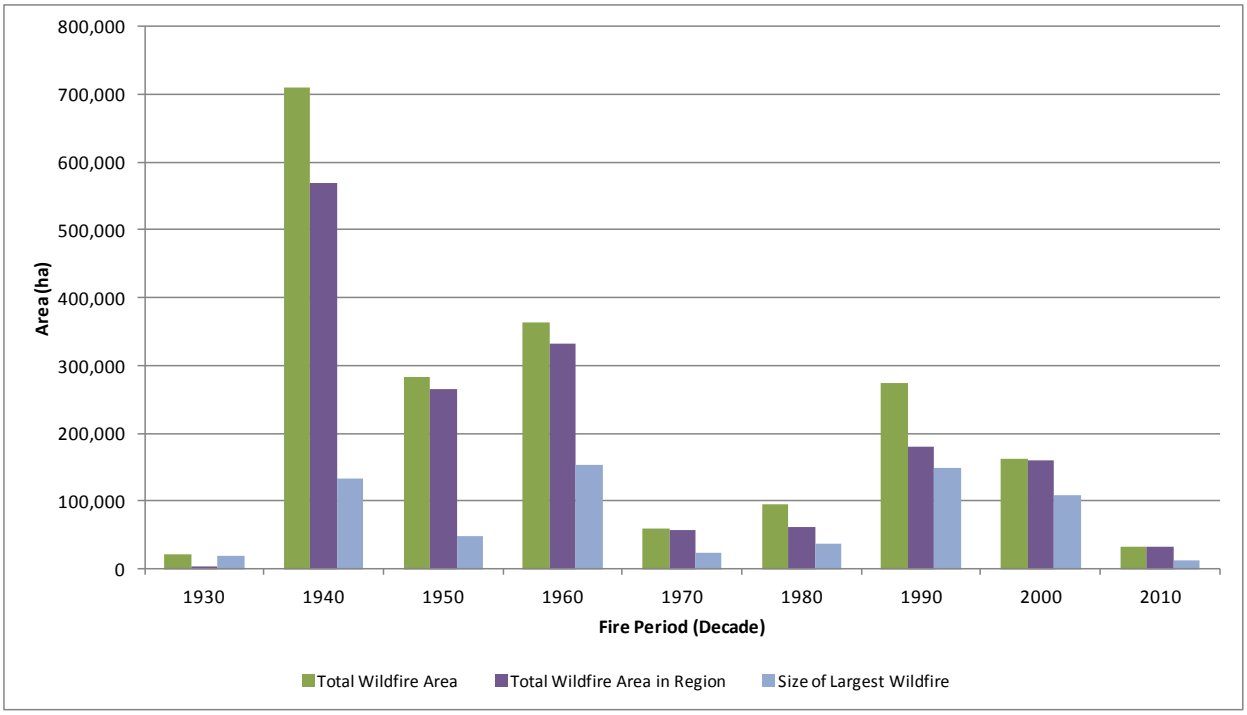
Summary statistics of the Region's wildfire history are reported in Table 4-5. The areas reported in Table 4-5 include only burned area and do not include residual islands that may not have burned during a wildfire event. The reporting period is by decade with the labelled wildfire date representing the start of the decadal period (i.e.: period '1930' represents 1930-1939 inclusive). The number of wildfires by decade is highly variable, as are the total area burned, average wildfire size and size of largest wildfire (Table 4-5, Figure 4-6). However, the median wildfire size is on a clear trend downwards (Figure 4-7). 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 4-5).

Table 4-5 Wildfire Statistics by Decade

Fire Period	Number of Wildfires	Total Wildfire Area (ha)	Wildfire Area in Upper Athabasca (ha)	Average Wildfire Size (ha)	Median Wildfire Size (ha)	Size of Maximum Wildfire (ha)	Area Burned as percentage of Region[1] (%)
1930	3	21,633	2,245	7,211	893	20,011	0
1940	232	709,475	568,570	2,087	493	133,681	8
1950	132	287,461	269,616	971	100	48,281	4
1960	70	373,161	339,738	1,117	31	151,422	5
1970	20	61,932	60,203	439	26	22,332	1
1980	54	96,570	63,401	773	37	36,989	1
1990	51	293,722	197,107	639	21	147,439	3
2000	226	165,765	164,051	334	5	83,322	2
2010[2]	95	35,543	35,535	57	7	12,505	0

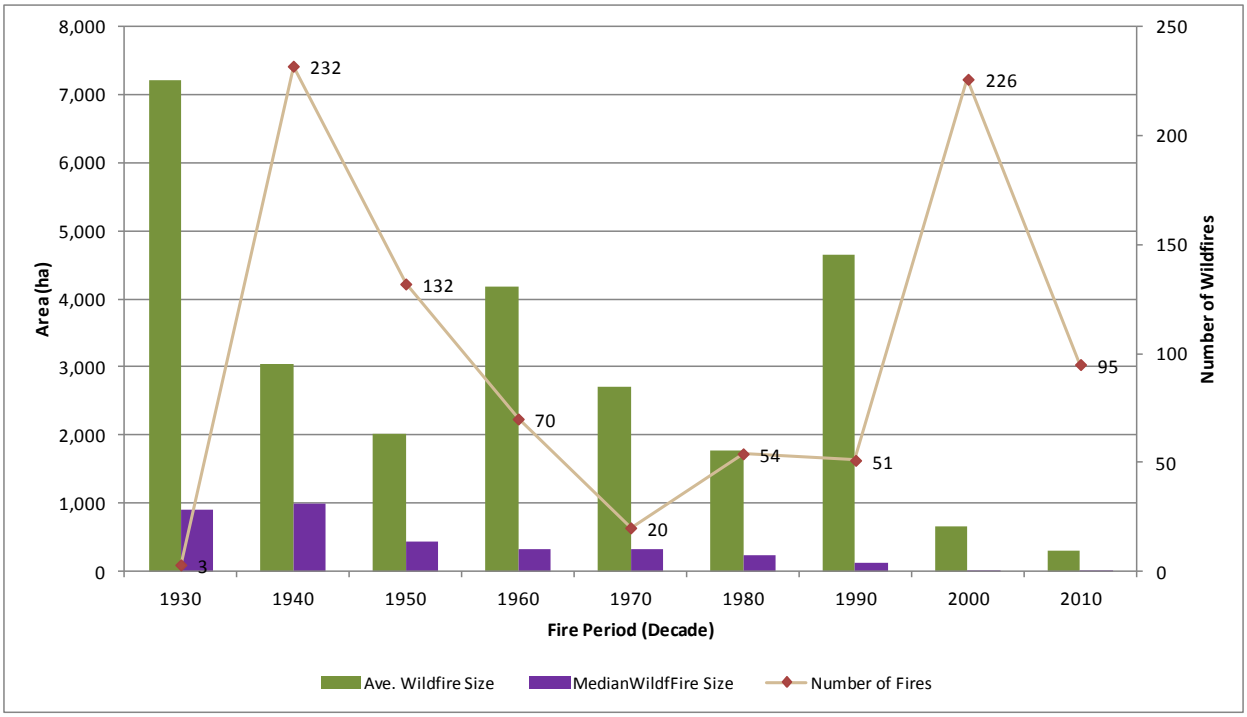
[1] Note that the area used for percent calculation is only the Region's Green and White Area.

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



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

Figure 4-6 Wildfire Size Statistics by Decade



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

Figure 4-7 Average and Median Fire Size by Decade

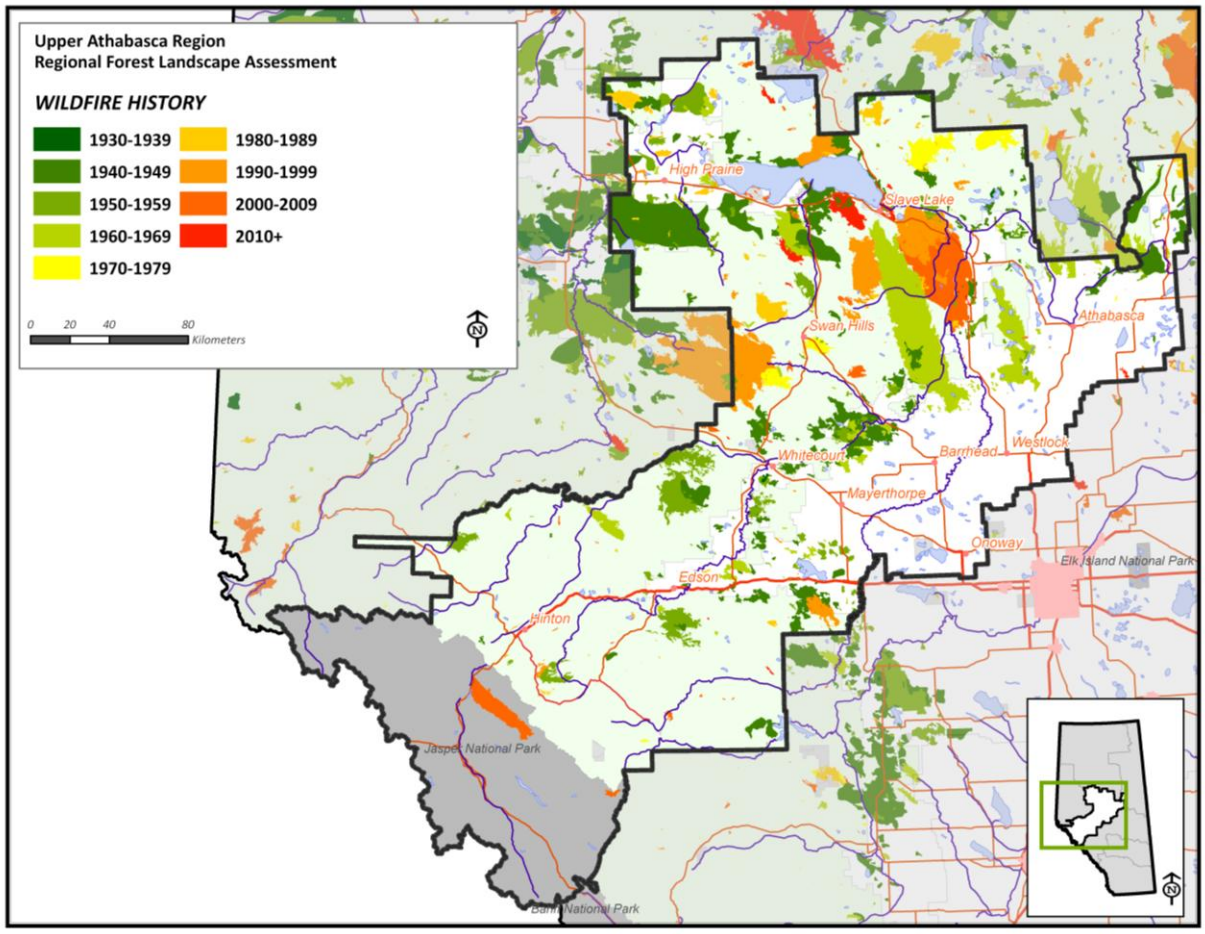


Figure 4-8 Wildfire Distribution by Decade

4.6 Timber Harvesting

Timber harvesting has been a component of anthropogenic disturbances in the Upper Athabasca since the beginning of the province. From the time of the transfer of resource management from the Federal government to the provincial government in 1930 (Alberta 1930) until approximately the mid-1950's, forest harvesting was generally for local or regional use. Large scale commercial harvesting began in 1955 with the establishment of the first Forest Management Agreement with (the former) Northwest Pulp and Power company, who established a pulp mill in Hinton. Timber harvesting began a rapid expansion in the early 1980's and there has been a steady increase in activity since then. A summary of the harvest area and number of harvest areas by decade is displayed in Table 4-6.

Much of the early harvesting in the Region was the result of historic species preference (coniferous removed from mixedwood stands or product preference based on tree size (for example, sawlogs versus other products). In many cases, these activities would not result in complete removal of the stand (a clearcut). However, the area summaries presented in Table 4-6 do not account for partial stand removal; rather, they assume complete removal. In that respect, the area summaries may slightly over estimate the area of harvesting. Recent management activities such as green retention or shelterwood operations resulting from the implementation of specific forest management strategies, also result in partial clearings over full clearcuts.

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 4-6 represents all the known harvest 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 4-6 is a best approximation based on the information available.

Table 4-6 Summary of Harvesting by Decade

	Total Harvest Area		Number of Harvest Areas		Average Area / Year
Year of Harvest	(ha)	%	Count	%	(ha)
1950-1959	839	0	693	2	105
1960-1969	6,200	1	3,441	8	689
1970-1979	21,973	4	4,936	12	2,197
1980-1989	62,969	13	4,747	11	6,297
1990-1999	129,914	26	9,340	22	12,991
2000-2009	201,806	40	9,578	23	20,181
2010 [2]	8,087	2	408	1	8,087
Unclassified	67,812	14	8,688	21	
Total	499,600	100	41,831	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 amount of area being harvested annually has been increasing steadily as shown in Table 4-6 and Figure 4-9. However, much of the harvesting activity from the 1950's and 1960's may not be included in this summary as historic information is not available.

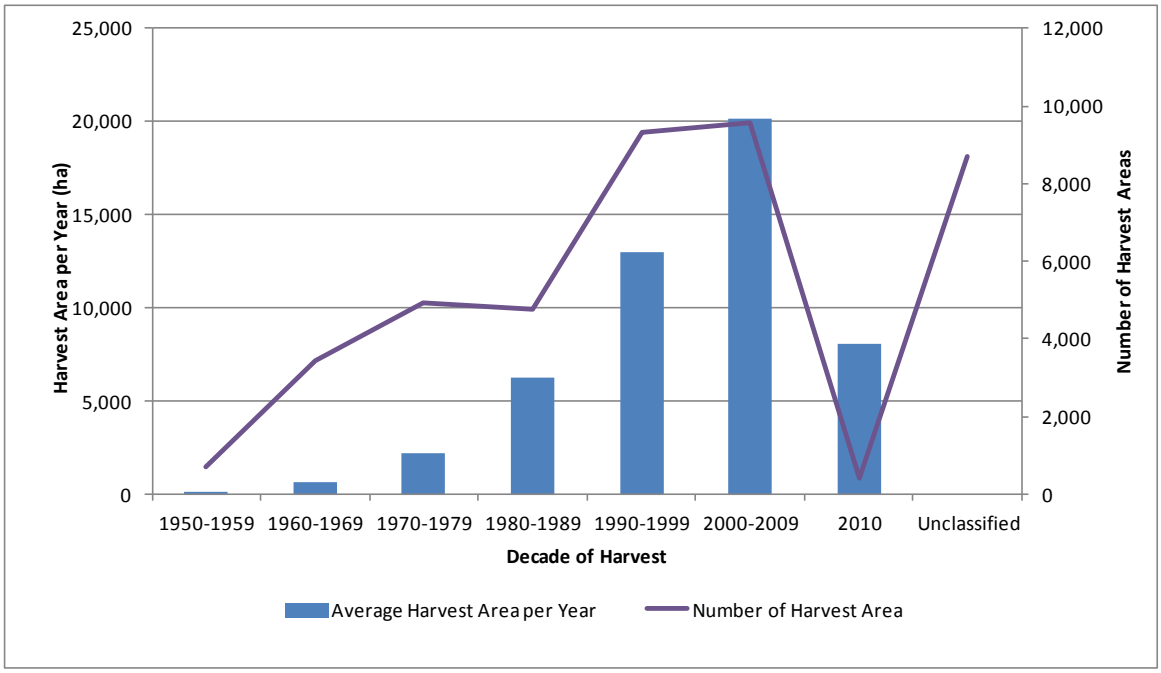


Figure 4-9 Average Annual Area and Count of Harvesting Activity

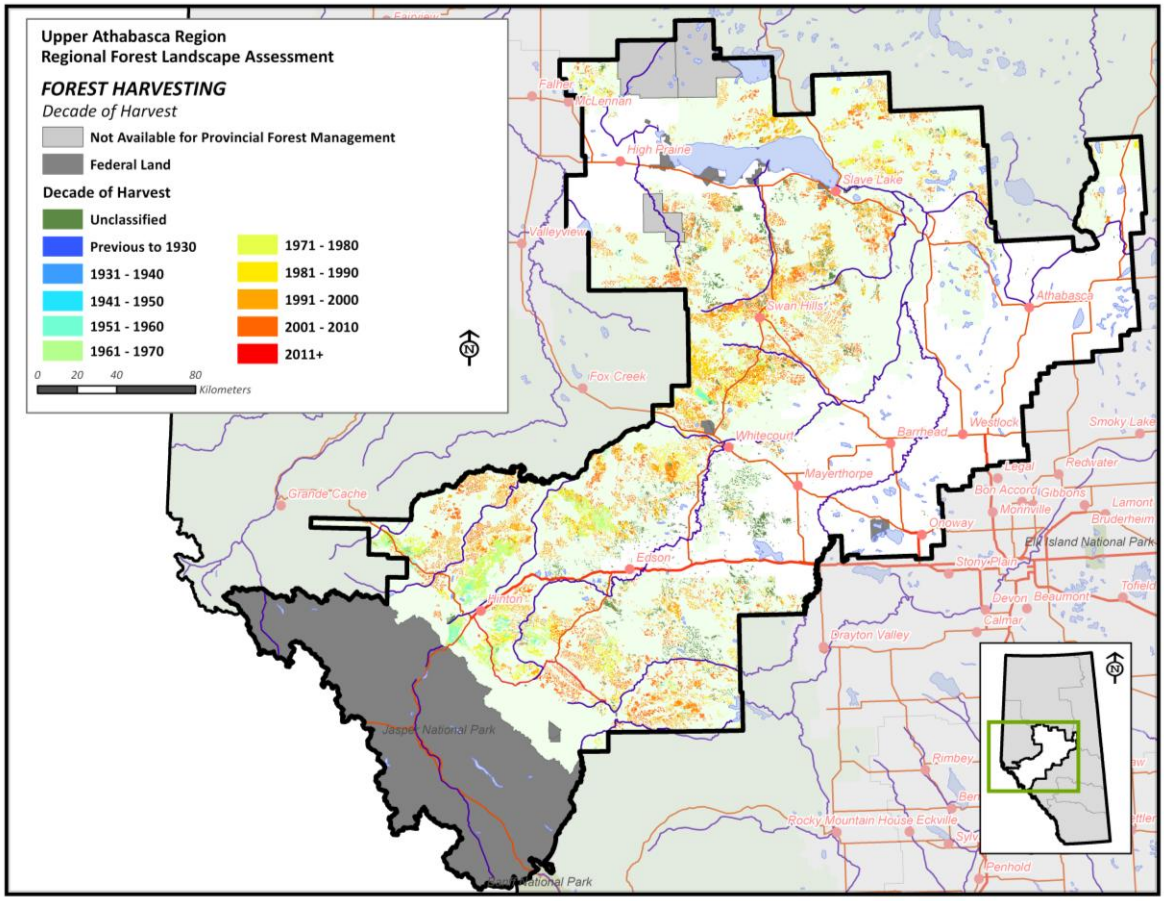


Figure 4-10 Harvest Area by Decade

4.7 Access

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

Figure 4-11 shows the major transportation routes in the Region, including the railroad access. In this map, note that only major paved and all-season gravel roads are displayed. The main transportation corridors are:

- Yellowhead Highway: Highway 16 running east-west through the south part of the Region from Edmonton, west through Jasper to the BC border. The Yellowhead Highway is part of the Trans-Canada Highway system and is a major corridor for truck transport of goods.
- Highway 2: running north from Edmonton to Slave Lake, then west along the south shore of Slave Lake to High Prairie.
- Highway 43: running northwest from Edmonton, through Whitecourt.
- Highway 32 running northeast from Barrhead, through Swan Hills, terminating at Highway 2 on the south shore of Slave Lake.

A map of all road classes is shown in Figure 4-12.

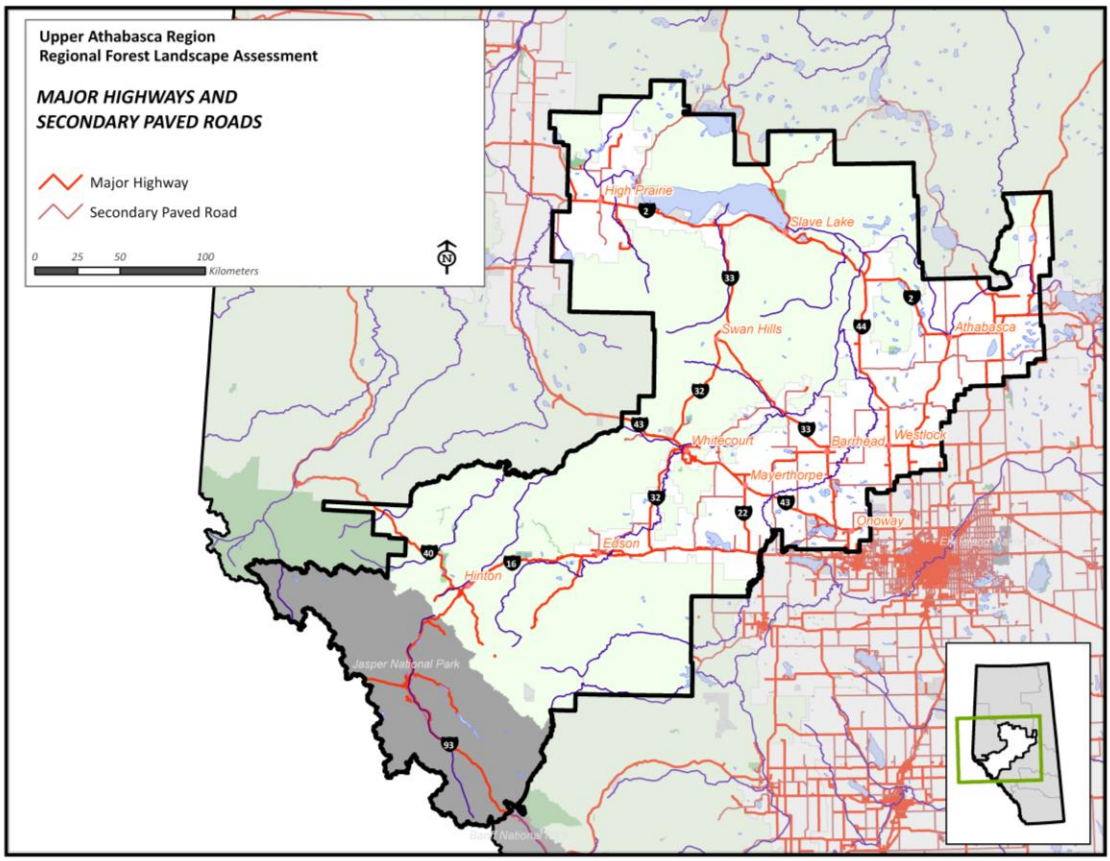


Figure 4-11 Major Transportation Access

Table 4-7 summarizes the length of road by road class within each of the Green Area, White Area and on Federal lands. At only 344 kilometers, road development on Federal lands is minimal. There is more road development in the White Area and this would be expected primarily due to agricultural activities. Access throughout the Green Area is still quite high and, as noted earlier, is the result of natural resource exploration and extraction.

Table 4-7 Length of Road by Class and Location

Road Classification	Length of Roads (km)			
	Green Area	White Area	Federal Lands	Total
Major Highway	1,032	2,177	327	3,536
Secondary Paved Road	194	982	25	1,201
Gravel Road	7,371	10,457	78	17,907
Winter Road / Unclassified	226	99		325
Trail suitable for Vehicle Access	123	1	9	133
Total	8,946	13,716	439	23,102
Railway	565	647	85	1,297

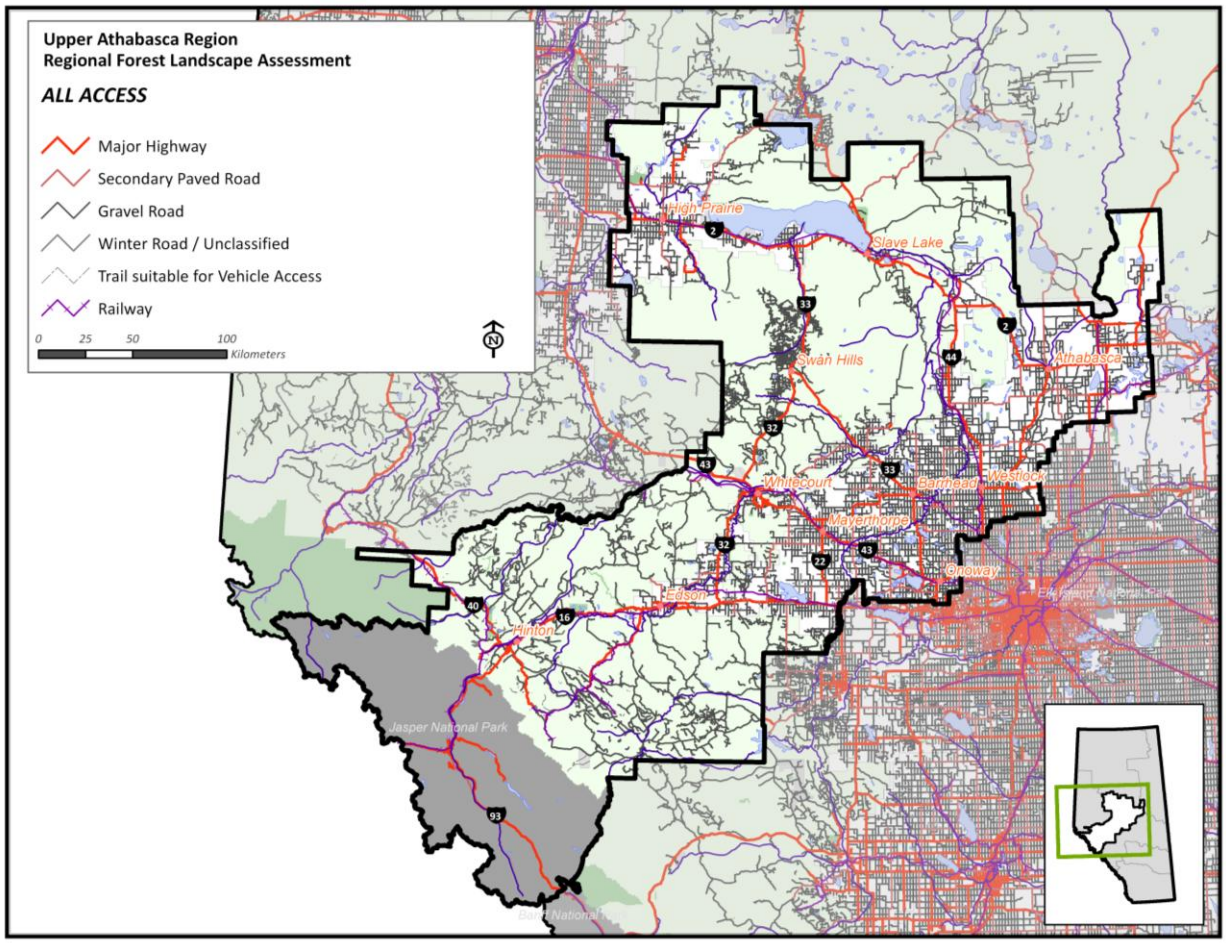


Figure 4-12 All Road Access by Road Class

4.8 Industrial Development

The energy sector accounts for the majority of disposed surface dispositions in this Region (33). As indicated in Table 4-8, the highest percentages of dispositions have been issued to these types: License of Occupation, Mineral Surface Lease and Pipeline Agreement. A License of Occupation typically is for all season road access to specific areas. A Mineral Surface Lease can be issued for a number of energy industry facilities, but with the exception of coal mines, the most common feature in this Region are oil or gas well sites. Pipelines connect well sites, so naturally there are a high proportion of pipeline dispositions located in the Region.

Table 4-8 Land-use Dispositions

Industrial Dispositions			Distribution		
Type of Disposition	Code	Number of Dispositions	Area (ha)	Percentage of All Dispositions (%)	Percentage of Region[1] (%)
Easement	EZE	2,960	10,296	6	0
Licence of Occupation	LOC	13,321	58,744	33	1
Mineral Surface Lease	MSL	17,576	54,482	30	1
Pipeline Installation Lease	PIL	2,949	672	0	0
Pipeline Agreement	PLA	16,152	49,695	28	1
Rural Electrification Agreement	REA	243	287	0	0
Right of Entry Agreement	ROE	1,052	4,095	2	0
Right of Way Lease	ROW	3	194	0	0
Vegetation Control Easement	VCE	215	1,241	1	0
Total		54,471	179,706	100	3

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

Figure 4-13 shows the dense development of well sites and pipelines, most predominantly in the west and west-central parts of the Region. Despite the dense network, the total area occupied by industrial dispositions is 179,706 hectares or only 3% 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). This is because Alberta cannot authorize dispositions on Federal lands.

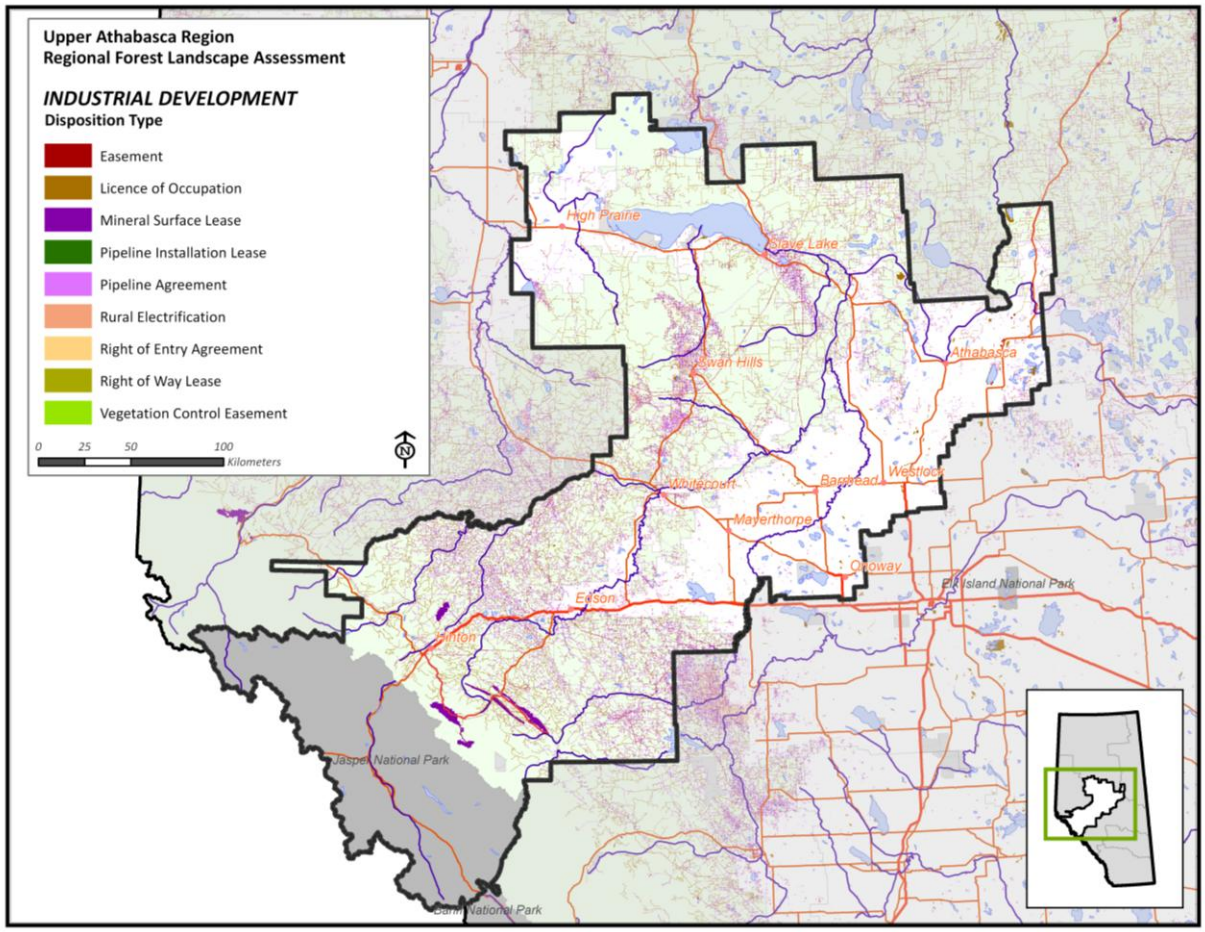


Figure 4-13 Industrial Development under Permit and License

Of note in the Upper Athabasca region is the number of operating coal mines (34). Of the 54,482 hectares of Mineral Surface Lease land in the Region, 42% or 23,221 hectares are occupied by coal mines. These mines are located in foothills areas (Figure 4-14). Other coal-bearing formations can be found in the area, but no mine development permits have been issued yet to access these formations.

All the coal mine development in the Upper Athabasca Region is contained within the Green Area.

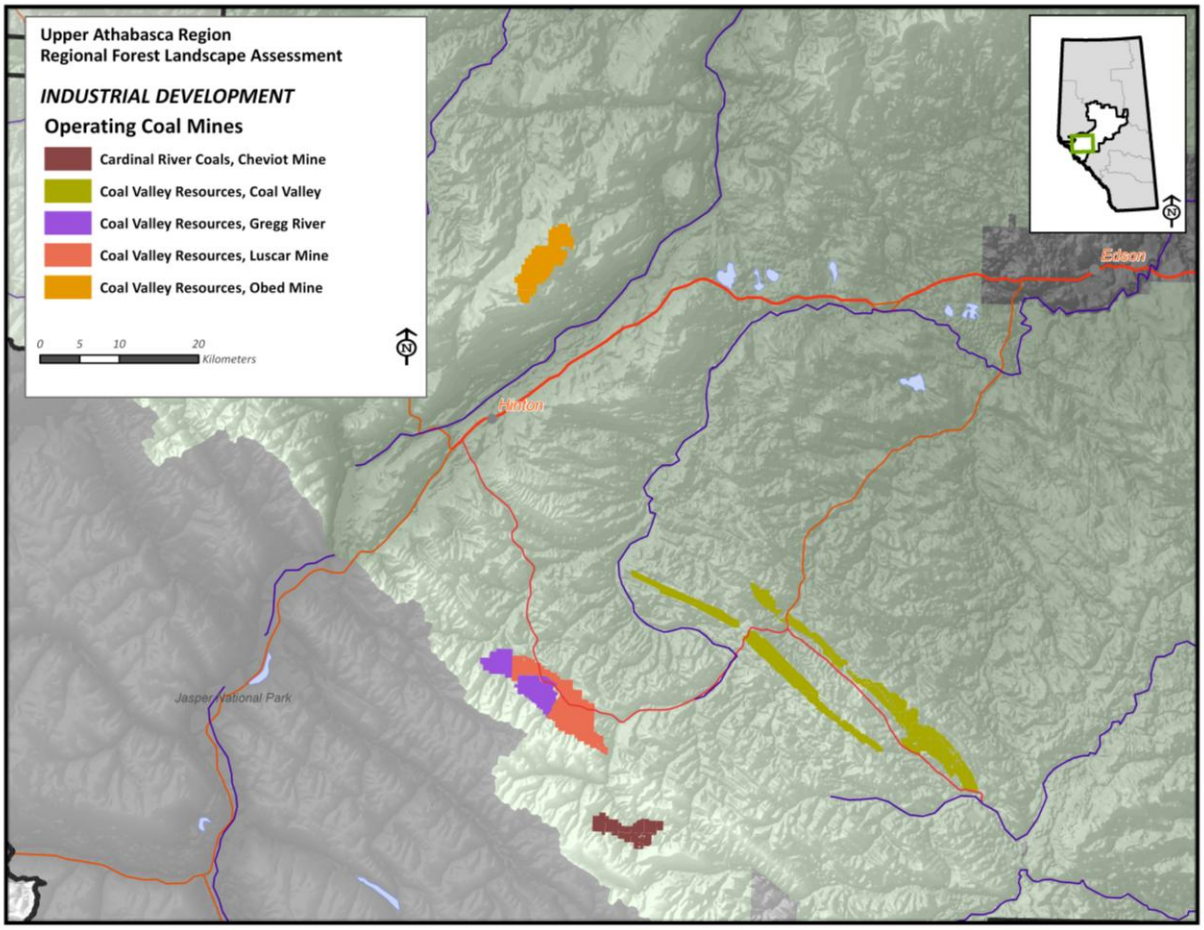


Figure 4-14 Operating Coal Mines

4.9 Monitoring Sites

Permanent monitoring plots have been established throughout the Upper Athabasca 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 4-9.

Note that Table 4-9 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 4-9 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 4-9 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	147	312	9	18			156	330
Reforestation Monitor Plots	120	5,020					120	5,020
Western Boreal Growth and Yield Cooperative	30	30					30	30
Stand Dynamics Plots	90	90					90	90
Other PSP (Special Projects)	20	164	53	53			73	217
Alberta Biodiversity Monitoring Institute								
ABMI Sample Grid	118	118	62	62	30	30	210	210
Other Agency Permanent Sample Plots								
ISP Registered	4,248	4,248	1	1			4,249	4,249
Total	4,773	9,982	125	134	30	30	4,928	10,146

The distribution of monitoring sites across the Upper Athabasca Region is displayed in Figure 4-15.

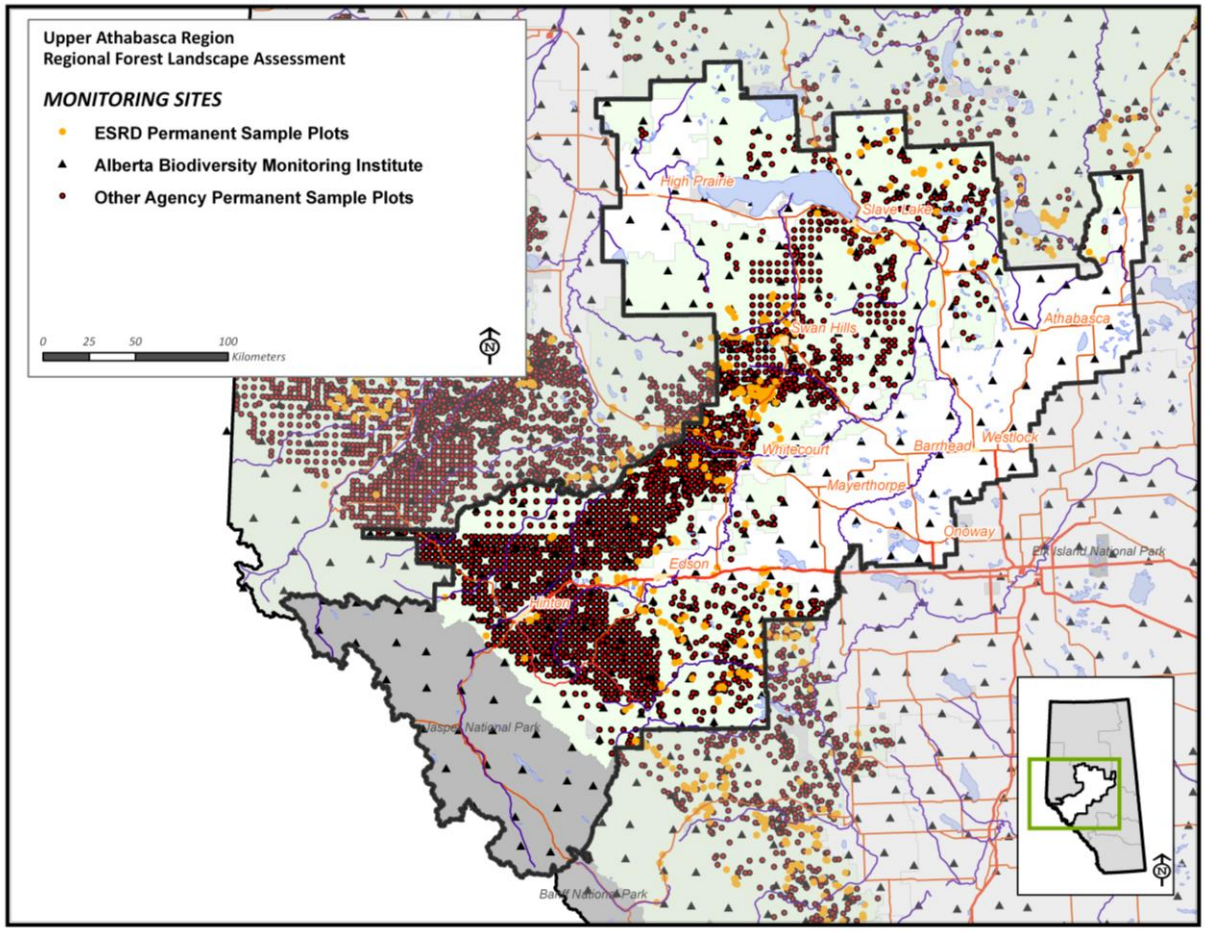


Figure 4-15 Location of Permanent Monitoring Sites

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.
Western Boreal Growth and Yield Cooperative	The Western Boreal Growth and Yield Cooperative was started in 1985 with the purpose of conducting research projects that contribute to the development of growth and yield information and modeling for both natural and regenerated stands in the boreal mixedwood region. Members of the Cooperative consist of industrial forest managers, provincial/territorial forest managers and academia. Sample design is a randomized block experiment. The re-measurement schedule is complex and depends on age and season of planting stock and reforestation activities occurring on the block.
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 PSPs 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 (e.g.: spruce budworm, blowdown event).

4.9.2 Alberta Biodiversity Monitoring Institute

The Alberta Biodiversity Monitoring Institute (ABMI) conducts monitoring of more than 2,000 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 1,656 plots are located across the province, of which 210 fall in the Upper Athabasca 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 Upper Athabasca Region, along with AAC levels prorated by the proportion of the FMU area located inside the Upper Athabasca 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		Entire FMU	Portion of FMU located in Upper Athabasca		Proportion of Upper Athabasca occupied by FMU	Annual Allowable Cut (m^3/year) (Prorated to FMU Area)		
Name	Managed by	Area (ha)	Area (ha)	% of FMU	% of Upper Athabasca	Coniferous	Deciduous	Total
E14	FMA	1,022,231	1,016,964	99	12	1,757,475	248,545	2,006,020
S20	FMA	658,367	647,817	98	8	823,406	553,103	1,376,509
S17	FMA	727,043	562,735	77	7	345,465	592,560	938,025
W14	FMA	668,335	329,021	49	4	397,894	191,841	589,734
S7	FMA	238,805	237,867	100	3	51,059	106,236	157,295
W13	FMA	301,616	228,560	76	3	330,275	158,689	488,964
R13	FMA	268,089	219,548	82	3	689,270	49,170	738,440
W6	FMA	233,762	183,972	79	2	193,117	119,253	312,370
W11	FMA	176,399	176,399	100	2	94,903	106,049	200,952
E2	FMA	122,524	122,524	100	1	97,268	90,572	187,840
S21	FMA	247,777	112,102	45	1	97,951	127,132	225,083
S19	FMA	415,173	83,629	20	1	33,646	101,990	135,635
R12	FMA	533,183	68,517	13	1	122,633	35,772	158,406
L8	FMA	126,796	61,886	49	1	19,293	32,092	51,384
W5	FMA	72,059	50,215	70	1	21,023	32,324	53,348
W15	FMA	379,054	44,144	12	1	136,257	11,355	147,612
L3	FMA	588,356	25,876	4	0	7,561	4,314	11,875
PO1	Crown	420,387	23,854	6	0	211	294	505
S18	FMA	610,026	21,210	3	0	7,482	9,735	17,218
S16	Crown	20,062	20,062	100	0	8,018	13,330	21,348
L2	FMA	298,744	13,014	4	0	5,073	6,654	11,726
E9	Crown	12,864	12,864	100	0	1,600	2,100	3,700
E8	Crown	219,562	8,579	4	0	17,689	532	18,221
Sub-total		8,361,214	4,271,359		51	5,258,568	2,593,642	7,852,210
No Allowable Harvest Calculated			4,026,709		49	0	0	0
Total			8,298,067		100	5,258,568	2,593,642	7,852,210

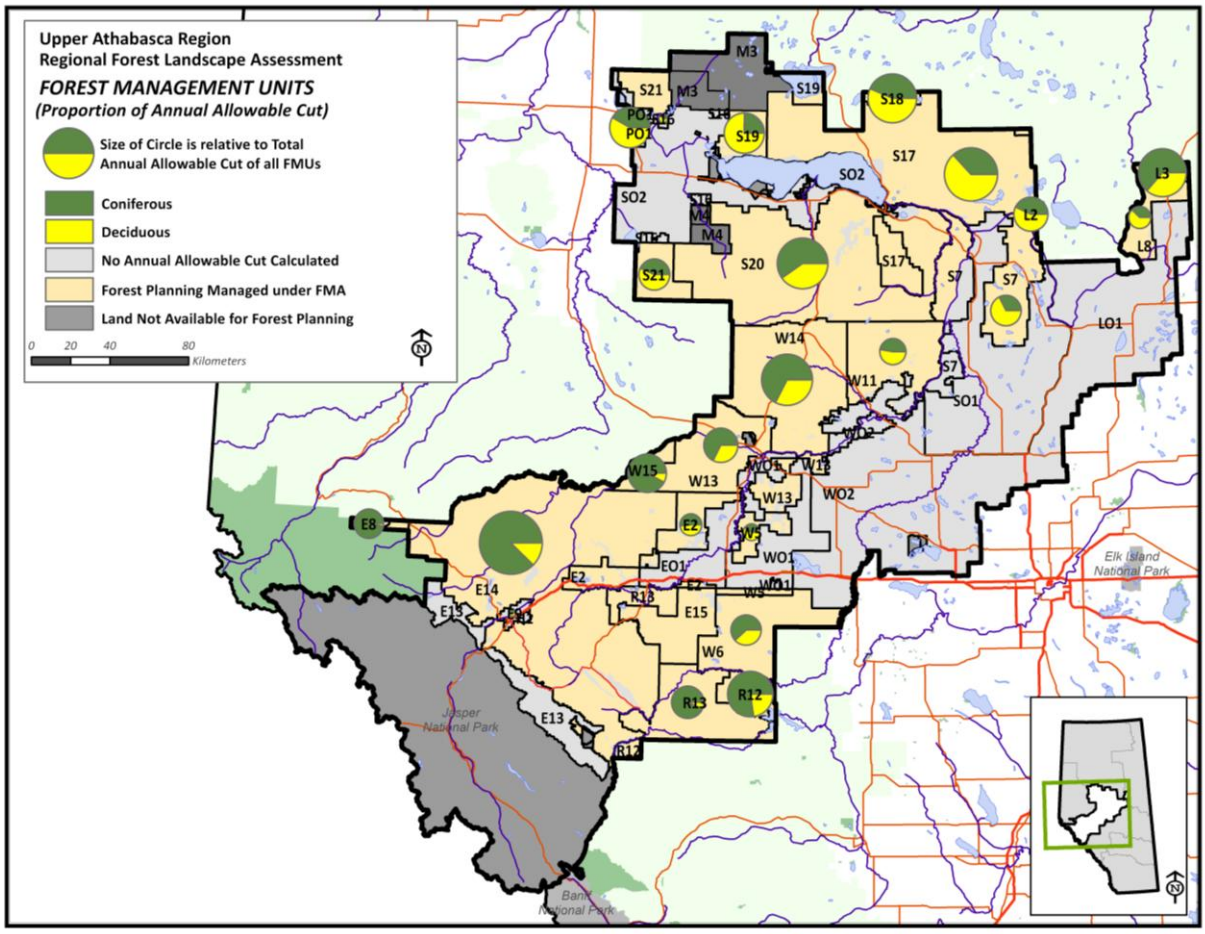


Figure 5-1 FMUs Indicating Prorated AACs

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).

The Upper Athabasca Region is covered by 428 registered fur management areas (39) (or traplines) totaling 5,906,111 hectares or approximately 71 % of the region (Figure 5-2). The average size of an individual trapline is 12,367 ha, with the largest at 213,891 ha (encompassing all of Slave Lake). With the exception of bobcat, all Alberta furbearers can be harvested in the Upper Athabasca Region.

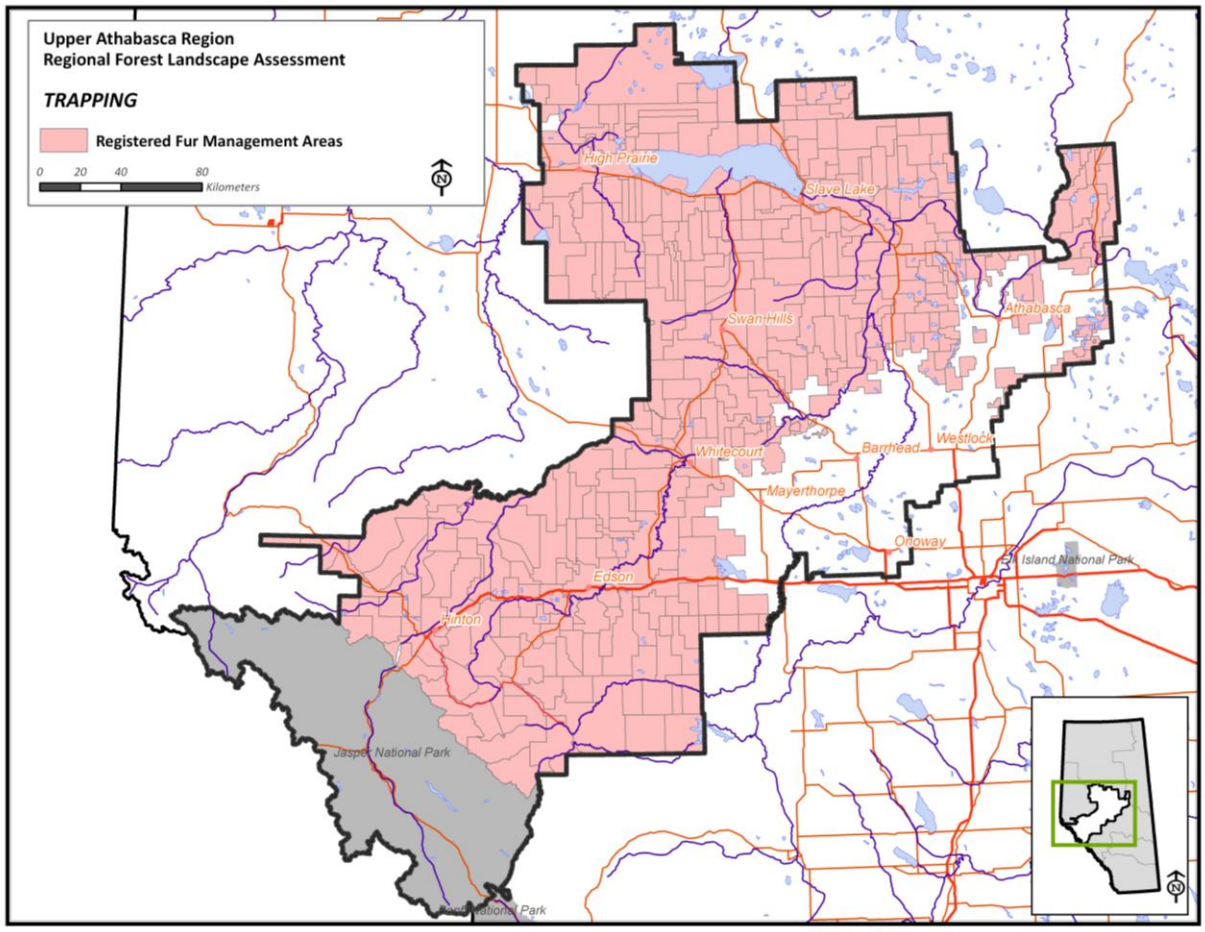


Figure 5-2 Registered Fur Management Areas

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 area by grazing types across the Upper Athabasca Region.

The majority of the grazing dispositions are located in the White Area (Figure 5-3) with only a few allocations stretching into 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 (e.g.: recreation, forest harvesting) 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 Licence	FGL	131	23,318	9	0
Grazing Lease	GRL	1,055	182,804	74	2
Grazing Permit	GRP	73	4,904	2	0
Provincial Grazing Reserve	GRR	4	36,323	15	0
Total		1,263	247,349	100	3

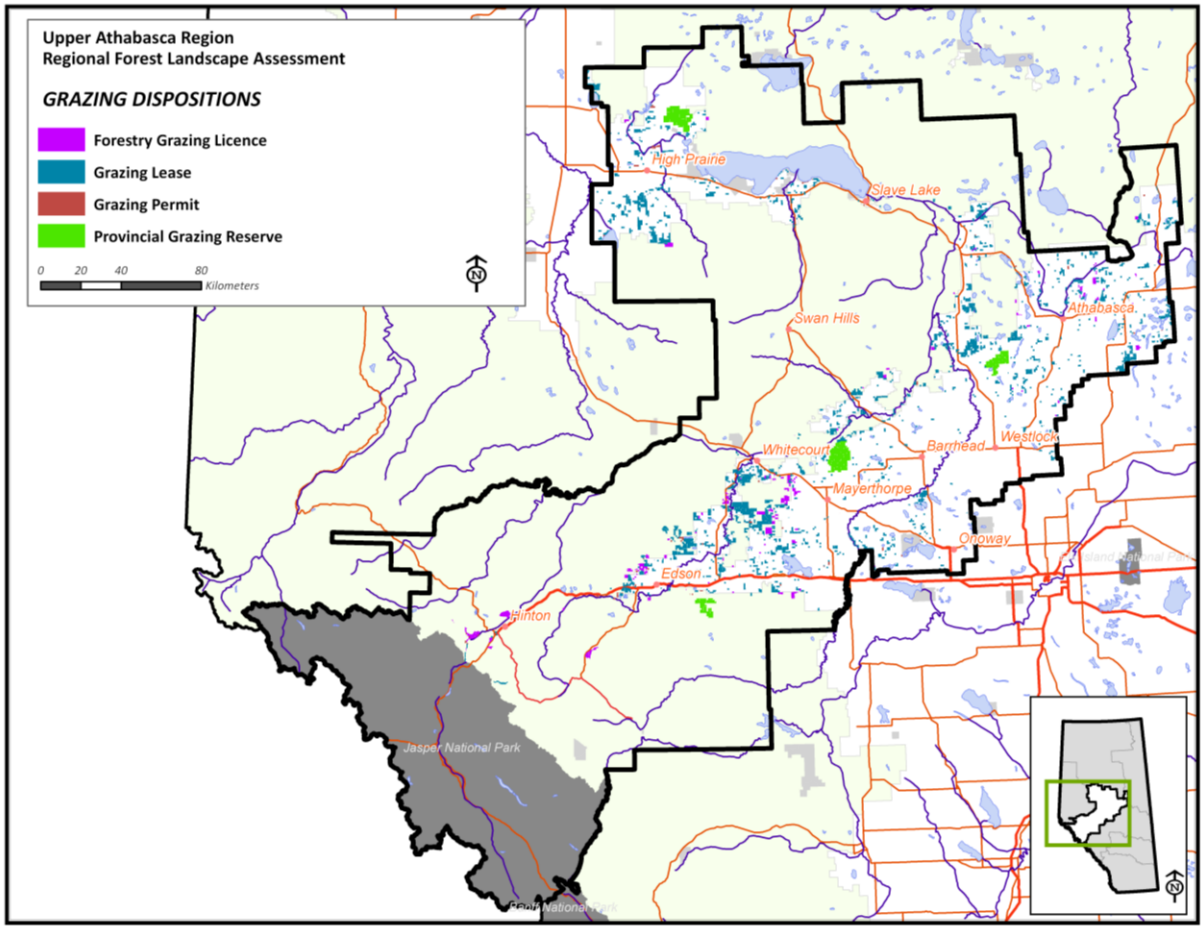


Figure 5-3 Grazing Dispositions

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

Jasper National Park is the primary recreation destination in the region, encompassing 14% (see section 1.7) of the Region. Virtually all recreation opportunities except off-highway vehicles (OHV), hunting and snowmobiling can be found there.

Lesser Slave Lake, in the northern part of the region, is a primary recreation draw. Several campgrounds, public and private, exist around the lake, which is popular for fishing. The Boreal Centre for Bird Conservation in Northern Alberta is north of the Town of Slave Lake. A portion of the multi-use Trans-Canada trail runs along the northeast edge of the lake.

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, and wildlife viewing.

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 operated by municipalities, towns or private organizations are not included in the analysis.

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

Table 5-4 Public land use zones

Public Land Use Zone	Area (ha)	Camping	Hiking	OHV	Snowmobile	Equestrian	Cross-Country Skiing	Fishing	Hunting	Purpose
Whitecourt Sandhills	1,258	X	X	X		X	X	X	X	25 km of cross-country ski trails.
Brule Lake	1,479	X	X	X	X	X	X	X	X	Maintain or increase elk populations in the area and minimize conflicts between motorized recreational users and elk.
Coal Branch	57,449	X	X	X	X	X	X	X	X	Mitigate environmental impacts on sensitive areas. Protect and properly manage reclaimed mine sites.
Holmes Crossing	2,730	X	X		X	X	X	X	X	Separate motorized and equestrian use.
Athabasca Ranch	4,132	X	X	X	X	X		X	X	Minimize conflicts between motorized access and elk breeding season

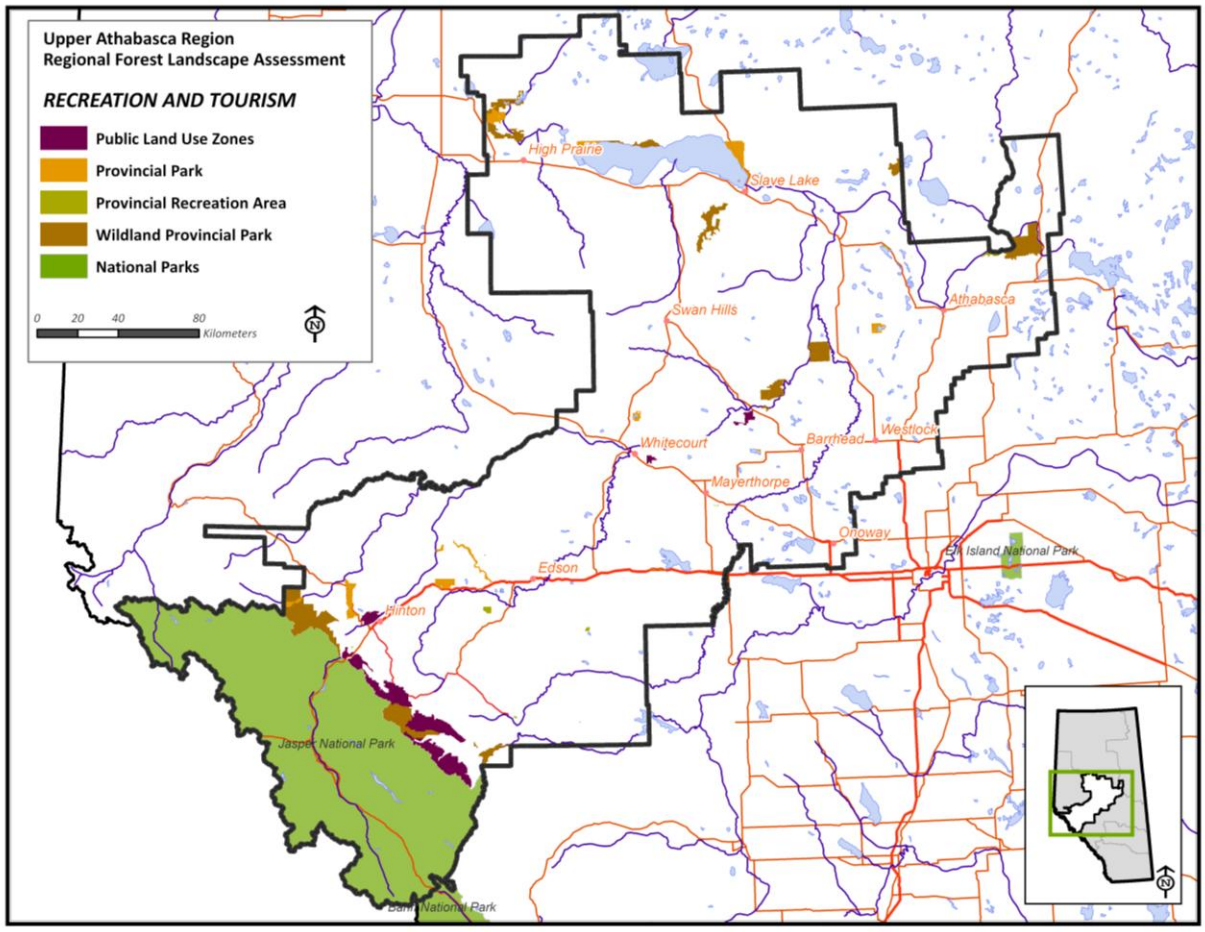


Figure 5-4 Recreation and Tourism Opportunities

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 published 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. A total of 212 hectares are listed as HRV 1 (Historical), with locations near Athabasca, Mayerthorpe, High Prairie and Onoway. A 32 hectare parcel categorized as HRV-1 (Geological) is located southeast of Whitecourt (a meteorite impact crater found in 2007). Archaeological and Paleontological sites are the most plentiful, occupying 50% and 33% respectively of the listing's total area.

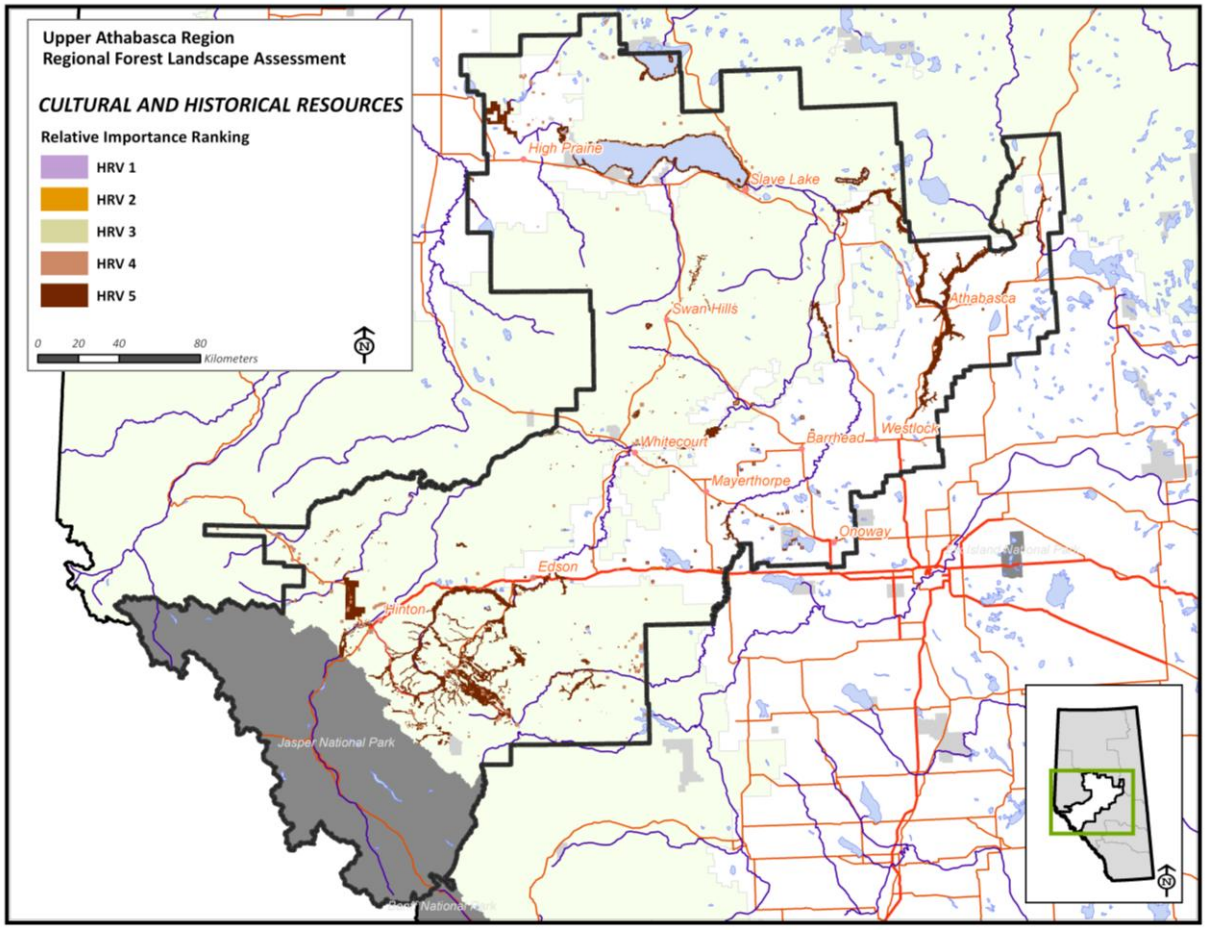


Figure 5-5 Areas of Historic Resource Value

Table 5-5 Categories and Relative Importance Value (HRV)

	Relative Importance Ranking (HRV)											
	1		2		3		4		5		Total	
Category	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)
Archaeological	-	-	-	-	510	0	19,587	6	139,912	42	160,009	48
Archaeological, Historical	-	-	-	-	-	-	16	0	-	-	16	0
Archaeological, Natural	-	-	-	-	-	-	-	-	23,846	7	23,846	7
Cultural	-	-	-	-	-	-	33,160	10	-	-	33,160	10
Cultural, Historical	-	-	-	-	-	-	276	0	-	-	276	0
Geological	32	0	-	-	-	-	-	-	-	-	32	0
Historical	212	0	84	0	175	0	933	0	-	-	1,404	0
Natural	-	-	-	-	145	0	-	-	-	-	145	0
Palaeontological	-	-	-	-	99	0	1,932	1	111,019	33	113,051	34
Total	245	0	84	0	929	0	55,906	17	274,777	83	331,940	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. Jasper 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 40 between Hinton and Grande Cache is well known for its visual resources.

The region supports a great deal of canoeing routes on rivers such as the Athabasca, Maligne, Berland and Brazeau affording views through the canyons and boreal forests.

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 Upper Athabasca 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 Upper Athabasca Area (ha)	Portion of District in Upper Athabasca (%)	Proportion of Upper Athabasca occupied by District (%)
Athabasca	1,504,338	949,971	63	11
Barrhead	656,891	652,849	99	8
Drayton Valley	279,737	4,627	2	0
Edson	1,023,570	1,014,425	99	12
Evansburg	666,861	576,738	86	7
Grande Cache	795,252	42,351	5	1
High Prairie	1,254,130	1,167,843	93	14
Hinton	740,273	674,537	91	8
Lac La Biche	1,328,292	174,000	13	2
Nordegg	843,691	38,873	5	0
Peace River	1,707,905	37,270	2	0
Rocky Mountain House	802,822	4,903	1	0
Slave Lake	1,749,981	997,793	57	12
Stony Plain	341,176	19,038	6	0
Swan Hills	469,345	415,188	88	5
Valleyview	1,392,872	12,552	1	0
Whitecourt	439,416	391,925	89	5
Subtotal	15,996,553	7,174,883		86
No Fish and Wildlife District		1,123,185		14
Total		8,298,067		100

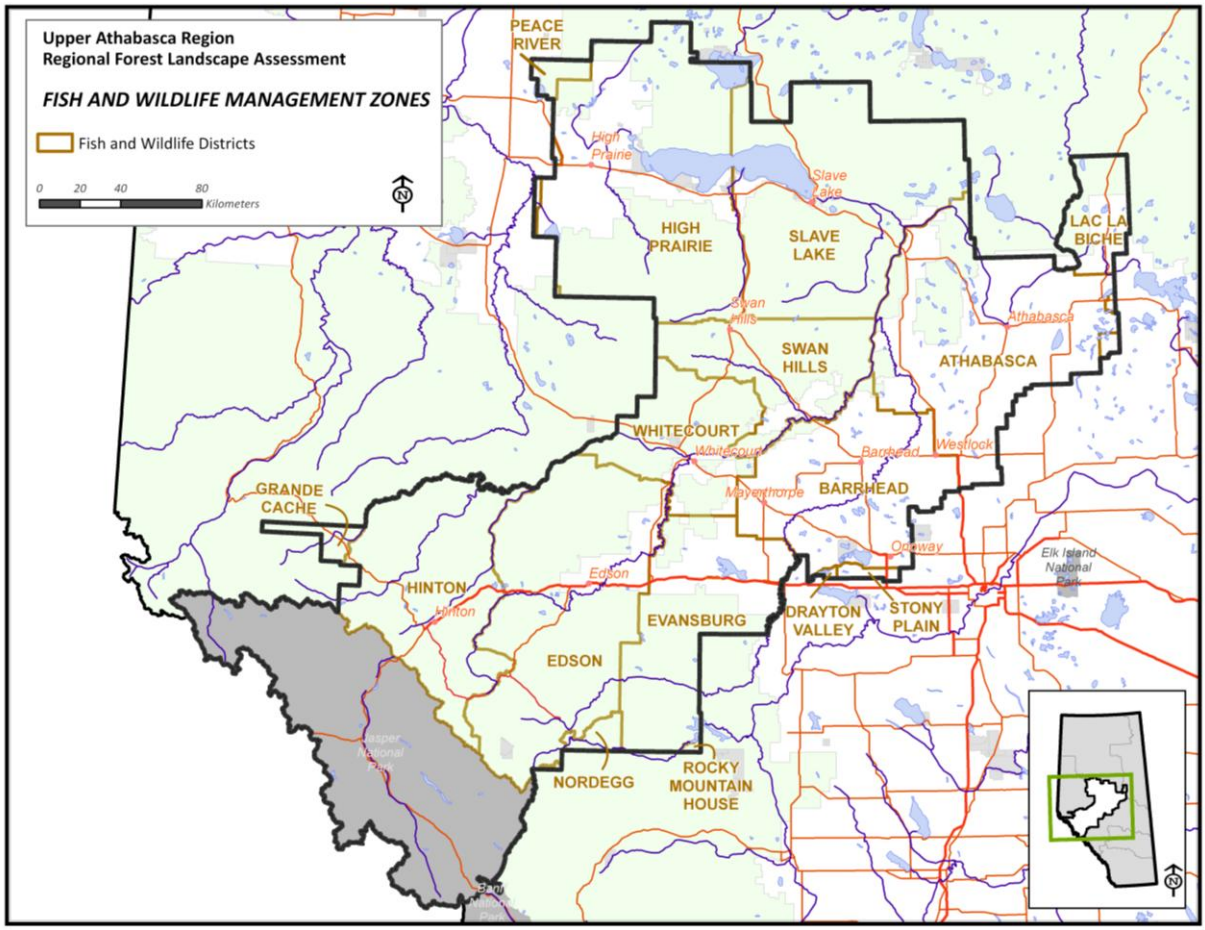


Figure 5-6 Fish and Wildlife Districts

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

Fish Management Zone	Entire Zone Area (ha)	Portion of Zone in Upper Athabasca Area (ha)	(%)	Proportion of Upper Athabasca occupied by Zone (%)
Northern Boreal Zone	32,972,500	4,388,873	13	53
Eastern Slopes Zone	12,264,460	2,678,291	22	32
Parkland-Prairie Zone	15,539,920	107,721	1	1
Sub-total	60,776,880	7,174,885		86
No Fish Management Zone		1,123,182		14
Total		8,298,067		100

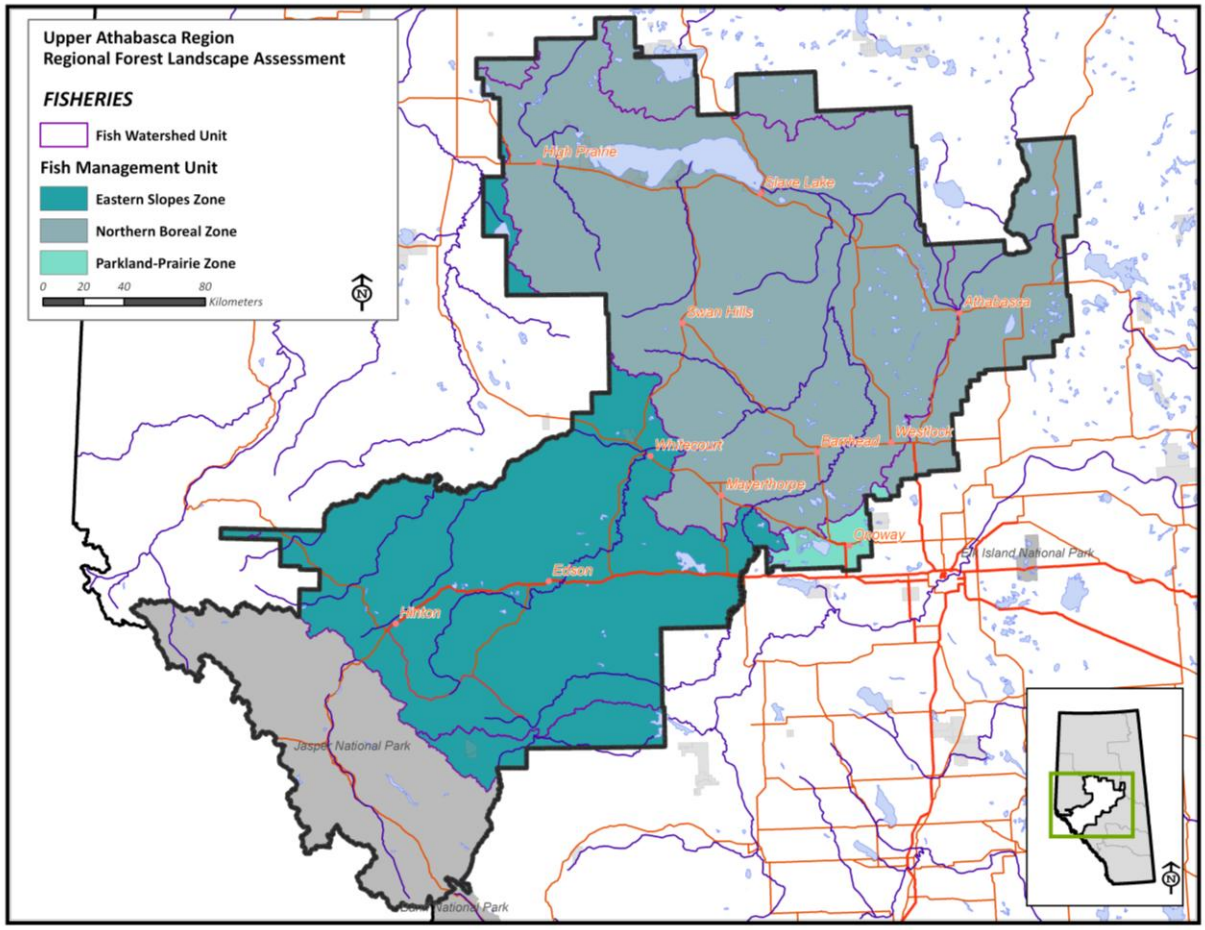


Figure 5-7 Fish Management Units and Fish Watershed Units

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 related to the development of 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 Wildlife Sensitivity Zones

Wildlife Species	Sensitivity Zone within Alberta (ha)	Portion of Sensitivity Zone in Upper Athabasca (ha)[1]	(%)	Proportion of Upper Athabasca occupied by Sensitivity Zone (%)
Caribou sp.(*Rangifer tarandus*)	9,749,350	306,623	4	3
Grizzly Bear (*Ursus arctos horribilis*)				
- Core Habitat	3,726,439	1,065,472	13	29
- Secondary Habitat	2,476,588	1,214,582	15	49
Mountain Goat (*Oreamnos americanus*) and Sheep (*Ovis canadensis*)	1,246,003	102,944	1	8
Sharp Tailed Grouse (*Pedioecetes phasianellus*) Survey	15,810,566	68,452	1	0
Trumpeter Swan (*Cygnus buccinator*)	538,615	43,154	1	8
Colonial Nesting Birds	46,319	6,078	0	13
- American White Pelican (*Pelecanus erythrorhynchos*)	14,911	1,269	0	9
- Great Blue Heron (*Ardea herodias*)	31,408	4,809	0	15
Sensitive Raptor Range	33,006,540	31,739	0	0
- Bald Eagle (*Haliaeetus leucocephalus*)	4,382,724	31,710	0	1
- Peregrine Falcon (*Falco peregrinus*)	13,246	29	0	0
Key Wildlife Biodiversity Zone	4,689,713	508,249	6	11
Special Access Zone	1,763,820	494,249	6	28
Total Area of Upper Athabasca		8,298,067		

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

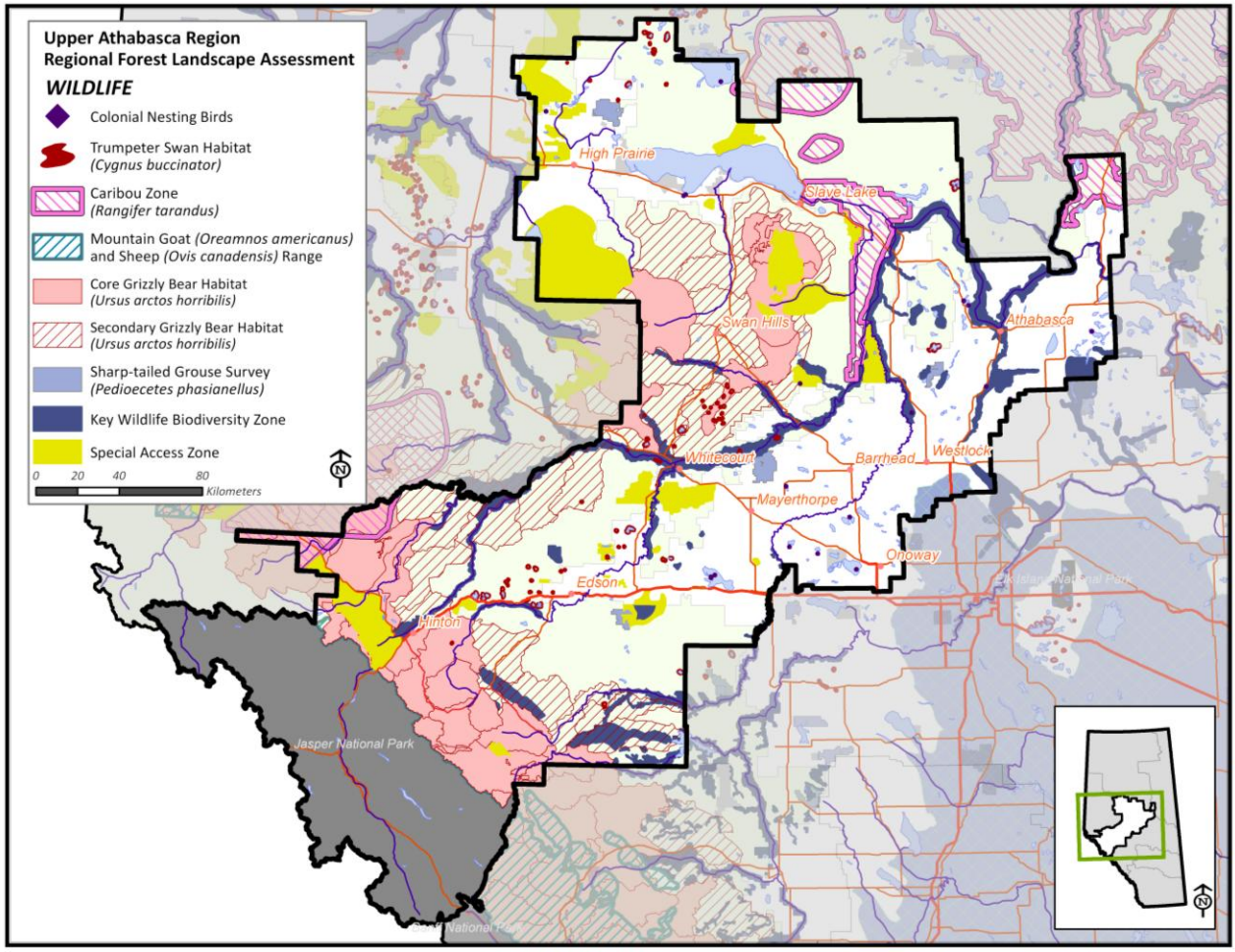


Figure 5-8 Wildlife Sensitivity Zones

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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
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.
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 Parks and Protected Areas in the Upper Athabasca

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 Upper Athabasca and these are noted in footnotes under each table.

Table 7-1 List of Provincial Parks

Provincial Park	Registered Area in Region (ha)	Percentage (%)	Additional PNT/CNT Area (ha)
Carson-Pegasus	1,209	4	0
Cross Lake	2,047	6	0
Hilliard's Bay	2,324	7	0
Lesser Slave Lake	7,590	22	0
North Buck Lake	0		1,449
Obed Lake	3,983	12	0
Pembina River	79	0	0
Rock Lake	1,684	5	0
Sundance	3,708	11	0
Thunder Lake	196	1	0
William A. Switzer	6,097	18	0
Winagami Lake[1]	5,209	15	0
Total	34,126	100	1,449

[1] 21% of Winagami Lake Provincial Park is in the Upper Peace Region

Table 7-2 List of Wildland Parks

Wildland Park	Registered Area in Region (ha)	Percentage (%)	Additional PNT/CNT Area (ha)
Brazeau Canyon Wildland	4,846	4	0
Fort Assiniboine Sandhills Wildland	8,129	7	0
Grizzly Ridge Wildland	10,694	9	0
Hubert Lake Wildland	9,647	8	0
La Biche River Wildland	17,337	14	0
Lesser Slave Lake Wildland	3,581	3	0
Otter-Orloff Lakes Wildland[1]	3,597	3	0
Rock Lake - Solomon Creek Wildland	33,224	27	0
Whitehorse Wildland	17,386	14	0
Winagami Wildland[2]	12,446	10	0
Total	120,887	100	0

[1] 49% of Otter-Orloff Wildland Park is in the Lower Peace Region

[2] 2% of Winagami Wildland Park is in the Upper Peace Region

Table 7-3 List of Provincial Recreation Areas

Provincial Recreation Area	Registered Area in Region (ha)	Percentage (%)	Additional PNT/CNT Area (ha)
Big Berland	168	4	0
Brazeau Reservoir[1]	57	1	0
Brazeau River	9	0	0
Chain Lakes	23	1	0
Chisholm	1	0	0
Chrystina Lake	26	1	0
Edith Lake	5	0	0
Elk River	33	1	0
Fairfax Lake	130	3	0
Fawcett Lake	47	1	0
Fickle Lake	1,152	25	0
Freeman River	10	0	0
Grouard Trail	0	0	3,397
Gunn	1	0	0
Heart River Dam	13	0	0
Hornbeck Creek	6	0	0
Lawrence Lake	265	6	0
Little Sundance Creek	24	1	0
Lovett River	39	1	0
McLeod River	31	1	0
Minnow Lake	361	8	0
Nojack	3	0	0
North Buck Lake	103	2	0
Paddle River Dam	71	2	0
Pembina Forks	10	0	0
Poacher's Landing	1,743	38	0
Trapper Lea's Cabin	7	0	0
Watson Creek	33	1	0
Weald	31	1	0
Whitehorse Creek	23	1	0
Wildhay	4	0	0
Wildhorse Lake	70	2	984
Wolf Lake West	32	1	0
Total	4,535	100	4,381

[1] 56% of Brazeau Reservoir Recreation Area is in the North Saskatchewan Region

Table 7-4 List of Natural Areas

Natural Area	Registered Area in Region (ha)	Percentage (%)	Additional PNT/CNT Area (ha)
Anton Lake	0	0	259
Armstrong Lake	0	0	883
Bear Lake	95	1	
Bilby	121	1	
Bleak Lake	0	0	2,016
Brazeau Tufa	0	0	63
Bridge Lake	111	1	170
Camp Creek	0	0	65
Cardinal Divide	0	0	630
Caslan	0	0	448
Centre of Alberta	313	3	
Clear Lake	91	1	
Clyde Fen	0	0	182
George Lake	123	1	
George Lake Area	0	0	64
Halfmoon Lake	129	1	
Halfway Lake	65	1	
Highway	259	3	
Hondo	434	4	
Jackpines	0	0	131
Kakina Lake	65	1	
Kimiwan Lake	0	0	2,745
Lac La Nonne	55	1	
Lily Lake	170	2	
Majeau Lake	130	1	389
Manly Corner	0	0	64
Mystery Lake	48	0	
Nestow	0	0	124
Newton Lake	35	0	
Noel Lake	268	3	160
North Buck Lake	0	0	1,452
Otauwau	244	2	
Paddle River	64	1	
Park Court	142	1	
Pembina River	75	1	
Perryvale	0	0	164
Pinto Creek Canyon	1,232	12	
Police Point	315	3	
Prefontaine Brock Lakes	198	2	
Roselea	250	2	
Saulteaux	261	3	
Spruce Island Lake	825	8	
Tawatinaw	718	7	
Tawatinaw River	0	0	271
Vega	100	1	
Whitecourt	0	0	23
Whitecourt Mountain	570	6	
Wildhay Glacial Cascades	2,480	24	
Yates	192	2	
Total	10,180	100	10,305

Table 7-5 List of Ecological Reserves

Ecological Reserve	Registered Area in Region (ha)	Percentage (%)	Additional PNT/CNT Area (ha)
Goose Mountain	956	25	0
Holmes Crossing Sandhills	2,006	53	0
Marshybank	845	22	0
Total	3,807	100	0

Table 7-6 List of Special Management Zones

Special Management Zone	Registered Area in Region (ha)	Percentage (%)	Additional PNT/CNT Area (ha)
Sundance Special Management	0	0	4,277
Zone			0
Total	0	0	4,277

APPENDIX II Data References

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